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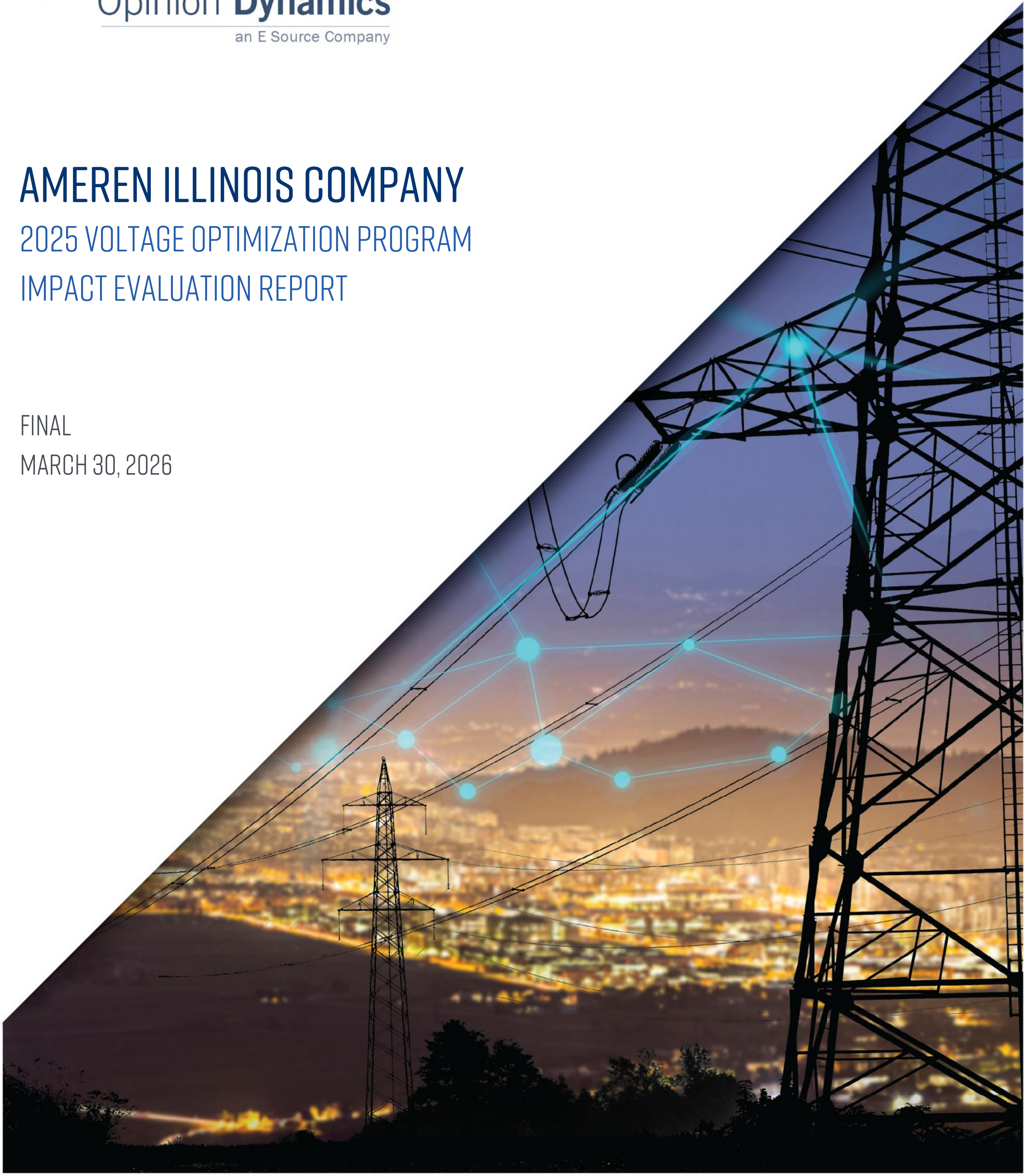
AMEREN ILLINOIS COMPANY

2025 VOLTAGE OPTIMIZATION PROGRAM IMPACT EVALUATION REPORT

FINAL

MARCH 30, 2026



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I. EXECUTIVE SUMMARY

This report presents the impact evaluation results from Ameren Illinois Company's (AIC) Voltage Optimization (VO) Program implemented in 2025. The objective of the 2025 impact evaluation was to determine energy and peak demand savings associated with the VO Program and verify the continued operation of VO for a sample of previously evaluated circuits.

1.1 BACKGROUND

VO is an energy efficiency that technology electric utilities implement at the distribution substation or circuit level. This technology optimizes voltage levels along distribution circuits to reduce electricity usage. AIC's VO Program employs a combination of hardware, software, and communications solutions that leverage VO technologies. The two primary VO technologies used are Volt-VAR Optimization (VVO) and Conservation Voltage Reduction (CVR). VVO improves the power factor to reduce line losses, and CVR reduces customer energy consumption by reducing line voltage. Once implemented, VO technologies are intended to operate 24 hours a day, every day of the year. This report discusses the investigation and analysis of circuits integrated with VO technology, and these will herein be referred to as "circuits."

Prior to the program launch, AIC identified multiple technology upgrades required to successfully deploy the VO Program successfully and selected a pool of potential candidate circuits for VO deployment.[1] In 2017, AIC began installing VO hardware, software, and communications components on a subset of the selected circuits on a phased basis. As outlined in the AIC Voltage Optimization Plan,[2] AIC is only allowed to claim savings for circuits that are operational during a full calendar year. Program Year 2025 is the seventh full calendar year in which AIC is claiming energy savings.

The 2025 evaluation activities included estimating energy and peak demand savings for all 250 circuits that became operational in 2025 and verifying the continued operation of a sample of circuits previously evaluated between 2019 and 2024.

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[1] AIC staff used voltage level as the primary criteria for establishing the initial pool of potential candidate circuits and excluded circuits served by voltage levels > 20 kilovolts (kV) or that only serve customers exempt at the time of this determination (a customer whose highest 15-minute demand is ≥ 10 MW). In addition, only circuits that were estimated to be cost-effective based on the Illinois Total Resource Cost test were deemed eligible.

[2] Ameren Illinois Voltage Optimization Plan, filed in ICC Docket 18-0211 on January 25, 2018. Accessed at: https://www.icc.illinois.gov/downloads/public/edocket/463457.pdf.

1.2 2025 VOLTAGE OPTIMIZATION PROGRAM SAVINGS

1.2.1 ANNUAL SAVINGS

We estimated energy and peak demand savings for all 250 circuits that became operational in 2025. Overall, the 2025 VO Program achieved 62,045 MWh of verified net energy savings and 10.95 MW of verified net peak demand savings (Table 1).

Table 1. 2025 VO Program Annual Energy and Peak Demand Savings

Metric	Energy Savings (MWh)	Peak Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings [a]	53,658	N/A	N/A
Gross Realization Rate	116%	N/A	N/A
Verified Gross Savings	62,045	10.95	N/A
NTGR	N/A	N/A	N/A
Verified Net Savings	62,045	10.95	N/A

[a] Ex ante energy savings sourced from AIC. Ex ante gross savings assume a 0.80 CVR factor and 3.2% voltage reduction across the 250 measured circuits. There are no ex ante demand savings estimates for this program.

1.2.2 CUMULATIVE PERSISTING ANNUAL SAVINGS

Table 2 summarizes cumulative persisting annual savings (CPAS) and the weighted average measure life (WAML) for the 2025 VO Program. The overall WAML for the VO Program is 15 years. For additional details about CPAS and WAML, please see Appendix C of this report.

Table 2. 2025 VO Program CPAS and WAML

Measure	Measure Life	Annual Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2025	2026	2027	2028	…	2030	…	
Voltage Optimization - 2025 Cohort	15.0	62,045	N/A	62,045	62,045	62,045	62,045	…	62,045	…	930,681
2025 CPAS		**62,045**	**1.000**	**62,045**	**62,045**	**62,045**	**62,045**	**…**	**62,045**	**…**	**930,681**
Expiring 2025 CPAS				**0**	**0**	**0**	**0**	**…**	**0**	**…**	
Expired 2025 CPAS				**0**	**0**	**0**	**0**	**…**	**0**	**…**	
WAML	**15.0**										

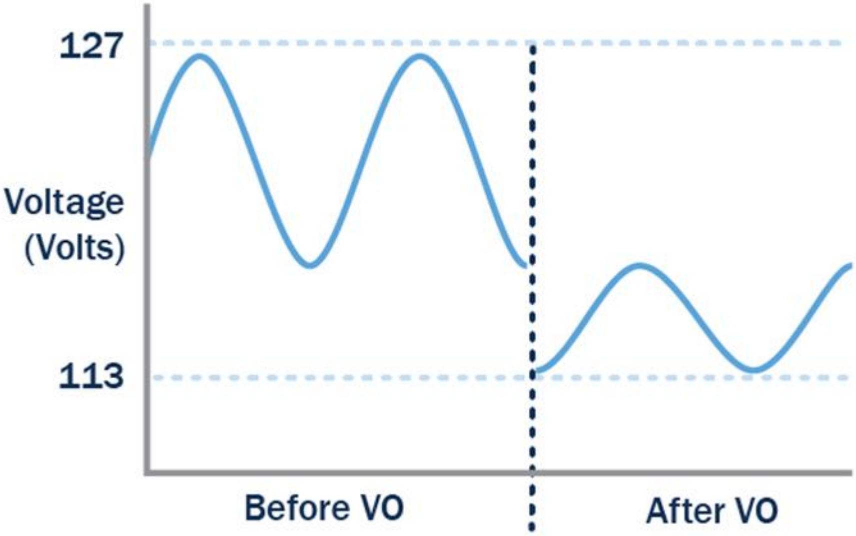
2. OVERVIEW OF VOLTAGE OPTIMIZATION PROGRAM

Illinois state law defines voltage optimization as an energy efficiency measure and allows AIC to make cost-effective voltage optimization investments as part of its energy efficiency portfolio.[3]

2.1 BACKGROUND

AIC defines VO as a combination of VVO and CVR, which are implemented first to reduce the reactive power flows on a circuit and then to lower the voltage in order to reduce end-use customer energy consumption and utility distribution system losses.[4] VVO optimizes capacitor bank[5] operations to improve power factor and reduce system losses.[6] CVR utilizes voltage regulators, transformer load tap changers and capacitors to control and reduce end-user voltages, which, in turn, lowers customers' energy consumption. In other words, VVO and CVR technologies work together to reduce distribution line voltage by regulating voltage in the lower portion of the allowable range. Historically, utilities have regulated voltage in the upper portion of the range to avoid low voltage violations. However, AIC regulates voltage in the lower portion of the range, which does not compromise power quality. Most end uses use less energy at lower voltage, due to VO technologies. (Figure 1).

Figure 1. Illustration of VO Effect on Voltage



VO technologies can operate 24 hours a day, every day of the year. Energy savings are predominantly driven through end-use load reduction and, to a lesser extent, distribution line loss reductions. While AIC's VO Program was developed to provide energy savings, not peak demand savings, some associated demand reduction on some circuits is to be expected during the hours of operation of the system.

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[3] Specifically, 220 ILCS 5/8-103B(b-20).

[4] Reactive power is measured in Volt-Amperes Reactive (VAR).

[5] Capacitor banks are groupings of several capacitors and are used to store or condition electricity (e.g., by correcting power factor).

[6] Power factor is the ratio of working power (kW) to apparent power (kVA). Higher power factors indicate higher efficiency.

2.2 PROGRAM DESCRIPTION

AIC developed the VO Program, described in the Ameren Illinois Voltage Optimization Plan (referred to as the Plan hereafter), to comply with Illinois state law and achieve energy savings supporting its energy efficiency portfolio goals.[7] By 2025, AIC deployed the VO technology on circuits that AIC estimated to be cost-effective by 2024. AIC initially planned to deploy VO on a total of 1,047 circuits by 2024.[8] By 2025, AIC had deployed VO technology to 1,163 circuits.

Before the program launch, AIC identified multiple technology upgrades required to deploy VO. In 2017, AIC began installing VO hardware, software, and communications components on a phased basis on a subset of the eligible circuits using four different VO vendor solutions: Utilidata, DVI, OSI, and ABB Group.[9] AIC staff used voltage level as the primary criteria for establishing the initial pool of candidate circuits and excluded circuits served by voltage levels >20 kilovolts (kV) and circuits that at the time served only customers exempt under Illinois state law (customers whose highest 15-minute demand is greater than or equal to 10 MW).[10]

Table 3 provides AIC's original implementation plan and savings estimates for the VO Program.

