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Voltage Optimization Program Update

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Agenda

System Overview

What is VO and how does it work?

Measurement & Verification (M&V)

Customer Benefits

Program Update (2018 – 2026)

Industry Collaboration

iPM (Intelligent Preventive Maintenance)

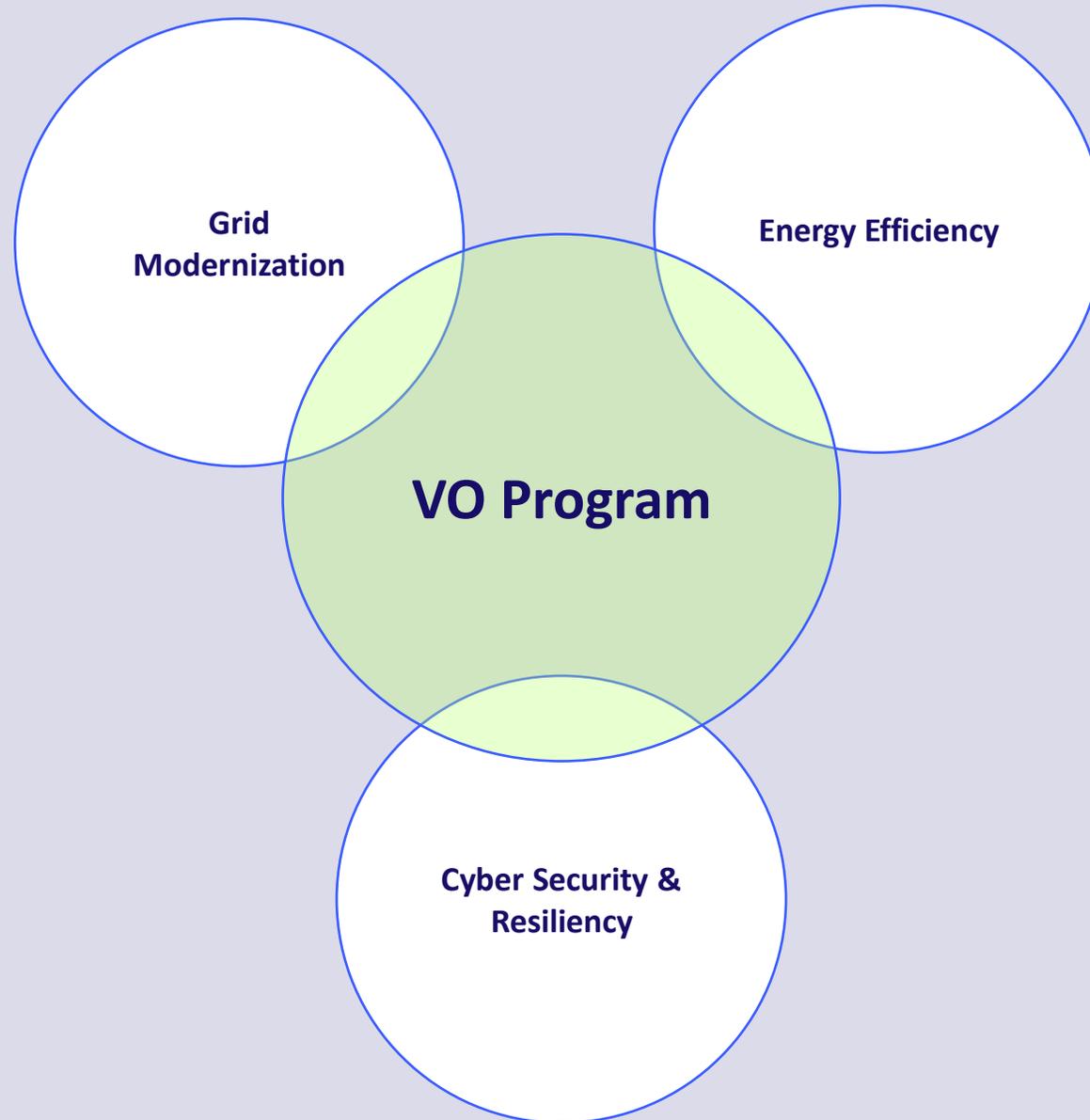
50-Year Measure Life Update

ComEd System Overview

- ✓ ComEd service territory covers ~**11,400** sq. miles
- ✓ Serves ~**4.1** million customers
 - ~70% of the customers in Illinois
 - Majority of the state's industrial companies
- ✓ ComEd's system includes among other things, approximately:
 - **800** substations
 - **506,600** distribution transformers
 - **8,500** cap banks
 - Summer peak: ~**21,000** MW
 - Winter peak: ~**16,000** MW