Table 3. AIC's Original VO Implementation Plan and Savings Estimates

Year Ending	2018	2019	2020	2021	2022	2023	2024	2025
Estimated Cumulative Persisting Annual Savings (MWh)	0	7,650	59,994	128,433	201,725	275,006	348,287	421,568
% Annual Cumulative Persisting Savings	0%	0.03%	0.21%	0.46%	0.72%	0.98%	1.25%	1.50%
Estimated Incremental # of Circuits Deployed	19	130	170	182	182	182	182	0
Estimated Incremental Construction Cost (Capital Cost)	$2M	$14M	$18M	$19M	$19M	$19M	$19M	$0
Estimated Incremental Total Investment Cost (Construction Capital, Construction O&M, Upfront Capital)	$5M	$17M	$20M	$20M	$20M	$20M	$20M	$0

Source: Ameren Illinois Voltage Optimization Plan

VO is a major part of AIC's 2022–2025 energy efficiency plan. Per AIC's most recent filing, the VO Program was initially expected to yield 73,281 MWh in energy savings in 2025, about 18% of AIC's total estimated 2025 portfolio energy savings goal.[11] In 2024, AIC completed the deployment of VO technology to 250 new circuits, which were then evaluated as part of the 2025 program year.

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[7] Ameren Illinois Voltage Optimization Plan, filed in ICC Docket 18-0211 on January 25, 2018. Accessed at: https://www.icc.illinois.gov/downloads/public/edocket/463457.pdf

[8] The number of circuits planned for VO deployment was determined based on a cost-effectiveness study using calculated assumptions, industry results, and past AIC VO pilot results. The actual number of circuits with VO could fluctuate based on deployment results. See Ameren Illinois Voltage Optimization Plan for details.

[9] AIC has now selected a primary vendor, and remaining circuit construction is proceeding with only one solution.

[10] Note that as a result of the Climate and Equitable Jobs Act, customers with >10MW demand are no longer automatically exempt.

[11] Appendix F to AIC's 2022–2025 EE Plan. Accessed at: https://www.icc.illinois.gov/docket/P2021-0158/documents/322771/files/561827.pdf

3. VOLTAGE OPTIMIZATION EVALUATION APPROACH

The 2025 VO evaluation approach was primarily governed by the Illinois Technical Reference Manual for Energy Efficiency (IL-TRM) Version 13.0, which prescribes the use of an algorithmic approach to estimating electric energy and peak demand savings from VO activities.[12] In addition to the IL-TRM, we leveraged a previously agreed-upon methodology and approach to verifying the continued operation of previously installed circuits during 2025.[13]

In this report, we address the following key research questions:

- What are the estimated energy savings from VO?
- What are the estimated peak demand savings from VO?
- Did a randomly selected sample of circuits[14] implemented between 2019 and 2024 deployment continue to operate for over 90% of non-excludable hours in 2025?

3.1 EVALUATION RESEARCH OBJECTIVES

The 2025 VO evaluation estimated annual energy savings and peak demand savings for the 250 operational circuits as of January 1, 2025.

3.2 VERIFIED IMPACT ANALYSIS APPROACH

3.2.1 ENERGY SAVINGS METHODOLOGY

The IL-TRM requires the use of an algorithmic approach to evaluate VO energy savings. The algorithmic approach combines deemed parameter values with measured reductions in voltage to calculate energy savings. The algorithm used for AIC's VO Program energy savings evaluation is shown in Equation 1.

Equation 1. AIC VO Energy Savings Algorithm

$$Annual\ Energy\ Savings_i = \ Annual\ Energy\ Use_{2014-2016,i} * \ CVR_f * \%\ \Delta V_i$$

Where:

- $Annual\ Energy\ Use_{2014-2016,i}$= the average annual customer energy use for circuit *i* over the 2014–2016 timeframe, excluding exempt customers;
- CVR_f= conservation voltage reduction factor, defined as the percent change in energy usage divided by the percent change in voltage (deemed at 0.80 by the IL-TRM V13.0); and,

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[12] Illinois Statewide Technical Reference Manual for Energy Efficiency Version 13.0, Volume 4, Cross-Cutting Measures and Attachments, Measure 6.2.1. Accessed at: https://www.ilsag.info/wp-content/uploads/IL-TRM_Effective_010125_v13.0_Vol_4_X-Cutting_Measures_and_Attach_09202024_FINAL.pdf

[13] Ameren Illinois Company Voltage Optimization Verification and Exclusion Approach Memo, accessed at: https://www.ilsag.info/wp-content/uploads/AIC-2019-Voltage-Optimization-Operation-Verification-Memo-FINAL-2020-04-17.pdf

[14] Roughly 10 percent of the evaluated circuits from each evaluation, chosen randomly.

- $\% \, \Delta V_i$= the percent change in voltage for circuit *i* resulting from VO implementation relative to the pre-period, estimated using a regression model to control for exogenous factors that may contribute to changes in voltage (e.g., weather).
- $Annual\ Energy\ Savings_i$ = the estimated energy savings for circuit *i*

3.2.2 PEAK DEMAND SAVINGS METHODOLOGY

Peak demand savings were also estimated using an algorithmic approach. The peak period is defined as 1:00 p.m.–5:00 p.m. (CDT) on non-holiday weekdays from June 1 to August 31.[15] The algorithm used for AIC's VO peak demand savings program evaluation is shown in Equation 2.

Equation 2. AIC VO Peak Demand Savings Algorithm

$$Peak\ Demand\ Savings_i = Avg\ Peak\ Demand_{2014-2016,i} * CVR_{f,PEAK} * \% \, \Delta V_{i,PEAK}$$

Where:

- $Avg\ Peak\ Demand_{2014-2016,i}$ = the average demand in the peak hour for circuit *i* over the 2014–2016 timeframe during the peak period adjusted by a calibration factor that captures the relationship between peak demand and average demand in the peak period, excluding >10 MW customers;
- $CVR_{f,PEAK}$ = the estimate of the peak conservation voltage reduction factor, defined as the percent change in energy usage divided by the percent change in voltage during the peak period (deemed at 0.68 by the IL-TRM V13.0); and,
- $\% \, \Delta V_{i,PEAK}$= the percent change in voltage for circuit *i* resulting from VO implementation relative to the peak hours of the pre-period, using a regression model to control for exogenous factors that may contribute to changes in voltage (e.g., weather). Per guidance in the IL-TRM, this is to be calculated in the same manner as energy savings but with the intention of measuring peak demand savings rather than total energy savings.
- $Peak\ Demand\ Savings_i$ = the estimated peak demand savings for circuit *i*.

3.2.3 VERIFICATION OF CONTINUED OPERATION

The IL-TRM V13.0 deems VO savings for 15 years after completion of the initial evaluation of a circuit.[16] Retroactive changes to deemed savings are not permitted.[17] Therefore, in the Illinois evaluation framework, impact evaluation for VO does not require retroactive or ongoing verification.

Nevertheless, in 2020, Opinion Dynamics, AIC, and ICC staff agreed that ongoing verification of VO should be conducted for process purposes to provide information to all stakeholders as to the level of continued VO operation and, if needed, to provide context as to why VO may not have operated continuously. All parties agreed that Opinion Dynamics would conduct verification activities to assess the degree to which VO continued to operate in a sample of circuits deployed

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[15] Illinois Statewide Technical Reference Manual for Energy Efficiency Version 13.0, Volume 4, Cross-Cutting Measures and Attachments, Measure 6.2.1. Accessed at: https://www.ilsag.info/wp-content/uploads/IL-TRM_Effective_010125_v13.0_Vol_4_X-Cutting_Measures_and_Attach_09202024_FINAL.pdf

[16] Note that the IL-TRM V13.0 outlines a process through which the measure life for VO, including circuits that have already been evaluated and had savings claimed, can be "extended." If needed, AIC and its evaluator will revisit past circuits at the expiration of their existing measure life, beginning in the 2034 program year.

[17] Illinois Energy Efficiency Policy Manual Version 3.0, Section 11.2. Accessed at: https://www.ilsag.info/wp-content/uploads/IL_EE_Policy_Manual_Version_3.0_Final_11-3-2023.pdf

and evaluated prior to the current evaluation period. An acceptable uptime threshold of operation was set to ensure that circuits operated over 90% of the time, barring non-operation due to excludable events.[18]

As part of the 2025 evaluation, Opinion Dynamics verified ongoing operation of circuits evaluated between 2019 and 2024. To determine whether these circuits operated at or over the target 90% uptime threshold during 2025, we conducted the following analytical activities:

- Selected a random sample of the circuits previously evaluated (2 of the 19 circuits evaluated in 2019, 13 of the 125 circuits evaluated in 2020, 18 of the 180 circuits evaluated in 2021, 19 of the 181 circuits evaluated in 2022, 20 of the 194 circuits evaluated in 2023 and 22 of 214 circuits evaluated in 2024);
- Requested operation log summaries for the sample of circuits. Our variable of interest for this effort included the VO status (e.g., "On/Off") at a circuit level for all hours throughout 2025;
- Removed excludable events;[19] and,
- Divided the total number of hours the status logs indicated that VO was 'On' by the total number of non-excludable hours in the year.

3.2.4 CONSIDERATION OF VOLTAGE OPTIMIZATION NET EFFECTS

Because AIC is the sole operator and "participant" in the VO Program, no adjustments to savings were made to reflect net effects (free ridership and spillover) that are often present for other, more traditional energy efficiency programs.

3.3 SOURCES AND MITIGATION OF ERROR

Because the evaluation team relied on regression models to estimate the change in voltage and peak demand, some uncertainty is to be expected in the model-produced estimates. Therefore, the team designed analyses to address the following types of errors:

- **Model Specification Error:** The most difficult type of modeling error in terms of bias and the ability to mitigate it is specification error. In this type of error, variables that determine model outcomes are excluded when they should not be, potentially producing biased estimates. We addressed this type of error by carefully examining the model diagnostics and goodness-of-fit statistics of the data variables.
- **Measurement Errors:** Specifying an incorrect time period (either VO "On" or VO "Off") can lead to measurement error. We worked extensively with AIC to ensure that operations log data anomalies were discussed and addressed where possible. Measurement error can also come from variables such as weather data, which are commonly included in consumption analysis models. If an inefficient base temperature is chosen for calculating degree days or an incorrect climate zone weather station is chosen, the model results could be subject to measurement error. We mitigated this type of error by meticulously choosing the closest weather station for each circuit in the model to ensure the most accurate weather data were used in the model.
- **Multi-collinearity:** This type of modeling error can both bias and produce substantial variances in the results. We dealt with this type of error by using evaluation model diagnostics, though the models used in the impact analysis are unlikely to have problems with multi-collinearity.

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[18] Ameren Illinois Company Voltage Optimization Verification and Exclusion Approach Memo, accessed at: https://www.ilsag.info/wp-content/uploads/AIC-2019-Voltage-Optimization-Operation-Verification-Memo-FINAL-2020-04-17.pdf

[19] For the rationale behind and definition of excludable events, please see the IL-TRM Voltage Optimization measure: Illinois Statewide Technical Reference Manual for Energy Efficiency Version 13.0, Volume 4 Cross-Cutting Measures and Attachments, Measure 6.2.1. Accessed at: https://www.ilsag.info/wp-content/uploads/IL-TRM_Effective_010125_v13.0_Vol_4_X-Cutting_Measures_and_Attach_09202024_FINAL.pdf

- **Heteroskedasticity:** This type of modeling error can result in imprecise statistical inference due to variance changing across circuits with different consumption levels. We addressed this type of error by calculating heteroskedastic-robust standard errors. In line with most statistical packages, we make conservative assumptions when calculating errors, which also makes the model's significance tests conservative.

4. 2025 VOLTAGE OPTIMIZATION PROGRAM VERIFIED SAVINGS

In this section, we present the results of the impact evaluation of the 2025 VO Program. Additional details on the impact analysis methodology used for this evaluation are presented in Appendix B.

4.1 ANNUAL SAVINGS SUMMARY

The 2025 VO Program deployed the VO technology to 250 circuits, achieving 62,045 MWh of verified net energy savings and 10.95 MW of verified net peak demand savings. The year-end verified savings are within 1% of Opinion Dynamics' June 2025 interim forecasted savings of 62,705 MWh.[20] Table 4 presents the 2025 VO Program annual energy and peak demand savings. Detailed results by circuit are available in Appendix B.

Table 4. 2025 VO Program Annual Energy and Peak Demand Savings

Metric	Energy Savings (MWh)	Peak Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings [a]	53,658	N/A	N/A
Gross Realization Rate	116%	N/A	N/A
Verified Gross Savings	62,045	10.95	N/A
NTGR	N/A	N/A	N/A
Verified Net Savings	62,045	10.95	N/A

[a] Ex ante energy savings sourced from AIC. Ex ante gross savings assume 0.80 CVR factor and 3.2% voltage reduction across the 250 measured circuits. There are no ex ante demand savings estimates for this program.

Factors driving program performance include the following:

- The 2025 VO Program exceeded its ex ante gross energy savings due to larger estimated percent changes in voltage than assumed values (3.20% ex ante compared to 3.70% verified weighted average).
- Greater changes in voltage resulted in greater than expected energy savings, and the program achieved a gross realization rate of 116%.

4.1.1 DETAILED ENERGY SAVINGS

Savings were calculated using the annual energy savings algorithm, which uses the CVR factor (CVR_f), the percent change in voltage resulting from VO implementation relative to the baseline, and average annual customer energy use over the 2014–2016 timeframe, excluding exempt customers. We used regression models to estimate the percent change in voltage for each circuit and applied that to the CVR_f and assumed baseline of each circuit. Table 5 summarizes the energy savings results across all 250 circuits. Appendix B provides the circuit-level percent change in voltage results.

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[20] The June 2025 interim evaluation forecasted savings of 62,686 MWh for 251 feeders. AIC notified the evaluation team in September 2025 that feeder U95001 (Macomb S) should no longer be evaluated in 2025. The reported forecast of 62,705 MWh reflects this adjustment.

Table 5. Ex Ante and Verified Algorithmic Inputs and Associated Energy Savings

Metric	Annual Gross Energy Use (MWh)	CVR$_f$	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
Ex Ante [a]	2,096,032	0.80	3.20%	53,658
Verified	2,096,032	0.80	3.70%[a]	62,045[b]
Realization Rate	100%	100%	116%	116%

[a] Weighted average percent change in voltage is obtained after weighing circuit-level voltage reductions in percentage terms by their 2014–2016 average yearly energy usage in MWh.

[b] Application of Equation 1 to values in Table 5 does not produce 62,045 MWh savings due to the rounding of the values in Average Percent Change.

4.1.2 DETAILED PEAK DEMAND SAVINGS

Given the variability of load across circuits, we estimated peak demand savings using an individual regression analysis approach for each circuit. The percentage voltage reduction for each circuit was multiplied by the peak period CVR factor (CVR$_{f,PEAK}$) of 0.68 (deemed) and the annual peak demand baseline value (measured in MW). The resulting peak demand savings were summed across circuits to determine the total peak demand reduction of 10.95 MW. The weighted average percent change in voltage during peak demand periods was 2.97%, as shown in Table 6. AIC does not report ex ante demand savings; therefore, no ex ante savings or realization rates are reported.

Table 6. Verified Algorithmic Inputs and Associated Demand Savings

Metric	Peak Demand (MW)	CVR$_{f,PEAK}$	Average Percent Change in Peak Voltage	Peak Demand Savings (MW)
Verified	540	0.68	2.97% [a]	10.95

[a] Weighted average percent change in peak voltage is obtained after weighing feeder level voltage reductions in percentage terms by their 2014-2016 average yearly energy usage in MWh.

4.2 CUMULATIVE PERSISTING ANNUAL SAVINGS

Table 7 presents CPAS and WAML for the 2025 VO Program. The total verified gross savings for the Program are summarized, and CPAS in 2025–2030 are presented. The WAML for the Program is 15 years.

Table 7 2025 VO Program CPAS and WAML

Measure	Measure Life	Annual Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2025	2026	2027	2028	…	2030	…	
Voltage Optimization - 2025 Cohort	15.0	62,045	N/A	62,045	62,045	62,045	62,045	…	62,045	…	930,681
2025 CPAS		**62,045**	**1.000**	**62,045**	**62,045**	**62,045**	**62,045**	**…**	**62,045**	**…**	**930,681**
Expiring 2025 CPAS				**0**	**0**	**0**	**0**	**…**	**0**	**…**	
Expired 2025 CPAS				**0**	**0**	**0**	**0**	**…**	**0**	**…**	
WAML	**15.0**										

4.3 VERIFICATION OF CONTINUED OPERATIONS

As discussed in Section 3.2.3, we analyzed status logs for a randomly selected sample of previously implemented circuits to verify continued VO operation. In 2025, we sampled 2 of the 19 circuits evaluated in 2019, 13 of the 125 circuits evaluated in 2020, 18 of the 180 circuits evaluated in 2021, 19 of the 181 circuits evaluated in 2022, 20 of the 194 circuits evaluated in 2023 and 22 of the 214 circuits evaluated in 2024. Per the terms of the verification agreement, detailed further in Section 3.2.2, we set a threshold of operation of 90% of non-excludable hours.

Our analysis found that all sampled circuits, except R28870, evaluated in 2022, were “On” for more than 90% of non-excludable hours in 2025. Circuit R28870 was “On” for around 84.8% of non-excludable hours in 2025, with most of the non-excludable “Off” status attributable to loss of communications.

More information on the verification approach can be found in Appendix D.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this evaluation, we offer the following key findings and recommendations for AIC's VO Program moving forward:

- **Key Finding #1:** The average percent change in voltage due to VO was 3.70%, higher than the planning value of 3.20%. There is substantial variation across circuits in percent change in voltage (0.72%–5.58%). For 188 of the 250 evaluated circuits, the percent change in voltage was estimated to be larger than the planning value of 3.20%.
    - **Recommendation:** Consider further updates to planning values to reflect the percent change in voltage derived from evaluated values to better align with evaluation findings to date. Updating the planning value could also support a more accurate assessment of the ex ante cost-effectiveness for each circuit screened for inclusion in the program.
- **Key Finding #2:** The evaluation team found that except for circuit R28870, all of the 94 circuits sampled from the 2019-2024 evaluation cohorts were "On" for more than the 90% threshold of non-excludable hours in 2025. Specifically, the uptime ranges from 84.78% to 99.72% of non-excludable hours, with an average of 99.07%. The lowest uptime value of 84.78% was for the circuit R28870. The next lowest uptime value was 97.40%, which is well above the 90% threshold, and indicates that lower-than-expected uptime is not a systematic issue. Overall, we find that previously deployed VO circuits have been appropriately maintained and operated in 2025.
- **Key Finding #3:** The evaluation team developed and presented a forecast of 2025 year-end savings in its first interim impact analysis of 2025. The year-end verified savings of 62,045 are within 1% of the interim report forecasted savings of 62,705 MWh. This indicates that the evaluation team's year-end forecasting approach continues to operate effectively to provide very accurate forecasts of year end savings based on data from the first four months of each year.

APPENDIX A. 2025 VOLTAGE OPTIMIZATION CIRCUIT SUMMARY

Table 8 presents detailed characteristics for VO circuits evaluated in 2025. It includes the circuit name and substation for each circuit, as well as various circuit characteristics that may affect voltage reductions. Since AIC prioritized low-income customers as part of its VO deployment, we also note the number of low-income customers estimated to be served by each circuit evaluated in 2025 when data are available.

Table 8. 2025 Evaluated VO Circuits

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
328119	Clifton	10.7	91%	9%	0%	12	1
328120	Clifton	19.3	93%	6%	1%	12	3
A68002	Roanoke	22.3	88%	12%	1%	7.62	6
A80001	Toulon 69kV	123.8	86%	14%	1%	7.2	6
A80002	Toulon 69kV	18.4	73%	27%	0%	12	1
B08001	Junction	3.7	97%	3%	0%	132	7
B10002	Cruger	20.9	69%	31%	0%	132	0
B35002	Stevens	27.9	86%	13%	0%	7.62	0
B38002	Wilson	35.5	84%	15%	1%	7.62	4
B58002	Tremont	24.7	79%	21%	0%	12	3
B77002	Nebraska	6.6	98%	2%	0%	132	8
B81002	Groveland	45.1	92%	8%	0%	7.62	4
C66002	Dorlan	17.8	67%	31%	2%	7.2	1
D35001	Henry	10.6	82%	18%	0%	12	7
D35003	Henry	83.2	89%	11%	0%	12	3
D60002	Sherman	10.1	96%	4%	0%	12	0
D70001	Pioneer Parallel	11.3	75%	25%	0%	7.62	8
D70002	Pioneer Parallel	5.1	0%	97%	3%	7.62	0
D70003	Pioneer Parallel	5.4	0%	97%	3%	7.62	0
D70004	Pioneer Parallel	13.9	71%	28%	1%	7.62	2
D70005	Pioneer Parallel	23.9	92%	8%	0%	7.62	10
D70006	Pioneer Parallel	19.0	88%	12%	0%	7.62	0
D70007	Pioneer Parallel	5.9	0%	88%	37%	7.62	0
D93001	Hammond	49.5	76%	24%	0%	12	1
D93002	Hammond	42.8	82%	18%	0%	12	22
E05001	St Joseph	12.1	99%	1%	0%	7.2	0
F10001	Mt Pulaski F10	53.6	80%	20%	0%	12	9
F10002	Mt Pulaski F10	77.7	75%	24%	0%	12	5
F10003	Mt Pulaski F10	39.0	67%	33%	0%	12	1
H11338	Wood River 6th St	3.9	88%	12%	0%	4	5
H22347	Wood River Picker St	6.7	77%	23%	0%	12	1
H22348	Wood River Picker St	3.7	88%	12%	0%	12	5
HB0393	Champaign Ford Harris	7.0	30%	52%	17%	7.2	37
HB5890	North Utica Sub	30.2	59%	41%	1%	12	0

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
HC9327	Belleville Concordia	39.5	93%	6%	1%	7.2	2
HD5253	Belleville New West Haven	3.2	76%	24%	0%	12	5
HG8174	Belleville North Shrine	11.0	95%	5%	0%	12	7
J15302	Atkinson Rte 6	40.8	77%	23%	0%	12	3
J46180	Bloomington Division St	4.5	87%	13%	0%	4	12
J46183	Bloomington Division St	3.5	83%	17%	0%	4	4
J46184	Bloomington Division St	5.3	90%	10%	0%	4	11
J67134	Bloomington East Taylor St	2.9	87%	13%	0%	4	2
J71128	Blandinsville	29.6	80%	20%	0%	12	12
J71129	Blandinsville	28.6	74%	26%	0%	12	7
J75271	Bondville Route 10	69.0	78%	22%	0%	12	10
J79305	Buda	52.5	67%	32%	1%	12	3
J79306	Buda	18.3	77%	23%	0%	12	3
J97103	Belleville Lebanon Ave	3.0	71%	29%	0%	4	3
J97113	Belleville Lebanon Ave	4.7	77%	23%	0%	4	6
J97136	Belleville Lebanon Ave	4.4	91%	9%	0%	4	5
K07320	Cambridge	13.9	81%	19%	0%	12	5
K07322	Cambridge	46.0	82%	18%	0%	7.2	6
K09809	Carlinville	11.8	78%	22%	0%	12	4
K09855	Carlinville	7.4	84%	16%	0%	12	15
K11373	Caseyville Gardens	11.7	94%	6%	0%	12	1
K17119	Central City	10.0	83%	17%	0%	4	8
K27122	Centralia S Pleasant, Centralia South Pleasant St	4.9	94%	6%	0%	4	13
K27123	Centralia S Pleasant, Centralia South Pleasant St	3.1	86%	14%	0%	4	6
K36251	Clinton Monroe St	5.3	90%	10%	0%	4	16
K43382	Collinsville	5.0	86%	14%	0%	4	15
K48378	Collinsville Goethe St	3.5	93%	7%	0%	4	3
K48381	Collinsville Goethe St	2.6	60%	40%	0%	4	1
K48384	Collinsville Goethe St	6.6	93%	7%	0%	4	4
K62102	Concord	108.2	76%	24%	0%	12	7
K69112	Champaign Bradley	47.1	94%	6%	1%	7.2	22
K75312	Champaign Miller Ave	2.6	96%	3%	0%	4	3
K89144	Decatur Baltimore Ave	12.0	98%	2%	0%	12	2
K95201	Decatur Edward St	3.0	70%	30%	0%	4	2
K95202	Decatur Edward St	3.5	81%	19%	0%	4	11