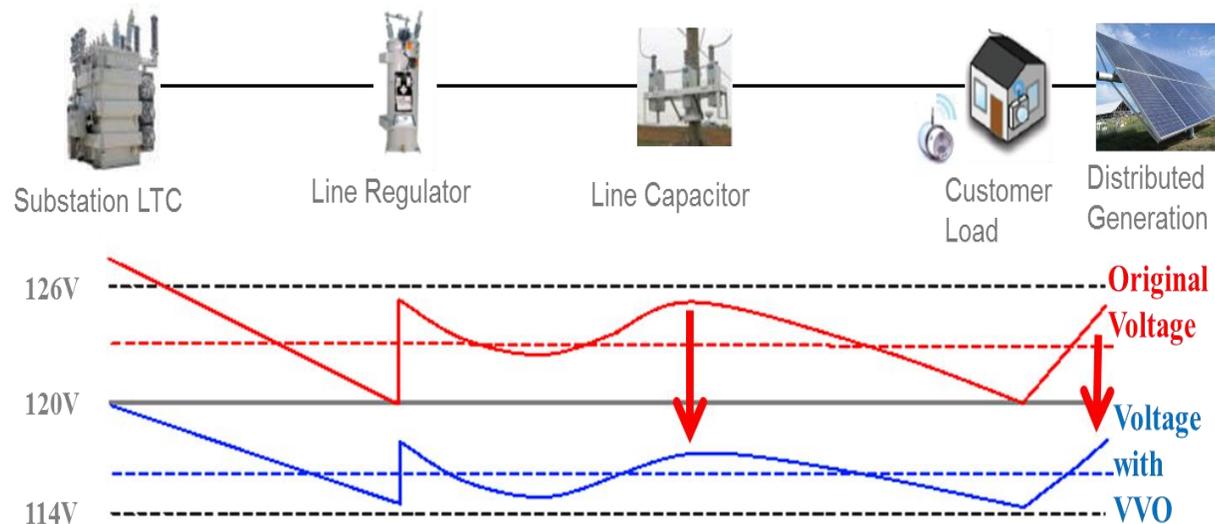


VO Program



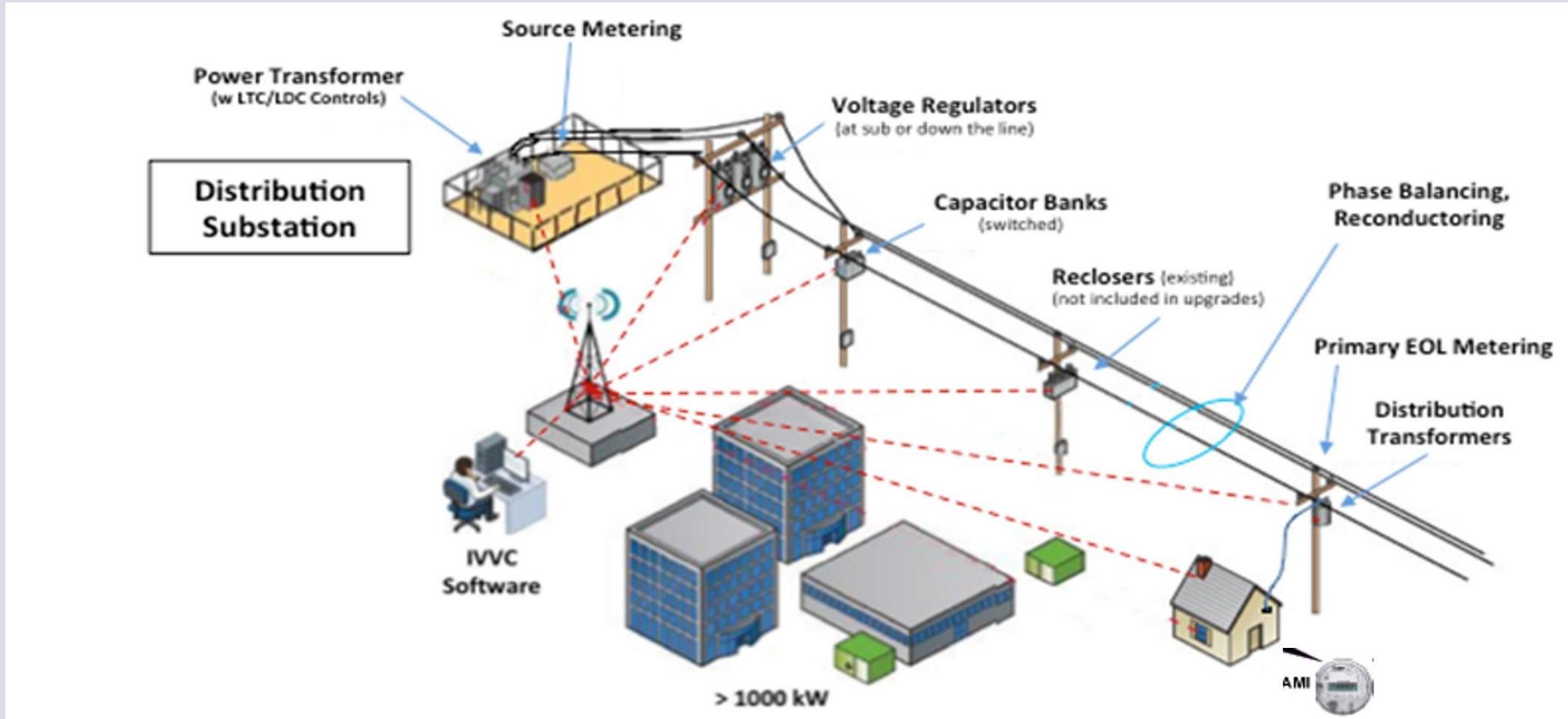
What is Voltage Optimization (VO)?

- Voltage Optimization (VO) is defined as a combination of Conservation Voltage Reduction (CVR) and Volt-VAR Optimization (VVO). VO dynamically controls and lowers the voltage range delivered to customers. This reduces energy usage and enable customers to operate more efficiently
- VO reduces power consumption by 1-3% with no impact to customers while offering improved voltage control on distribution circuits.
- Algorithmically determined optimal line settings are implemented with remote SCADA controls; this level of operational coordination would be impossible if attempted manually