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
K95203	Decatur Edward St	2.5	92%	8%	0%	4	8
K95204	Decatur Edward St	3.6	91%	9%	0%	4	10
K95207	Decatur Edward St	1.4	14%	86%	0%	4	74
K95208	Decatur Edward St	2.9	95%	5%	0%	4	12
L11242	Decatur Michigan Ave	5.8	90%	10%	0%	4	20
L18261	Decatur Plaza	1.3	75%	25%	0%	4	1
L23148	Decatur Rt 48 South	4.8	91%	9%	0%	12	15
L35138	Decatur Walnut Grove	7.1	92%	8%	0%	12	4
L35282	Decatur Walnut Grove	4.4	92%	8%	0%	4	18
L35283	Decatur Walnut Grove	4.4	95%	5%	0%	4	15
L42158	Deland	40.3	78%	22%	0%	12	14
L43154	Depue	14.2	84%	16%	0%	12	1
L59923	Duquoin	4.1	90%	10%	0%	4	4
L62927	Duquoin Division St	11.6	86%	14%	0%	4	15
L62928	Duquoin Division St	9.0	88%	12%	0%	4	11
L63936	Duquoin Fairside	19.6	73%	27%	0%	12	2
L74193	Danville Hazel St	9.1	88%	13%	0%	12	16
L74195	Danville Hazel St	1.4	64%	36%	0%	4	3
L90358	East Alton Bell St	3.0	85%	15%	1%	12	2
L90359	East Alton Bell St	5.3	75%	25%	0%	12	11
L93148	East Belleville	21.5	99%	1%	0%	7.2	4
L95211	East Decatur	3.4	94%	6%	0%	4	7
M12151	Enfield	18.0	78%	22%	0%	12	15
M18130	Fairview Decatur	5.3	80%	20%	0%	12	15
M18216	Fairview Decatur	2.5	95%	5%	0%	4	0
M19222	Fayetteville Bee Hollow Road	97.6	85%	15%	0%	12	5
M22812	Fillmore	170.2	79%	21%	0%	12	12
M31204	Galva	37.6	71%	28%	1%	12	12
M47816	Gillespie Macoupin St	21.0	86%	14%	0%	12	12
M51275	Goodfield Rural	34.6	83%	16%	1%	7.2	3
M78322	Granite City Maryland	5.3	88%	12%	0%	12	2
M78323	Granite City Maryland	6.7	96%	4%	0%	12	8
M78324	Granite City Maryland	4.5	87%	13%	0%	12	3
M83408	Granite City Pontoon Road	7.0	67%	33%	0%	4	10
N03299	Granite City Wabash	4.7	87%	13%	0%	4	7
N05170	Granville	40.0	77%	23%	0%	12	3
N13860	Greenville Ridge Ave	5.4	93%	7%	0%	4	6
N13861	Greenville Ridge Ave	6.4	70%	30%	0%	4	12
N35819	Hillsboro	4.7	84%	16%	0%	4	10
N35820	Hillsboro	4.8	84%	16%	0%	4	9
N60172	Knoxville	20.6	92%	8%	1%	7.2	10
N86225	Lebanon Monroe Street	9.2	77%	23%	0%	4	2

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
N86226	Lebanon Monroe Street	8.4	94%	6%	0%	4	1
N90247	Leroy	7.5	69%	31%	0%	4	2
N90248	Leroy	6.1	85%	15%	0%	4	5
N95821	Litchfield	5.0	76%	24%	0%	4	11
N95822	Litchfield	7.4	96%	4%	0%	4	5
N95859	Litchfield	7.4	90%	10%	0%	4	12
N97886	Litchfield Commercial Drive	8.7	6%	92%	2%	7.2	0
N97887	Litchfield Commercial Drive	19.3	62%	38%	0%	12	1
P09304	Madison	3.1	77%	23%	0%	4	9
P09307	Madison	9.7	87%	13%	0%	4	26
P20913	Marissa	6.6	92%	8%	0%	12	1
P26281	Marseilles	15.4	87%	13%	0%	12	6
P39298	Mascoutah Route 4	21.3	74%	26%	0%	7.2	0
P58139	Mt Vernon 27th St	7.9	75%	25%	0%	12	10
P60161	Mt Vernon Brownsville Road	13.9	89%	11%	0%	12	14
P71830	Mulberry Grove	64.1	80%	20%	0%	12	12
P72318	Nameoki	3.1	86%	14%	0%	4	6
P77233	New Athens	51.3	84%	16%	0%	12	4
P82290	New Hanover	10.4	88%	12%	0%	12	0
P83705	Newark	25.9	85%	14%	0%	7.2	6
P83710	Newark	39.7	88%	12%	0%	12	4
Q06141	North Champaign	3.7	81%	19%	0%	12	3
Q15845	North Staunton	14.5	90%	10%	0%	12	6
Q18242	Ofallon	9.2	94%	6%	0%	12	14
Q25802	Oglesby	14.0	85%	14%	1%	7.2	1
Q71846	Ramsey	69.1	84%	16%	0%	12	20
Q75145	Ridgeway	24.9	77%	23%	0%	12	11
Q80354	Rosewood Heights	7.0	95%	5%	0%	12	2
Q83149	Salem	2.2	65%	35%	0%	4	5
Q83171	Salem	14.3	92%	8%	0%	12	10
R05115	Galesburg South Farnham St	22.9	91%	9%	0%	12	25
R05186	Galesburg South Farnham St	10.8	83%	17%	0%	12	7
R06211	South Edwardsville	19.5	73%	27%	0%	12	8
R09226	Southeast Downs	28.0	91%	8%	0%	7.2	3
R16513	Spring Valley	2.2	80%	20%	0%	12	3
R68903	Utica Ridge Ave	14.3	76%	24%	0%	12	7
R73839	Vandalia	5.6	76%	24%	0%	4	16
R73841	Vandalia	87.2	82%	18%	0%	12	23
R84148	Viola	136.0	87%	13%	0%	7.2	12
S04545	Benton E	18.7	87%	12%	1%	7.2	10

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
S07535	Benton Oil Field	10.5	74%	26%	0%	12	3
S28551	Crab Orchard	9.5	80%	20%	0%	12	2
S31561	Elkville	8.7	86%	14%	0%	12	4
S41562	Harrisburg	3.7	66%	34%	0%	4	4
S42578	Harrisburg North	7.0	54%	45%	1%	7.2	5
S50542	Herrin W	3.1	72%	28%	0%	4	7
S61529	Marion	5.4	79%	21%	0%	12	8
S61575	Marion	0.7	75%	25%	0%	12	6
S79510	Mound City W	7.9	73%	27%	1%	12	5
S86595	Murphysboro	1.7	58%	42%	0%	4	2
S93504	Norris City	33.7	72%	28%	1%	12	6
S93507	Norris City	5.7	83%	17%	0%	12	15
S93553	Norris City	10.5	80%	20%	0%	12	7
T02539	Sesser	6.0	74%	26%	0%	4	6
T06504	West Frankfort	14.3	89%	11%	0%	12	16
T12527	Whittington JCT	12.2	75%	25%	0%	12	2
T22508	Carbondale SW	7.5	96%	4%	0%	12	10
T29563	Illinois Centre Mall Sub	4.3	0%	100%	0%	12	39
U11531	Banner	42.0	82%	18%	0%	12	10
U12540	Barry	27.5	81%	18%	1%	7.2	1
U13551	Basco	54.6	73%	27%	0%	12	4
U19534	Beardstown Om	25.0	80%	19%	1%	7.2	1
U30005	Canton	1.7	35%	64%	0%	4	1
U30006	Canton	3.7	89%	11%	0%	4	7
U30007	Canton	1.3	59%	40%	1%	4	2
U31542	Canton N	4.1	89%	11%	0%	12	11
U37002	Carthage	4.4	69%	31%	0%	4	2
U37003	Carthage	6.2	88%	12%	0%	4	2
U52516	Franklin	35.2	77%	23%	0%	12	7
U93507	Macomb N	8.7	93%	7%	0%	12	4
U93563	Macomb N	21.9	66%	34%	0%	12	4
U93590	Macomb N	9.9	89%	11%	0%	12	3
U95003	Macomb S	3.9	88%	12%	0%	4	5
U98001	Mason City W and Mason City	4.3	94%	6%	0%	4	2
U98002	Mason City W and Mason City	2.4	65%	35%	0%	4	1
U99515	Mason City W	36.7	74%	26%	0%	12	1
U99578	Mason City W	12.6	80%	20%	0%	12	0
V10002	Mt Sterling	3.6	78%	22%	0%	4	10
V13510	Naples	5.5	76%	24%	0%	12	1
V17539	Palmyra	18.4	84%	16%	0%	12	3
V18541	Pawnee W	7.6	92%	8%	0%	12	1
V18553	Pawnee W	16.8	76%	24%	0%	12	0

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
V18582	Pawnee W	21.9	81%	19%	0%	12	4
V19001	Pawnee W and Pawnee	6.6	94%	6%	0%	4	7
V19002	Pawnee W and Pawnee	1.9	74%	26%	0%	4	2
V29003	Quincy 6 and Ohio	2.1	91%	8%	0%	4	5
V31002	Quincy 8 and Chestnut	2.8	93%	7%	0%	4	8
V37509	Quincy 16 and Wells	6.2	79%	21%	1%	12	1
V39003	Quincy 22 and Spruce	2.6	87%	13%	0%	4	5
V41568	Quincy 28th and Adams	4.1	96%	4%	1%	7.2	2
V42586	Quincy 30 and Hampshire, Quincy 30th and Hampshire	3.4	86%	14%	0%	12	3
V42593	Quincy 30 and Hampshire, Quincy 30th and Hampshire	1.1	0%	100%	0%	12	0
V46521	Quincy 42 and Columbus	10.1	53%	47%	0%	12	0
V49541	Quincy Front St	19.5	74%	25%	0%	12	3
V74506	Virden	15.9	80%	20%	0%	12	3
V77543	Waggoner JCT	21.7	78%	22%	0%	12	7
W01528	Quincy 30th and Weiss Ln	8.9	78%	19%	3%	7.2	0
W01554	Quincy 30th and Weiss Ln	1.7	0%	50%	50%	7.2	0
W01591	Quincy 30th and Weiss Ln	0.2	0%	0%	100%	12	0
X02546	Albion Elm St	28.2	86%	14%	0%	12	9
X12002	Arthur	5.0	92%	8%	0%	4	6
X24536	Bridgeport Marathon	20.5	87%	13%	0%	7.2	4
X39542	Cissna Park	4.8	78%	22%	0%	12	7
X52537	Dieterich	16.7	80%	20%	0%	7.2	10
X56521	Effingham Banker St	4.1	97%	2%	1%	7.2	2
X57003	Effingham Cherry St	2.4	78%	22%	0%	4	2
X57545	Effingham Cherry St	1.6	45%	53%	2%	12	1
X62031	Effingham S	4.4	93%	7%	0%	4	2
X62032	Effingham S	3.2	70%	28%	2%	4	7
X72535	Forrest JCT	24.3	80%	19%	1%	7.2	4
X88502	Kansas	9.9	81%	19%	0%	12	12
X91510	Kincaid	11.1	87%	13%	0%	12	15
X91511	Kincaid	6.6	87%	13%	0%	12	7
X95001	Lawrenceville N	2.9	79%	21%	0%	4	6
X95002	Lawrenceville N	1.8	59%	41%	0%	4	3
X95003	Lawrenceville N	4.7	88%	12%	0%	4	6
Y01524	Lovington	10.2	87%	13%	0%	12	14
Y07558	Mattoon	3.2	95%	5%	0%	12	5
Y07577	Mattoon	6.5	77%	23%	0%	12	5

Circuit	Substation	Line Length (Miles)	% Res.	% Com.	% Large C&I	Voltage Level	Low Income Customers
Y28597	Newman	30.9	78%	22%	0%	12	13
Y55555	Paxton	10.0	92%	7%	1%	7.2	4
Y64012	Robinson N	3.8	86%	13%	2%	4.16	5
Y66530	Robinson W	0.0	0%	0%	100%	7.2	1
Y66549	Robinson W	0.0	0%	0%	100%	7.2	1
Y66557	Robinson W	13.1	91%	9%	0%	12	16
Y79503	Shelbyville W, Shelbyville West	4.6	77%	23%	0%	12	3
Y89540	Taylorville E	19.4	89%	11%	0%	12	4
Y93543	Taylorville W	8.2	83%	16%	1%	12	12
Y97513	Tolono	24.6	84%	16%	0%	12	8
Y97514	Tolono	19.5	87%	13%	0%	7.2	5
Z05002	Watseka	2.1	42%	58%	0%	4	0
Z05003	Watseka	2.6	73%	26%	0%	4	1
Z05549	Watseka	11.7	92%	8%	0%	7.2	2
Z10501	West Salem JCT	17.6	78%	22%	0%	12	9
Z11506	Windsor	34.3	77%	23%	0%	12	5
Z37530	Effingham Mcgrath Ave	12.6	70%	29%	1%	7.2	4
Z43549	Dorans South	22.7	84%	16%	0%	12	14
Z43562	Dorans South	1.6	0%	86%	14%	7.2	5
Z60545	Palestine W	0.0	0%	0%	100%	7.2	N/A

Note: N/A indicates that low-income data were not available.

APPENDIX B. DETAILED IMPACT ANALYSIS METHODOLOGY

DATA INGESTION AND REVIEW

Opinion Dynamics used the following data to perform the energy and peak demand savings evaluation: (1) advanced metering infrastructure (AMI) data extracts; (2) VO status and operations logs; (3) circuit characteristics; and (4) hourly weather data.

- **AMI data extracts.** AIC provided Opinion Dynamics with AMI data containing hourly demand (kWh), instantaneous voltage, and average instantaneous voltage at four different base voltages. AMI data are preferred for all evaluations in Illinois, and consumption is measured at the customer meter rather than the circuit level. Because there may be over 1,000 AMI meters on a given circuit, AIC provided average normalized voltage and kWh data. For a given circuit, the AMI data reflects normalized voltage based on the voltage class (e.g., 120V, 240V, 480V) where each AMI meter was located on the circuit.
- **System operations log.** This log contains the VO “On” and “Off” schedules, as well as information on critical system operation events that could cause data anomalies, such as outages. AIC provided this log with a summary tab containing VO status events (VO “On” and VO “Off”), timestamps for the events, and notes on the cause of the event. Within the system operations log, the evaluation team flagged certain time frames as excludable, adhering to guidance in the IL-TRM V13.0.
- **Circuit characteristics.** AIC provided Opinion Dynamics with a number of datasets with descriptive circuit characteristic information, including data presented in Appendix A, as well as baseline usage information.
- **Hourly weather data.** The evaluation team sourced weather data from the National Oceanic and Atmospheric Administration’s (NOAA) National Centers for Environmental Information’s Local Climatological Data (LCD), which were mapped to circuits using GPS coordinates. We then calculated the cooling and heating degree hours, using base temperatures of 75ºF and 65ºF, respectively, to generate the weather parameters used in modeling.

ENERGY SAVINGS

DATA CLEANING

To support the 2025 impact evaluation, we cleaned the provided data to meet analytical needs. 2025 VO data were provided by AIC incrementally throughout the year to support interim impact analyses. As such, we incrementally aggregated the VO data provided before we took further data-cleaning steps. During this aggregation, we took three steps to prepare data:

- **Remove observations for U95001 circuit on request from AIC:** The circuit was initially deployed in 2025, and was included in our first interim savings estimate, but was subsequently postponed for 2026 evaluation per AIC.
- **Remove perfectly duplicated observations:** Observations with perfectly duplicated values across all variables (e.g., perfect overlaps between data files) were flagged and removed from the analysis.
- **Aggregate remaining duplicate observations:** After removing perfect duplicates, a small number of observations remained with duplicate timestamps by circuit but different voltage data. In this case, we averaged observations to arrive at a dataset with a unique set of timestamps by circuit. This affected 0.02% of records.

Once the data were aggregated, we conducted the following data-cleaning steps prior to modeling:

- **Remove negative and zero values:** Negative and zero values in kV and MW data were flagged and removed from use in the analysis.
- **Examine outliers:** Outliers were screened on a circuit-by-circuit basis. Exploration of the outliers showed that all outliers were within a reasonable range to be included in the analysis.
- **Remove "On" events in pre-period:** To construct a pre-period, "On" events were flagged and removed from the 2024 dataset.
- **Flag excludable time periods:** In some circumstances, it is best practice or required to disable VO to support system changes, growth, outages, and maintenance, both planned and unplanned. AIC has indicated that a subset of VO events should be excluded in this analysis. In 2020, Opinion Dynamics, ICC Staff, and stakeholders agreed on specific VO events that could be considered excludable and memorialized them in a memo.[21] VO events that were approved for exclusion were those for which (1) there was a circuit outage for any reason; (2) the circuit was under repair or maintenance, causing VO to be disabled; (3) VO was disabled due to any necessary switching event; (4) the circuit had experienced a failure in information or communication technology; and (5) any event was flagged for the worldwide pandemic or outages ordered by civil authorities. This information has now been memorialized in IL-TRM V13.0.
- **Remove time periods without weather data:** As previously noted, we downloaded weather data from NOAA. We used circuit longitude and latitude to find the weather station closest to each circuit's location. We removed the corresponding time periods from the analysis for instances where weather data for a particular weather station was not recorded.

Table 9 provides a summary of the second stage of data cleaning for this analysis. Results include all 250 circuits within the analysis. The primary driver for removing observations were occurrences when VO was turned "Off" for an excludable event (5.7% of total observations), followed by time periods without weather data (2.0% of total observations). Overall, after data cleaning activity, 7.7% of observations were dropped. It should be noted that no circuits were removed from the energy savings analysis due to data insufficiency.

Table 9. Summary of Data Cleaning Results for 2025 VO Energy Savings Impacts

Cleaning Steps	Circuits	Remaining Observations	# Dropped Observations	% Remaining
Initial Count	251	4,405,601	N/A	100.0%
Remove U95001 Feeder	250	4,388,057	17,544	99.6%
Perfect Duplicates	250	4,385,165	2,892	99.5%
Aggregated Duplicates	250	4,384,665	500	99.5%
kV Less than or Equal to 0	250	4,384,586	79	99.5%
On in the Pre Period	250	4,384,586	N/A	99.5%
Data is Excludable	250	4,155,523	229,063	94.3%
No Weather Data	250	4,066,229	89,294	92.3%
Final	**250**	**4,066,229**	**N/A**	**92.3%**

MODELING PERCENT CHANGE IN VOLTAGE FOR DEMAND SAVINGS

The evaluation team removed VO "On" periods in 2024 to develop a pre-period baseline for this evaluation. As a result, the baseline includes VO "Off" periods only. The post-period of interest is 2025 when all circuits are active. The post-

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[21] Ameren Illinois Company Voltage Optimization Verification and Exclusion Approach Memo, accessed at: https://www.ilsag.info/wp-content/uploads/AIC-2019-Voltage-Optimization-Operation-Verification-Memo-FINAL-2020-04-17.pdf

period consists of largely “On” periods and non-excludable “Off” periods. The evaluation team used this structure to fit individual models on each circuit.

To estimate changes in voltage, we used a regression model described in Equation 3.

Equation 3. Voltage Reduction Model

$$kV_{it} = a_i + \beta_{1i}Post_{it} + \beta_{2i}CDH_{it} + \beta_{3i}HDH_{it} + \beta_{4i}Weekend_t + \beta_{5i}Post_{it} * CDH_{it} + \beta_{6i}Post_{it} * HDH_{it} + \beta_{7i}Post_{it} * Weekend_t + \varepsilon_{it}$$

Where:

- kV_{it} = Kilovolts for circuit *i* at time *t*
- a_i = Model intercept of circuit *i*
- β_x = Regression coefficients for circuit i
- $Post_{it}$= Indicator variable for circuit *i* at time *t* for the time relative to VO deployment where the circuit is in the post-period ($Post_{it}$ = 1) or in the pre-period ($Post_{it}$ = 0)
- CDH_{it}= The number of cooling degree-hours at time *t* corresponding to circuit *i*
- HDH_{it} = The number of heating degree-hours at time *t* corresponding to circuit *i*
- $Weekend_t$ = Indicator variable for weekend ($Weekend_t$= 1) or weekday ($Weekend_t$ = 0)
- ε_{it} = Error term

CALCULATING ANNUAL ENERGY SAVINGS

The IL-TRM V13.0 prescribes an algorithmic approach to evaluating VO energy savings. The algorithmic approach combines deemed parameter values with measured savings in voltage to calculate energy savings using Equation 4. Since we apply the estimated change in voltage to the circuit-level annual usage, the results are effectively annualized for the entire year.

Equation 4. AIC VO Energy Savings Algorithm

$$Annual\ Energy\ Savings_i = Annual\ Energy\ Use_{2014-2016,i} * CVR_f * \%\ \Delta V_i$$

Where:

- $Annual\ Energy\ Use_{2014-2016,i}$= the average annual customer energy use for circuit *i* over the 2014–2016 timeframe, excluding exempt customers;
- CVR_f= conservation voltage reduction factor, defined as the percent change in energy usage divided by the percent change in voltage (deemed at 0.80 by the IL-TRM V13.0); and,
- $\%\ \Delta V_i$= the percent change in voltage for circuit *i* resulting from VO implementation relative to the pre-period, estimated using a regression model to control for exogenous factors that may contribute to changes in voltage (e.g., weather).

DETAILED CIRCUIT RESULTS: ANNUAL ENERGY SAVINGS

Table 10 provides each algorithmic input by circuit as well as the total estimated savings per circuit that can be attributed to the VO Program. For 188 of the 250 circuits, the percent change in voltage was estimated to be larger than the planned value of 3.2%. The overall weighted average percent change in voltage was 3.70%.

Table 10. Verified Algorithmic Inputs and Associated Energy Savings by Circuit

Circuit	Annual Gross Energy Use 2014-2016 (MWh)	CVR_f	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
328119	14,544	0.8	2.87%	334
328120	8,419	0.8	2.64%	178
A68002	11,012	0.8	4.16%	366
A80001	12,113	0.8	2.06%	199
A80002	6,461	0.8	2.82%	146
B08001	4,294	0.8	4.97%	171
B10002	5,922	0.8	4.04%	191
B35002	10,366	0.8	4.82%	400
B38002	12,416	0.8	3.78%	375
B58002	7,485	0.8	3.45%	207
B77002	5,572	0.8	4.90%	218
B81002	13,402	0.8	3.31%	355
C66002	10,693	0.8	3.66%	313
D35001	7,439	0.8	2.45%	146
D35003	8,719	0.8	2.25%	157
D60002	7,721	0.8	2.47%	152
D70001	17,062	0.8	1.43%	195
D70002	9,804	0.8	1.44%	113
D70003	12,897	0.8	1.46%	150
D70004	14,901	0.8	1.40%	167
D70005	24,266	0.8	1.39%	270
D70006	19,731	0.8	1.39%	220
D70007	20,056	0.8	1.50%	241
D93001	6,152	0.8	3.22%	158
D93002	11,434	0.8	4.66%	427
E05001	8,560	0.8	5.28%	362
F10001	14,750	0.8	3.78%	446
F10002	6,625	0.8	1.33%	70
F10003	4,208	0.8	3.34%	112
H11338	6,166	0.8	4.98%	246
H22347	5,536	0.8	4.48%	199
H22348	6,167	0.8	3.59%	177
HB0393	43,018	0.8	2.83%	975
HB5890	9,711	0.8	4.93%	383
HC9327	20,229	0.8	4.32%	700
HD5253	5,739	0.8	5.10%	234
HG8174	5,654	0.8	5.06%	229