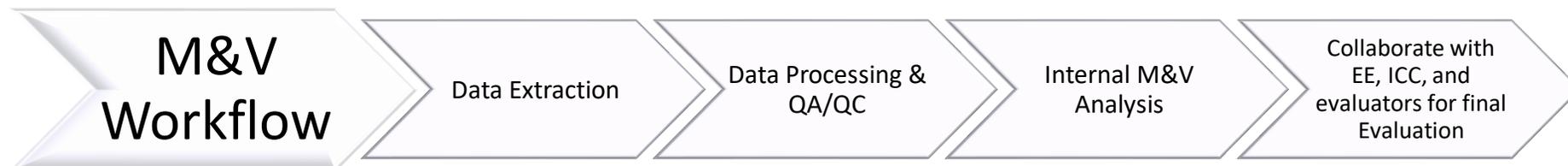
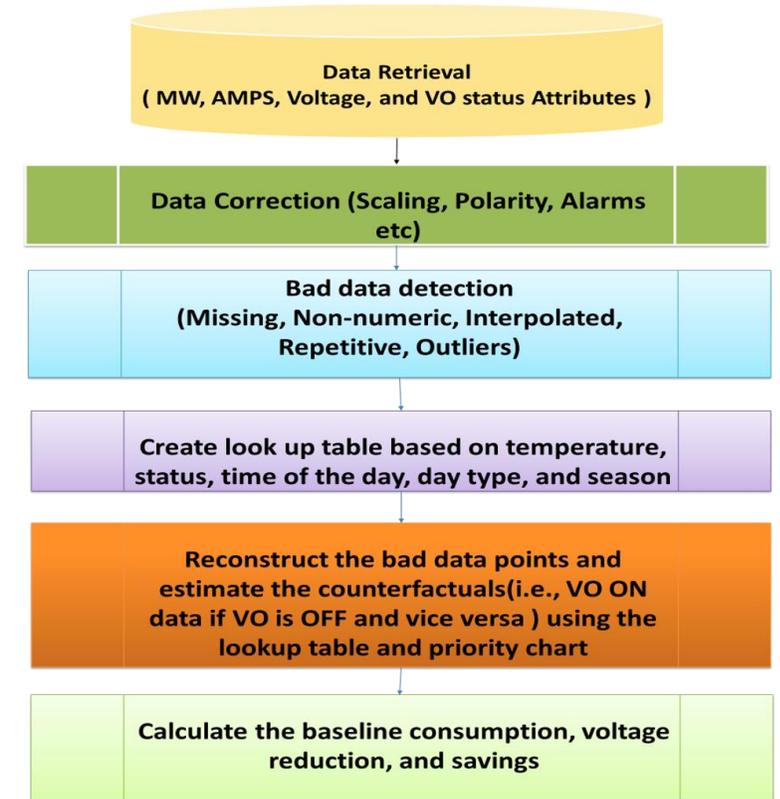