Circuit	Annual Gross Energy Use 2014-2016 (MWh)	CVR_f	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
J15302	10,501	0.8	4.02%	338
J46180	6,813	0.8	0.72%	39
J46183	7,899	0.8	4.31%	273
J46184	7,741	0.8	4.27%	264
J67134	5,844	0.8	4.85%	227
J71128	12,877	0.8	3.59%	370
J71129	4,660	0.8	3.72%	139
J75271	11,066	0.8	4.76%	421
J79305	6,040	0.8	4.32%	209
J79306	5,544	0.8	3.94%	175
J97103	8,355	0.8	5.02%	336
J97113	7,348	0.8	4.39%	258
J97136	5,549	0.8	4.75%	211
K07320	6,400	0.8	3.13%	160
K07322	9,893	0.8	3.13%	248
K09809	5,789	0.8	4.15%	192
K09855	8,497	0.8	4.16%	283
K11373	4,852	0.8	4.50%	175
K17119	9,310	0.8	4.49%	334
K27122	7,964	0.8	4.74%	302
K27123	4,384	0.8	4.69%	165
K36251	5,430	0.8	4.04%	175
K43382	6,844	0.8	2.91%	159
K48378	6,311	0.8	4.40%	222
K48381	5,829	0.8	4.33%	202
K48384	6,903	0.8	3.69%	204
K62102	12,563	0.8	3.88%	390
K69112	35,239	0.8	1.32%	372
K75312	5,030	0.8	3.74%	151
K89144	5,650	0.8	4.33%	196
K95201	4,273	0.8	4.55%	156
K95202	7,424	0.8	3.29%	196
K95203	3,220	0.8	4.33%	111
K95204	4,200	0.8	4.35%	146
K95207	3,419	0.8	4.09%	112
K95208	2,997	0.8	3.76%	90
L11242	9,517	0.8	4.89%	372
L18261	5,105	0.8	4.73%	193
L23148	6,631	0.8	4.43%	235
L35138	5,076	0.8	4.94%	201
L35282	5,985	0.8	4.66%	223
L35283	6,328	0.8	3.91%	198
L42158	8,060	0.8	4.36%	281
L43154	6,392	0.8	4.09%	209

Circuit	Annual Gross Energy Use 2014-2016 (MWh)	CVR_f	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
L59923	6,448	0.8	4.56%	235
L62927	7,293	0.8	4.46%	260
L62928	8,183	0.8	4.48%	293
L63936	9,304	0.8	4.41%	328
L74193	10,301	0.8	3.91%	322
L74195	5,175	0.8	4.18%	173
L90358	3,152	0.8	5.09%	128
L90359	9,110	0.8	2.47%	180
L93148	10,252	0.8	5.05%	414
L95211	4,498	0.8	3.72%	134
M12151	6,001	0.8	3.51%	169
M18130	8,454	0.8	3.67%	248
M18216	3,629	0.8	4.12%	120
M19222	14,806	0.8	2.90%	344
M22812	14,367	0.8	3.57%	410
M31204	10,605	0.8	3.72%	315
M47816	9,508	0.8	4.18%	318
M51275	28,051	0.8	3.99%	896
M78322	5,763	0.8	4.39%	203
M78323	8,157	0.8	4.45%	290
M78324	4,254	0.8	4.87%	166
M83408	10,596	0.8	4.07%	345
N03299	8,259	0.8	4.16%	275
N05170	12,050	0.8	3.10%	299
N13860	5,434	0.8	3.41%	148
N13861	6,861	0.8	3.90%	214
N35819	5,269	0.8	4.26%	180
N35820	6,154	0.8	3.52%	173
N60172	8,514	0.8	3.50%	238
N86225	7,804	0.8	3.91%	244
N86226	6,513	0.8	4.58%	239
N90247	6,057	0.8	4.42%	214
N90248	7,229	0.8	4.55%	263
N95821	6,195	0.8	4.04%	200
N95822	6,938	0.8	4.11%	228
N95859	7,409	0.8	2.92%	173
N97886	13,317	0.8	2.07%	221
N97887	6,688	0.8	3.38%	181
P09304	4,547	0.8	4.30%	156
P09307	7,957	0.8	3.63%	231
P20913	4,359	0.8	2.98%	104
P26281	8,001	0.8	3.60%	230
P39298	7,155	0.8	3.46%	198
P58139	4,232	0.8	4.22%	143

Circuit	Annual Gross Energy Use 2014-2016 (MWh)	CVR_f	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
P60161	7,625	0.8	4.33%	264
P71830	10,103	0.8	4.19%	339
P72318	7,703	0.8	4.02%	248
P77233	9,789	0.8	4.11%	322
P82290	4,898	0.8	4.31%	169
P83705	7,989	0.8	4.21%	269
P83710	8,937	0.8	3.75%	268
Q06141	7,788	0.8	4.60%	287
Q15845	6,143	0.8	3.66%	180
Q18242	10,379	0.8	4.54%	377
Q25802	9,366	0.8	4.38%	328
Q71846	12,826	0.8	3.89%	399
Q75145	8,356	0.8	4.51%	301
Q80354	5,845	0.8	4.71%	220
Q83149	4,361	0.8	4.30%	150
Q83171	7,167	0.8	4.49%	258
R05115	9,834	0.8	3.89%	306
R05186	6,241	0.8	3.53%	176
R06211	4,540	0.8	4.32%	157
R09226	8,994	0.8	4.57%	329
R16513	4,499	0.8	4.21%	152
R68903	8,633	0.8	4.48%	309
R73839	6,552	0.8	3.76%	197
R73841	14,801	0.8	3.69%	437
R84148	15,011	0.8	2.13%	255
S04545	9,700	0.8	5.03%	390
S07535	6,650	0.8	4.41%	235
S28551	4,780	0.8	1.63%	62
S31561	4,635	0.8	3.42%	127
S41562	7,489	0.8	4.79%	287
S42578	8,923	0.8	3.82%	272
S50542	5,377	0.8	2.45%	106
S61529	6,965	0.8	5.26%	293
S61575	6,752	0.8	5.23%	282
S79510	8,827	0.8	3.77%	266
S86595	5,121	0.8	2.85%	117
S93504	6,126	0.8	3.12%	153
S93507	4,026	0.8	3.87%	125
S93553	5,140	0.8	3.26%	134
T02539	5,330	0.8	4.26%	182
T06504	7,883	0.8	3.87%	244
T12527	4,687	0.8	4.95%	186
T22508	6,678	0.8	5.14%	275
T29563	5,394	0.8	5.58%	241

Circuit	Annual Gross Energy Use 2014-2016 (MWh)	CVR_f	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
U11531	13,071	0.8	3.45%	360
U12540	8,942	0.8	4.36%	312
U13551	4,752	0.8	4.03%	153
U19534	10,262	0.8	3.89%	319
U30005	4,096	0.8	5.00%	164
U30006	5,242	0.8	3.85%	161
U30007	5,018	0.8	4.41%	177
U31542	8,373	0.8	3.59%	241
U37002	6,551	0.8	3.99%	209
U37003	3,642	0.8	4.20%	122
U52516	7,522	0.8	3.94%	237
U93507	6,673	0.8	4.49%	240
U93563	8,055	0.8	4.32%	278
U93590	3,629	0.8	4.16%	121
U95003	5,990	0.8	4.22%	202
U98001	3,997	0.8	4.10%	131
U98002	3,514	0.8	4.18%	118
U99515	11,797	0.8	3.82%	361
U99578	3,644	0.8	4.86%	142
V10002	4,472	0.8	4.54%	163
V13510	4,508	0.8	4.11%	148
V17539	6,235	0.8	4.18%	208
V18541	7,466	0.8	4.24%	253
V18553	4,421	0.8	4.92%	174
V18582	11,823	0.8	4.44%	420
V19001	5,190	0.8	4.44%	184
V19002	3,108	0.8	4.36%	109
V29003	4,873	0.8	3.96%	154
V31002	4,885	0.8	4.62%	181
V37509	8,812	0.8	3.27%	230
V39003	6,220	0.8	3.89%	194
V41568	10,256	0.8	4.73%	388
V42586	6,168	0.8	4.85%	239
V42593	3,068	0.8	2.89%	71
V46521	6,838	0.8	2.93%	160
V49541	7,778	0.8	5.28%	329
V74506	5,607	0.8	3.22%	145
V77543	8,642	0.8	3.14%	217
W01528	13,425	0.8	2.40%	257
W01554	10,933	0.8	5.28%	462
W01591	6,698	0.8	2.19%	117
X02546	6,604	0.8	4.41%	233
X12002	6,033	0.8	4.36%	210
X24536	12,245	0.8	2.14%	209

Circuit	Annual Gross Energy Use 2014-2016 (MWh)	CVR_f	Average Percent Change in Voltage	Annual Gross Energy Savings (MWh)
X39542	6,333	0.8	4.95%	251
X52537	7,110	0.8	4.62%	263
X56521	11,234	0.8	5.00%	449
X57003	5,402	0.8	4.36%	189
X57545	7,045	0.8	3.45%	194
X62031	5,296	0.8	3.69%	156
X62032	6,115	0.8	4.25%	208
X72535	16,298	0.8	4.00%	522
X88502	5,347	0.8	3.87%	166
X91510	6,942	0.8	3.88%	216
X91511	5,665	0.8	4.41%	200
X95001	5,984	0.8	3.33%	160
X95002	5,459	0.8	3.38%	147
X95003	5,740	0.8	3.03%	139
Y01524	8,157	0.8	3.32%	217
Y07558	3,819	0.8	2.81%	86
Y07577	9,176	0.8	3.70%	271
Y28597	8,497	0.8	3.67%	250
Y55555	9,420	0.8	2.97%	224
Y64012	9,669	0.8	2.97%	229
Y66530	22,337	0.8	5.09%	910
Y66549	22,337	0.8	5.22%	933
Y66557	7,568	0.8	3.53%	214
Y79503	5,013	0.8	3.21%	129
Y89540	9,452	0.8	3.84%	290
Y93543	7,370	0.8	4.04%	238
Y97513	9,893	0.8	4.32%	342
Y97514	8,488	0.8	3.93%	267
Z05002	2,966	0.8	4.43%	105
Z05003	2,536	0.8	4.78%	97
Z05549	9,681	0.8	3.62%	280
Z10501	6,605	0.8	3.73%	197
Z11506	9,893	0.8	2.26%	179
Z37530	18,383	0.8	4.51%	663
Z43549	6,814	0.8	3.44%	187
Z43562	30,069	0.8	2.98%	718
Z60545	38,134	0.8	2.78%	849

PEAK DEMAND ENERGY SAVINGS

DATA CLEANING

Data cleaning for the peak demand analysis included all steps undertaken for the energy savings model, plus the following additional cleaning steps:

- **Peak Period Data Only:** The VO peak demand model includes only observations during the peak period, defined as the hours of 1:00 p.m.–5:00 p.m. on non-holiday weekdays between June and August.
- **Less than 20 Days in Peak Period:** Circuits with less than 20 days in the peak period were removed from the analysis. No feeders were affected by this step.
- **Missing Peak Period:** Circuits missing the 2025 peak period were removed from the analysis. No feeders were affected by this step.

Table 11 provides a summary of the data cleaning results for this analysis. The dataset used for the second interim impact analysis, covering January through August, contains the entirety of the VO peak period as defined above. Starting with the January to August dataset, we removed all non-peak days. This step resulted in the removal of 78.5% of the data. The remainder of the data cleaning steps outlined below reduced the total number of observations by about 18 percentage points.

Table 11. Summary of Data Cleaning Results for Peak Demand Savings

Cleaning Steps	Circuits	Remaining Observations	# Dropped Observations	% Remaining
Initial Count	250	3,353,105 [a]	N/A	0.0%
Peak Period Subset	250	741,382	2,611,723	77.9%
Dropping if not 20 days in Peak Period	250	741,382	N/A	0.0%
Dropping if no Baseline in Peak Period	250	741,382	N/A	0.0%
Dropping non-peak hours	250	123,651	617,731	18.4%
Final	**250**	**123,651**		**18.4%**

[a] We conduct the peak period demand savings analysis using the dataset used for the second interim impact analysis, covering only January through August. As such, the initial count in this table is less than the initial count in Table 9 that starts with the full year dataset.

MODELING PERCENT CHANGE IN VOLTAGE FOR DEMAND SAVINGS

To develop a baseline, the evaluation team used the 2024 and 2025 peak period subsets of the cleaned data. The peak period is defined as 1:00 p.m.–5:00 p.m. on non-holiday weekdays from June 1 to August 31. As with the energy savings model, the demand savings model uses 2024 as the pre-period and 2025 as the post-period. To estimate changes in voltage, we used a regression model described in Equation 5.