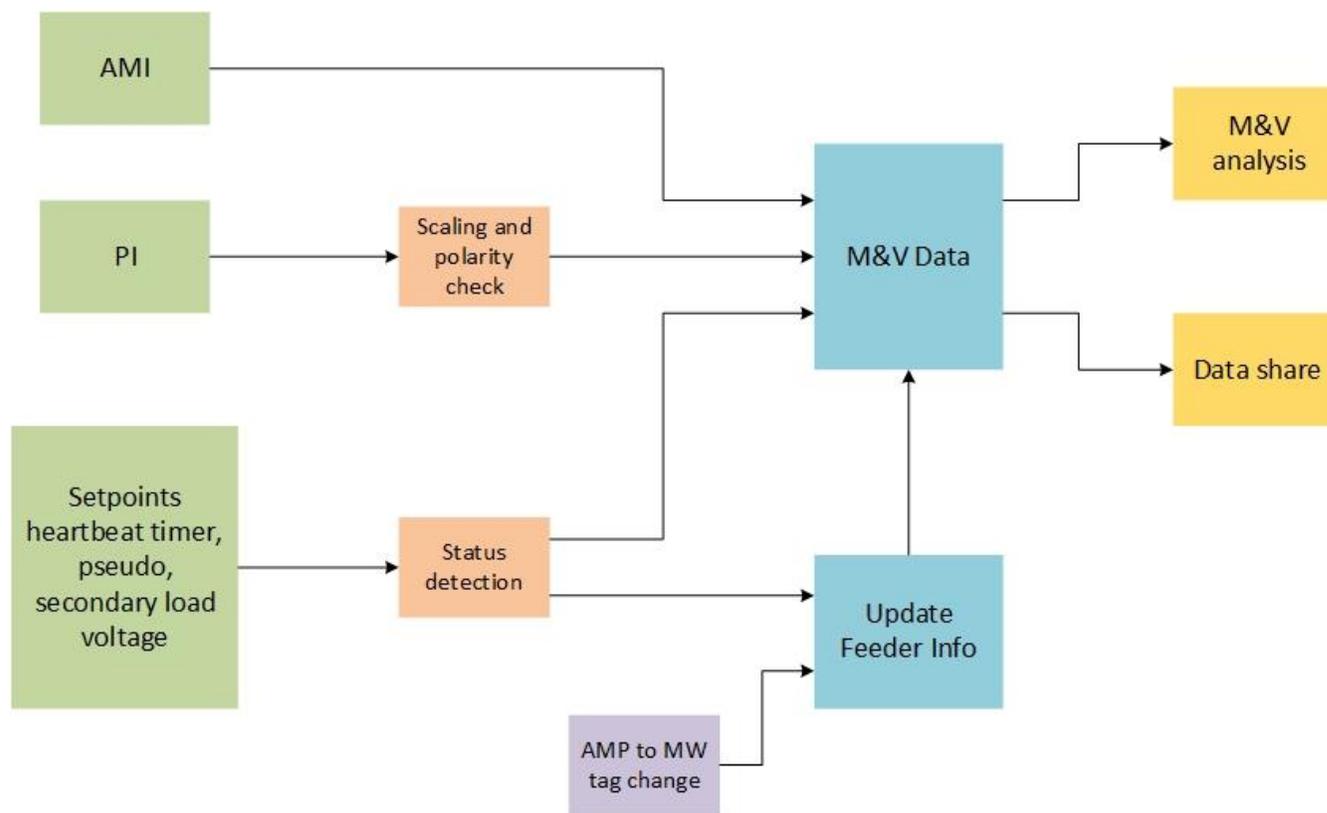