Equation 5. Voltage Reduction Model

$$kV_{it} = \alpha_i + \beta_{1i}Post_{it} + \beta_{2i}CDH_{it} + \beta_{3i}Post_{it} * CDH_{it} + \varepsilon_{it}$$

Where:

- kV_{it} = Kilovolts for circuit *i* at time *t*

- α_i= Model intercept for circuit *i*
- β_{xi} = Regression coefficients for circuit *i*
- $Post_{it}$= Indicator variable for circuit *i* at time *t* for the time relative to VO deployment where the circuit is in the post-period ($Post_{it}$ = 1) or in the pre-period ($Post_{it}$ = 0)
- CDH_{it}= The number of cooling degree-hours at time *t* corresponding to circuit *i*
- ε_{it} = Error term

CALCULATING PEAK DEMAND ENERGY SAVINGS

VO peak demand savings are also estimated with an algorithmic approach using Equation 6.

Equation 6. AIC VO Peak Demand Savings Algorithm

$$Peak\ Demand\ Savings_i = Avg\ Peak\ Demand_{2014-2016,i} * CVR_{f,PEAK} * \%\ \Delta V_{i,PEAK}$$

Where:

- $Avg\ Peak\ Demand_{2014-2016,i}$ = the average demand in the peak hour for circuit *i* over the 2014–2016 timeframe during the peak period adjusted by a calibration factor that captures the relationship between peak demand and average demand in the peak period, excluding >10 MW customers;
- $CVR_{f,PEAK}$ = the estimate of the peak conservation voltage reduction factor, defined as the percent change in energy usage divided by the percent change in voltage during the peak period (deemed at 0.68 by the IL-TRM V13.0); and,
- $\%\ \Delta V_{i,PEAK}$= the percent change in voltage for circuit *i* resulting from VO implementation relative to the peak hours of the pre-period, using a regression model to control for exogenous factors that may contribute to changes in voltage (e.g., weather). Per the guidance in the IL-TRM, this is to be calculated in the same manner as energy savings but to measure peak demand savings rather than total energy savings.

DETAILED CIRCUIT RESULTS: PEAK DEMAND ENERGY SAVINGS

Table 12 provides each algorithmic input by circuit and the total estimated savings per circuit that can be attributed to the VO Program. The overall weighted average percent change in voltage was 2.97%.

Table 12. Verified Algorithmic Inputs and Associated Peak Demand Savings by Circuit

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR_f	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
328119	1.59	0.68	0.02	0.02
328120	2.28	0.68	0.00	0.01
A68002	3.57	0.68	0.03	0.08
A80001	2.41	0.68	0.02	0.03
A80002	1.55	0.68	0.02	0.02
B08001	1.18	0.68	0.04	0.03
B10002	1.71	0.68	0.02	0.02
B35002	2.86	0.68	0.04	0.08

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR$_f$	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
B38002	2.35	0.68	0.02	0.04
B58002	1.46	0.68	0.02	0.02
B77002	1.95	0.68	0.04	0.05
B81002	3.53	0.68	0.03	0.06
C66002	2.33	0.68	0.02	0.03
D35001	2.09	0.68	0.04	0.05
D35003	2.70	0.68	0.03	0.05
D60002	2.90	0.68	0.01	0.03
D70001	4.60	0.68	0.00	0.01
D70002	2.40	0.68	0.00	0.00
D70003	3.83	0.68	0.00	0.01
D70004	4.34	0.68	0.00	0.01
D70005	6.53	0.68	0.00	0.01
D70006	5.25	0.68	0.00	0.01
D70007	4.43	0.68	0.01	0.02
D93001	1.39	0.68	0.03	0.03
D93002	2.98	0.68	0.04	0.09
E05001	3.08	0.68	0.05	0.11
F10001	3.77	0.68	0.02	0.05
F10002	3.25	0.68	0.01	0.03
F10003	1.50	0.68	0.02	0.02
H11338	2.02	0.68	0.05	0.07
H22347	1.16	0.68	0.04	0.03
H22348	1.67	0.68	0.03	0.04
HB0393	8.20	0.68	0.02	0.09
HB5890	2.97	0.68	0.05	0.09
HC9327	3.42	0.68	0.04	0.08
HD5253	1.32	0.68	0.05	0.04
HG8174	1.53	0.68	0.05	0.05
J15302	1.97	0.68	0.04	0.05
J46180	2.01	0.68	0.02	0.02
J46183	1.95	0.68	0.03	0.04
J46184	1.99	0.68	0.02	0.03
J67134	1.66	0.68	0.04	0.04
J71128	3.28	0.68	0.02	0.03
J71129	1.22	0.68	0.02	0.02
J75271	2.65	0.68	0.04	0.07
J79305	1.43	0.68	0.04	0.04
J79306	1.20	0.68	0.02	0.01
J97103	2.19	0.68	0.05	0.07
J97113	1.90	0.68	0.03	0.04
J97136	1.85	0.68	0.04	0.05
K07320	1.25	0.68	0.03	0.02
K07322	1.76	0.68	0.03	0.03

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR_f	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
K09809	1.55	0.68	0.04	0.04
K09855	2.51	0.68	0.03	0.05
K11373	1.68	0.68	0.04	0.04
K17119	2.39	0.68	0.03	0.05
K27122	2.45	0.68	0.03	0.05
K27123	1.44	0.68	0.04	0.04
K36251	1.64	0.68	0.03	0.03
K43382	1.87	0.68	0.01	0.02
K48378	1.65	0.68	0.04	0.04
K48381	1.77	0.68	0.03	0.04
K48384	2.21	0.68	0.03	0.05
K62102	3.38	0.68	0.03	0.06
K69112	8.41	0.68	0.01	0.05
K75312	1.33	0.68	0.04	0.03
K89144	2.61	0.68	0.03	0.06
K95201	1.13	0.68	0.03	0.02
K95202	2.06	0.68	0.03	0.04
K95203	0.70	0.68	0.04	0.02
K95204	0.91	0.68	0.04	0.02
K95207	1.28	0.68	0.04	0.03
K95208	0.90	0.68	0.04	0.02
L11242	1.93	0.68	0.04	0.05
L18261	1.12	0.68	0.04	0.03
L23148	1.62	0.68	0.04	0.04
L35138	1.34	0.68	0.04	0.04
L35282	2.85	0.68	0.04	0.07
L35283	2.90	0.68	0.03	0.07
L42158	1.46	0.68	0.04	0.04
L43154	1.85	0.68	0.04	0.05
L59923	1.62	0.68	0.03	0.04
L62927	1.80	0.68	0.03	0.04
L62928	2.15	0.68	0.04	0.06
L63936	1.98	0.68	0.04	0.05
L74193	2.42	0.68	0.04	0.06
L74195	1.12	0.68	0.04	0.03
L90358	0.84	0.68	0.05	0.03
L90359	1.81	0.68	0.01	0.01
L93148	3.46	0.68	0.05	0.12
L95211	3.15	0.68	0.02	0.05
M12151	1.51	0.68	0.03	0.03
M18130	1.60	0.68	0.02	0.02
M18216	1.24	0.68	0.02	0.02
M19222	3.95	0.68	0.02	0.05
M22812	3.39	0.68	0.03	0.07

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR_f	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
M31204	2.46	0.68	0.03	0.06
M47816	2.01	0.68	0.03	0.04
M51275	5.26	0.68	0.04	0.14
M78322	1.90	0.68	0.04	0.05
M78323	3.08	0.68	0.04	0.08
M78324	1.38	0.68	0.05	0.04
M83408	2.71	0.68	0.03	0.05
N03299	2.13	0.68	0.02	0.04
N05170	3.30	0.68	0.02	0.05
N13860	1.41	0.68	0.02	0.02
N13861	1.51	0.68	0.03	0.03
N35819	1.22	0.68	0.03	0.02
N35820	1.52	0.68	0.02	0.02
N60172	1.16	0.68	0.03	0.02
N86225	2.12	0.68	0.02	0.03
N86226	1.90	0.68	0.03	0.04
N90247	1.69	0.68	0.03	0.04
N90248	1.64	0.68	0.03	0.04
N95821	1.50	0.68	0.03	0.03
N95822	1.83	0.68	0.02	0.03
N95859	1.53	0.68	0.02	0.02
N97886	2.73	0.68	0.00	0.01
N97887	1.61	0.68	0.04	0.04
P09304	1.09	0.68	0.04	0.03
P09307	1.55	0.68	0.03	0.03
P20913	1.31	0.68	0.03	0.03
P26281	1.90	0.68	0.02	0.02
P39298	1.60	0.68	0.03	0.03
P58139	0.48	0.68	0.03	0.01
P60161	1.15	0.68	0.04	0.03
P71830	2.49	0.68	0.03	0.05
P72318	1.93	0.68	0.03	0.04
P77233	2.65	0.68	0.03	0.05
P82290	0.94	0.68	0.03	0.02
P83705	1.87	0.68	0.03	0.04
P83710	2.65	0.68	0.03	0.05
Q06141	2.05	0.68	0.04	0.05
Q15845	1.60	0.68	0.03	0.04
Q18242	3.27	0.68	0.04	0.10
Q25802	2.15	0.68	0.04	0.06
Q71846	3.00	0.68	0.03	0.07
Q75145	2.26	0.68	0.03	0.05
Q80354	1.74	0.68	0.04	0.04
Q83149	1.15	0.68	0.04	0.03

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR_f	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
Q83171	5.52	0.68	0.03	0.11
R05115	2.14	0.68	0.03	0.04
R05186	1.77	0.68	0.02	0.03
R06211	1.35	0.68	0.04	0.04
R09226	2.43	0.68	0.05	0.08
R16513	1.23	0.68	0.03	0.02
R68903	2.65	0.68	0.03	0.06
R73839	1.84	0.68	0.02	0.03
R73841	4.18	0.68	0.01	0.03
R84148	2.94	0.68	0.03	0.05
S04545	2.70	0.68	0.04	0.07
S07535	2.29	0.68	0.04	0.06
S28551	1.12	0.68	0.02	0.02
S31561	1.33	0.68	0.04	0.04
S41562	1.81	0.68	0.03	0.04
S42578	1.28	0.68	0.02	0.02
S50542	1.51	0.68	0.02	0.03
S61529	2.86	0.68	0.05	0.10
S61575	1.99	0.68	0.05	0.07
S79510	2.98	0.68	0.04	0.08
S86595	1.05	0.68	0.03	0.02
S93504	1.52	0.68	0.03	0.03
S93507	1.07	0.68	0.04	0.03
S93553	1.30	0.68	0.03	0.03
T02539	1.39	0.68	0.04	0.03
T06504	2.24	0.68	0.03	0.04
T12527	0.92	0.68	0.04	0.03
T22508	2.34	0.68	0.05	0.07
T29563	1.80	0.68	0.05	0.07
U11531	3.21	0.68	0.02	0.04
U12540	2.01	0.68	0.03	0.05
U13551	1.00	0.68	0.04	0.03
U19534	3.04	0.68	0.04	0.08
U30005	1.08	0.68	0.04	0.03
U30006	1.44	0.68	0.02	0.02
U30007	1.39	0.68	0.03	0.02
U31542	2.03	0.68	0.03	0.04
U37002	1.53	0.68	0.03	0.03
U37003	1.56	0.68	0.04	0.04
U52516	1.89	0.68	0.04	0.05
U93507	1.42	0.68	0.04	0.04
U93563	1.93	0.68	0.04	0.05
U93590	1.05	0.68	0.03	0.02
U95003	1.62	0.68	0.02	0.03