CUSTOMER SERVICE VOLTAGES				
NOMINAL VOLTAGE	RESIDENTIAL CUSTOMERS		COMMERCIAL CUSTOMERS	
	MIN.	MAX.	MIN.	MAX.
120	113	127	108	132
208	196	220	187	229
240	226	254	216	264
277	NA	NA	249	305
480	NA	NA	432	528

ComEd's Distribution Grid and VO



VO Measurement and Verification (M&V) Overview



Customer Benefits

- As part of the Future Energy Job Acts (FEJA) Bill, the Voltage Optimization Program will aid in meeting ComEd's energy efficiency goals for our customers by achieving an energy savings of up to **1,450 GWh/Yr by 2026**
- On average, the program will **decrease customer energy usage by 2-3%** without affecting customers' energy use habits. To date, achieved **~900 GWh** of energy savings since the initiation of program implementation in 2018 through the end of 2022.

600,000 Metric Tons of
Carbon di Oxide (CO2) reduction

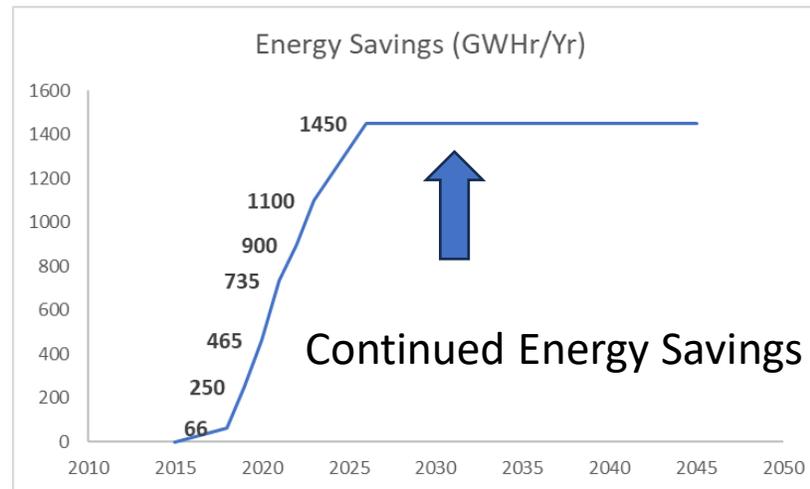
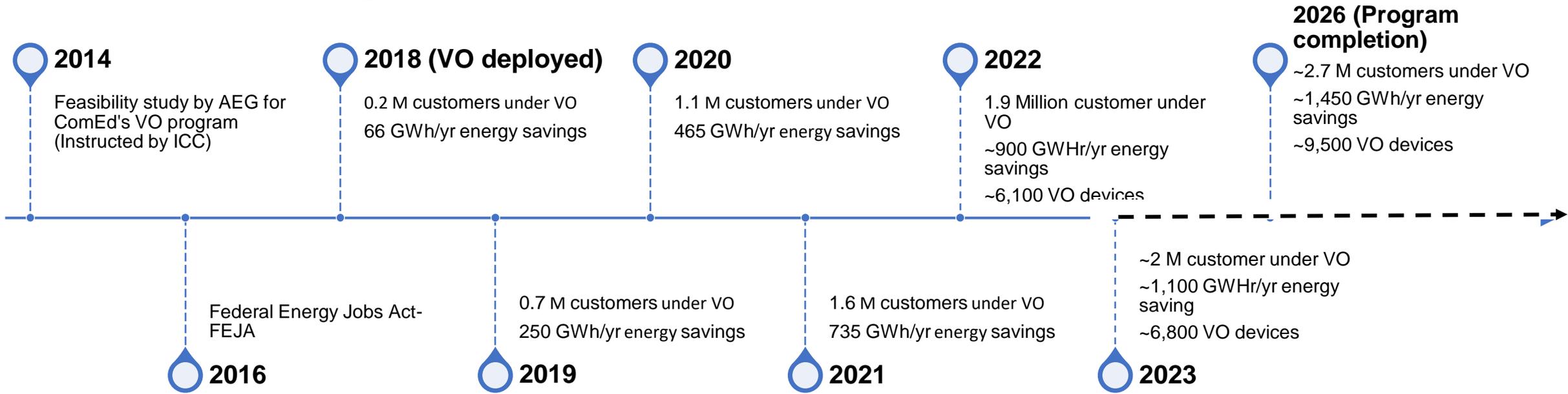


OR

80,000 homes energy use
for one year



ComEd VO Program



iPM (Intelligent Preventive Maintenance) Process

- Utilized OSI Platform running VO to automate the PM and CM processes for VO equipment
- Historically the PM process has been very labor intensive
- Using scripts to run analysis on VO Caps and Regs and create WRs
- The process used to take months whereas now it only takes a few weeks
- Optimizes resources as now only cap banks that require CM necessitate a truck role.
- Provides significant O&M savings by reducing the amount of work required.



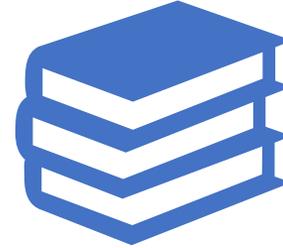
Industry Collaboration



IEEE CVR M&V Standard Development

ComEd VO group is leading an IEEE Task Force to develop a Standard on M&V for precise quantification of CVR efforts throughout the industry

The initial draft Standard document has passed ballot review with a approval rate of 96%; The Task Force is currently addressing the received comments



Publications and Conference Presentations

Published more than 15 VO papers and articles in IEEE/CIGRE conferences and Journals

Presented in 4 VO panels in IEEE/DistribUTECH conferences

Conducted 1 VO Tutorial in IEEE PES GM for industry enthusiasts

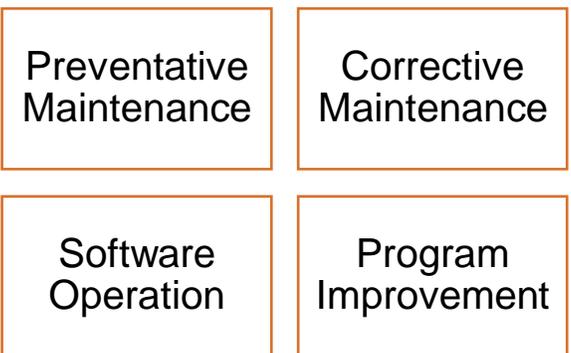
50 Year Measure Life Update

- The VO measure life was updated to 50 years from 15 years during the 2022 IL-TRM update. Measure life is the number of years Utilities can claim savings from an energy efficiency initiative.
- The updated measure life has incentivized ComEd to provide energy savings to customers through CVR for an extended period.
- With 50 years measure life ComEd has identified additional 83 stations (204 Feeders) that pass the preliminary TRC test (>1). These stations will provide ~93,000 MWhr energy savings per year if operated under VO. These stations are under ComEd's consideration to be included into the VO program in future.

Updated Clean Energy Law

Clean Energy Law: (b-20) Each electric utility subject to this Section may include cost-effective voltage optimization measures in its plans submitted under subsections (f) and (g) of this Section, and the costs incurred by a utility to implement the measures under a Commission-approved plan shall be recovered under the provisions of Article IX or Section 16-108.5 of this Act. For purposes of this Section, the measure life of voltage optimization measures shall be 15 years. The measure life period is independent of the depreciation rate of the voltage optimization assets deployed. Utilities may claim savings from voltage optimization on circuits for more than 15 years if they can demonstrate that they have made additional investments necessary to enable voltage optimization savings to continue beyond 15 years. Such demonstrations must be subject to the review of independent evaluation.