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR_f	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
U98001	1.24	0.68	0.03	0.03
U98002	1.07	0.68	0.03	0.02
U99515	2.25	0.68	0.04	0.06
U99578	2.85	0.68	0.04	0.07
V10002	1.32	0.68	0.03	0.03
V13510	1.93	0.68	0.04	0.05
V17539	1.72	0.68	0.03	0.04
V18541	2.01	0.68	0.03	0.04
V18553	3.36	0.68	0.05	0.11
V18582	3.31	0.68	0.04	0.09
V19001	1.61	0.68	0.04	0.04
V19002	0.85	0.68	0.02	0.01
V29003	0.90	0.68	0.04	0.02
V31002	1.11	0.68	0.04	0.03
V37509	2.55	0.68	0.03	0.05
V39003	1.34	0.68	0.03	0.02
V41568	1.46	0.68	0.04	0.04
V42586	2.14	0.68	0.04	0.06
V42593	0.89	0.68	0.03	0.02
V46521	2.21	0.68	0.03	0.04
V49541	2.16	0.68	0.05	0.07
V74506	1.43	0.68	0.02	0.02
V77543	1.93	0.68	0.03	0.04
W01528	3.96	0.68	0.03	0.07
W01554	0.95	0.68	0.05	0.03
W01591	2.15	0.68	0.02	0.03
X02546	1.50	0.68	0.03	0.03
X12002	1.85	0.68	0.03	0.04
X24536	3.08	0.68	0.01	0.03
X39542	1.21	0.68	0.04	0.04
X52537	1.95	0.68	0.02	0.02
X56521	2.36	0.68	0.05	0.08
X57003	1.14	0.68	0.04	0.03
X57545	2.65	0.68	0.05	0.09
X62031	1.30	0.68	0.02	0.02
X62032	1.58	0.68	0.03	0.03
X72535	3.66	0.68	0.03	0.07
X88502	1.30	0.68	0.04	0.03
X91510	2.59	0.68	0.03	0.05
X91511	1.83	0.68	0.04	0.04
X95001	1.53	0.68	0.02	0.02
X95002	1.30	0.68	0.03	0.02
X95003	1.78	0.68	0.02	0.03
Y01524	1.95	0.68	0.03	0.04

Circuit	Annual Peak Demand 2014-2016 (MW)	CVR_f	Average Percent Change in Peak Voltage	Annual Demand Savings (MW)
Y07558	1.24	0.68	0.03	0.02
Y07577	2.24	0.68	0.03	0.05
Y28597	1.98	0.68	0.04	0.05
Y55555	2.18	0.68	0.03	0.05
Y64012	2.10	0.68	0.02	0.03
Y66530	3.62	0.68	0.05	0.12
Y66549	5.99	0.68	0.05	0.21
Y66557	2.03	0.68	0.03	0.04
Y79503	1.55	0.68	0.03	0.03
Y89540	2.26	0.68	0.03	0.04
Y93543	1.49	0.68	0.03	0.03
Y97513	2.46	0.68	0.04	0.06
Y97514	2.24	0.68	0.04	0.06
Z05002	0.70	0.68	0.04	0.02
Z05003	0.64	0.68	0.04	0.02
Z05549	2.22	0.68	0.03	0.05
Z10501	1.98	0.68	0.02	0.02
Z11506	2.22	0.68	0.02	0.03
Z37530	3.57	0.68	0.04	0.10
Z43549	1.54	0.68	0.03	0.03
Z43562	5.79	0.68	0.03	0.10
Z60545	10.32	0.68	0.03	0.23

APPENDIX C. CUMULATIVE PERSISTING ANNUAL SAVINGS

Table 13 provides CPAS and WAML for the 2025 VO Program through 2040. Lifetime savings for the 2025 VO Program are 930,681 MWh.

Table 13. 2025 VO Program CPAS and WAML through 2040

Measure Category	Measure Life	Annual Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)															
				2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Voltage Optimization - 2025 Cohort	15.0	62,045	1.000	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	0
2025 CPAS		62,045	N/A	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	62,045	0
Expiring 2025 CPAS				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62,045
Expired 2025 CPAS				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62,045
WAML	15.0																		

Table 14 presents cumulative verified CPAS and expected CPAS per the original AIC VO plan. As of the end of program year 2025, cumulative verified CPAS exceeded the expected CPAS by 15%.

Table 14. Total CPAS vs. Expected CPAS Per AIC's Original VO Implementation Plan

Year Ending	2018	2019	2020	2021	2022	2023	2024	2025
Expected Cumulative Persisting Annual Savings (MWh) per AIC's VO Implementation Plan	0	7,650	59,994	128,433	201,725	275,006	348,287	421,568
Total Cumulative Persisting Annual Savings (MWh) [a]	0	9,175	81,843	177,275	264,167	347,583	424,751	486,796
% of Expected Savings Reached by End of Evaluation Period	N/A	120%	136%	138%	131%	126%	122%	115%

[a] This row contains the total CPAS from all years of VO Program implementation (2019–2025) and, therefore, differs from the values presented in Table 13 above, which presents only CPAS from the 2025 VO Program.

APPENDIX D. VERIFICATION OF CONTINUED OPERATIONS

Opinion Dynamics conducted an analysis of each cohort of circuits deployed from 2019 through 2024 to verify continued operations. Since VO savings are deemed for 15 years after completion of the initial evaluation of a circuit, and no retroactive changes are subsequently made to the savings, verification is necessary to confirm continued operation.

In 2020, Opinion Dynamics, AIC, and ICC Staff agreed that ongoing verification of VO should be conducted during the period covered by the Voltage Optimization Plan to provide information to all stakeholders about the level of continued VO operation and, if needed, to provide context as to why VO may not have operated continuously. After the initial evaluation of each year of circuits, all parties agreed that Opinion Dynamics would conduct verification activities to assess the degree to which VO continued to operate throughout each year. The acceptable uptime threshold of operation was set to ensure that circuits operated over a 90% threshold.[22]

The purpose of this verification is to provide information to stakeholders and other parties as to the level of continued operation of VO throughout the deemed 15-year period of savings and, if needed, to provide context as to why VO may not have operated continuously at the acceptable 90% uptime threshold throughout the period. Our analysis found that all sampled circuits, except R28870, originally evaluated in 2022, were "On" for more than 90% of non-excludable hours in 2025. For R28870 circuit, most of the "Off" status was attributable to operational events classified as loss of communications, which is deemed as a non-excludable event. We conducted the following activities to determine whether these circuits operated over a 90% uptime threshold.

- **Sample Selection.** We randomly selected roughly 10% of each of the previously evaluated cohorts of circuits. This translates to 2 of the 19 circuits evaluated in 2019, 13 of the 125 circuits evaluated in 2020, 18 of the 180 circuits evaluated in 2021, 19 of the 181 circuits evaluated in 2022, 20 of the 194 circuits in 2023 and 22 of the 214 circuits in 2024. See Table 15 for the list of sampled circuits. Sample selection was performed retrospectively and provided to AIC in the second half of December of the evaluation year. This was done to ensure that the anticipated evaluation did not change the operations of the circuits subject to verification of continued operation.
- **Review operation log summaries for the sample.** The variable of interest for this effort included the VO status (i.e., VO "On" and VO "Off") for specific hours throughout the year at a circuit level. We were able to rely on the VO status log summaries for this analysis since we generally expected VO to run for nearly all hours in a year.
- **Data cleaning.** Opinion Dynamics did not perform any data cleaning prior to the verification activities except for removing excludable events. Excludable events are discussed in detail in Appendix B.
- **Calculated operation status.** We calculated the proportion of hours that each circuit's VO status was "On" for a given year. We then divided the total number of hours the status logs indicated that VO was operational by the total number of non-excludable hours in the year.

Table 15 presents the sample selected for verification in 2025 of the circuits evaluated from 2019 through 2024.

Table 15. Sample of Circuits Where Continued Operations Were Verified in 2025

Feeder	Substation	Year Previously Evaluated	Uptime (% of 2025)[a]
J34357	Bethalto	2019	99.35%
V41533	Quincy 28th and Adams	2019	99.24%
A17026	Bartonville	2020	99.35%

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[22] See Ameren Illinois Company Voltage Optimization Verification and Exclusion Approach Memorandum here: https://www.ilsag.info/wp-content/uploads/AIC-2019-Voltage-Optimization-Operation-Verification-Memo-FINAL-2020-04-17.pdf

Feeder	Substation	Year Previously Evaluated	Uptime (% of 2025)[a]
B44002	Chester	2020	99.34%
D48002	Jefferson	2020	99.34%
H00163	West Bloomington	2020	99.31%
H06135	Westville West Main	2020	99.29%
K01239	Belleville Pontiac	2020	99.34%
K76541	Champaign Oak St	2020	97.99%
M36185	Galesburg Fremont Rd	2020	99.34%
Q83168	Salem	2020	99.35%
U31565	Canton N	2020	99.34%
Y07001	Mattoon	2020	99.32%
Y55003	Paxton	2020	99.35%
Z17554	Effingham NW	2020	99.35%
A17021	Bartonville	2021	99.34%
D37004	Park	2021	99.35%
D55001	Hines	2021	99.01%
D55002	Hines	2021	99.01%
H11339	Wood River 6th St	2021	99.35%
J01119	Abingdon	2021	99.28%
J89105	Belleville C St	2021	99.33%
L17104	Decatur Northgate	2021	99.33%
M45211	Georgetown Indianola Rd	2021	99.35%
N70331	Kewanee South Street	2021	99.32%
P98191	Normal Main St	2021	99.29%
Q85162	Sandoval	2021	99.23%
R01153	South Bloomington	2021	99.30%
R60552	Urbana Perkins Rd	2021	99.30%
T22507	Carbondale SW	2021	99.34%
X30506	Charleston East	2021	99.24%
X60596	Effingham N	2021	99.34%
Y11556	Mattoon NW	2021	99.25%
A26005	Corrington	2022	99.33%
B10001	Cruger	2022	99.32%
B19002	Logan	2022	99.34%
B57001	Court	2022	99.26%
B77001	Nebraska	2022	99.31%
D28124	Washburn	2022	99.34%
G30001	Emden	2022	99.29%
H14343	Wood River Ben Bow	2022	99.28%
K73365	Champaign Leverett Rd	2022	97.40%
K73366	Champaign Leverett Rd	2022	97.40%
N05173	Granville	2022	99.25%
N50331	Jacksonville Power Plant	2022	99.30%
P42230	Millstadt	2022	99.33%
P69175	Mt Zion Rte 121	2022	99.35%

Feeder	Substation	Year Previously Evaluated	Uptime (% of 2025)[a]
Q23256	Ofallon Seven Hills Road	2022	99.24%
R28870	Staunton Spring Street	2022	84.78%
V46563	Quincy 42 And Columbus	2022	99.35%
Y37592	Olney S	2022	99.35%
Z29579	Rossville E	2022	99.31%
B21001	Fondulac	2023	99.34%
B21002	Fondulac	2023	99.34%
B21003	Fondulac	2023	99.34%
B27006	Adams	2023	99.11%
B28004	Koch B28ltc1	2023	99.11%
B61002	Brimfield 69kv	2023	99.35%
B71003	Lake	2023	99.11%
D90004	Mcgrath	2023	99.32%
J39391	Bloomington Beich Road	2023	99.33%
M07235	El Paso	2023	97.56%
M49410	Glen Carbon Main St	2023	99.31%
N70332	Kewanee South St	2023	99.33%
P17107	Mahomet	2023	99.33%
R16510	Spring Valley	2023	99.33%
S01501	Anna	2023	99.34%
T59942	Sparta North Market St	2023	99.32%
U92593	Macomb E	2023	99.20%
V33003	Quincy 10th and Hampton	2023	99.33%
V36001	Quincy 15 and Kochs Ln	2023	99.33%
X78537	Grayville	2023	99.31%
301052	Mitchell 12KV	2024	99.35%
301053	Mitchell 12KV	2024	99.35%
A32001	Wallace	2024	99.72%
A49002	Farmdale	2024	99.27%
A49003	Farmdale	2024	99.29%
A50002	Flint	2024	99.31%
C15002	Riverton	2024	99.33%
D41001	Alta	2024	98.92%
D69001	Radnor	2024	99.29%
D69004	Radnor	2024	99.29%
K78352	Champaign Southwest Campus	2024	99.32%
M54314	Granite City 22nd Street	2024	99.34%
Q10702	North Granite City	2024	99.32%
Q18244	Ofallon	2024	99.32%
R10941	Sparta	2024	99.27%
R10943	Sparta	2024	99.32%
R93351	Wanda	2024	99.31%
V04537	Meredosia Switchyard	2024	99.33%
V55524	Quincy Soybean	2024	99.22%

Feeder	Substation	Year Previously Evaluated	Uptime (% of 2025)[a]
X64003	Fairbury	2024	99.28%
X82585	Hoopeston	2024	99.26%
X83533	Hoopeston S	2024	99.33%

[a] Excludes excludable events

Opinion **Dynamics**
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