Sustainability Investments





Thank you

Adjustment To TRM

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ComEd's Mission & Values promote reliable, safe, economic investments that focus on customer value

VO Technology is a Fundamental Improvement in Distribution Grid Operations

Sustainability Investments

Preventative Maintenance

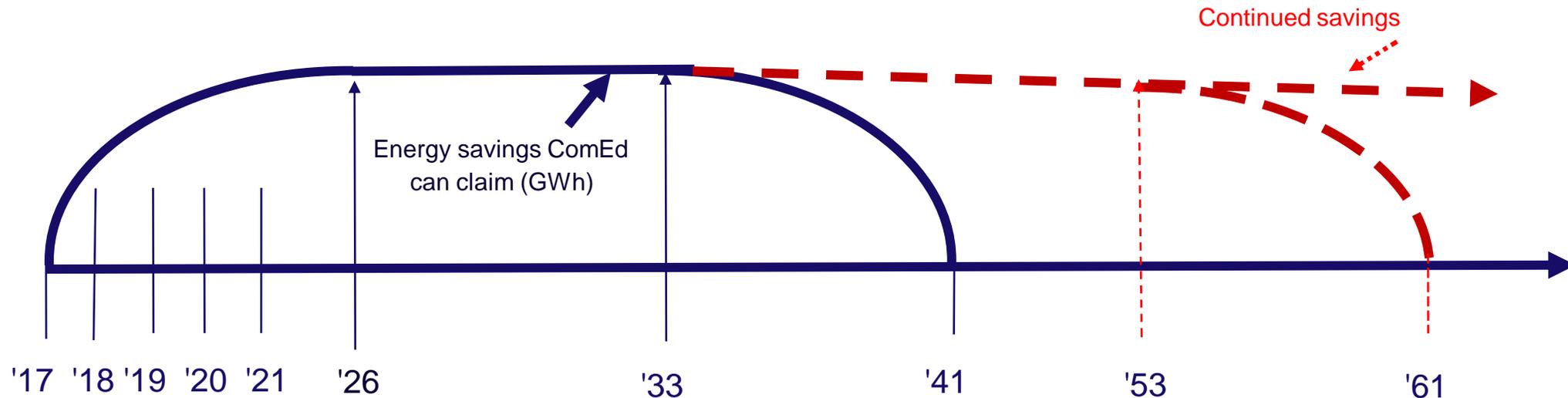
Corrective Maintenance

Software Operation

Program Improvement

Illinois Technical Reference Manual (IL-TRM)

- Illinois Technical Reference Manual (IL-TRM):
 - ICC approved reference document for the VO program. Outlines detailed energy savings calculation procedure. Measure life of VO program is 15 years
- Measure Life:
 - The number of years that ComEd can claim the energy savings produced by a specific energy efficiency measure, including the VO investment. These energy savings are claimed under the EE annual targets and reported to the ICC via the annual EE Formula Rate Update.



Measurement and Verification (M&V) Savings Calculation

- Energy savings calculation

- For each timestamp (30-minute interval), calculate the energy savings, $P_{savings}$ (MW), as follows

$$P_{savings,t} = \text{Baseline} \times \text{Average Voltage Reduction} \times \text{CVR}_{factor}$$

- The annual energy savings, $E_{savings}$ (MWh) is calculated as below

$$E_{savings} = \frac{\sum_{t=1}^{17,520} P_{savings,t}}{2}$$

- The annual energy savings at customer service level, $E_{savings-customer}$, is calculated by applying the distribution system loss factor to the annual energy saving estimated at feeder**

$$E_{savings-customer} = E_{savings} * (1 - \% \text{ Losses})$$

- Realization Factor (RF)

$$RF\% = \frac{\text{Calculated Savings}}{\text{Planned Savings}} \times 100$$

Software Applications



2023- (510 caps, 179 regs)
2024 – (814 caps, 395 regs)
2025 – 941 devices
2026 – 583 devices