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Impact of Smart Inverters with Volt/ var on ComEd's Voltage Optimization Program

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Agenda

- ✓ Background
- ✓ Summary
- ✓ Study Methodology
- ✓ Study Feeder Selection
- ✓ Study Notes
- ✓ Impact of Smart Inverters with Volt/ var on the Effectiveness of Voltage Optimization
- ✓ Conclusions of Investigation
- ✓ Questions

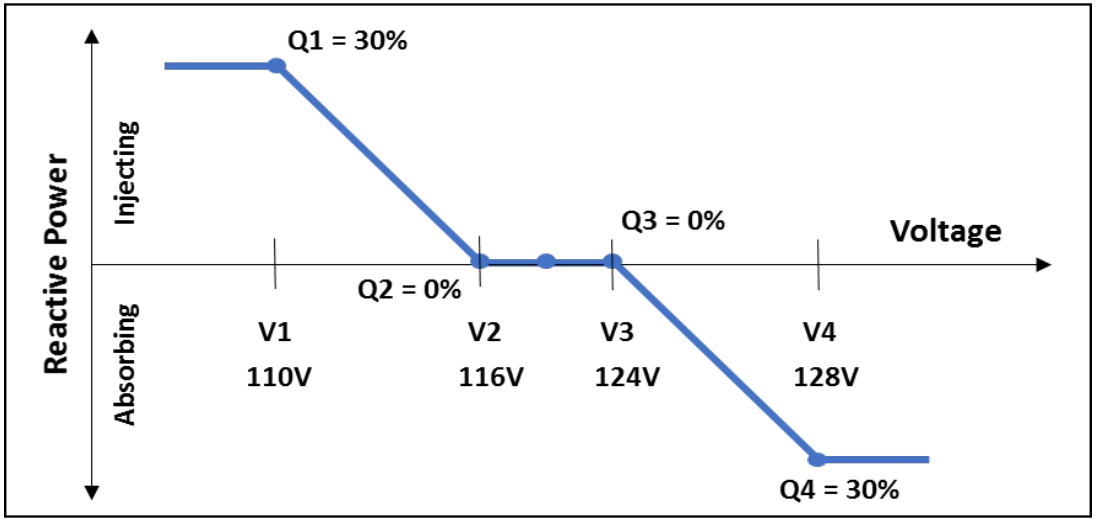
Background

- ✓The purpose of the study
- ✓ComEd's VO program
- ✓Feeder conditioning

DG Rebate Volt/var Settings

ComEd DG Rebate Volt-var Settings

V2	Dead band lower voltage limit	96.7% (116 Volts)
Q2	Reactive power injection or absorption at voltage V2	0.0%
V3	Dead band upper voltage limit	103.3% (124 Volts)
Q3	Reactive power injection or absorption at voltage V3	0.0%
V1	Voltage at which DER shall inject Q1 reactive power	92% (110 Volts)
Q1	Reactive power injection at voltage V1	30.0%
V4	Voltage at which DER shall absorb Q4 reactive power	107% (128 Volts)
Q4	Reactive power absorption at voltage V4	30.0%



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Summary

- ✓ Aggregated results of study feeder population
- ✓ Analyzed results over one full year
- ✓ Smart inverters with autonomous Volt/var control
- ✓ Using the ComEd DG Rebate settings applied to all inverters
- ✓ Dynamic control of inverters was not studied (communication infrastructure does not exist at ComEd)
- ✓ Results focused on the difference in energy savings with smart inverters operated with Volt/ var configuration compared to unity power factor

Study Methodology

16-12kV Feeders

- 4 - Urban Residential
- 4 - Urban Non-Residential
- 4 - Non-Urban Residential
- 4 - Non-Urban Non-Residential

→ Randomly apply 100kW PV up to DER capacity

32 Feeder models

- 16 with Volt/ var enabled
- 16 with unity power factor

→ 8760 simulation

- 0% PV Density
- 25% PV Density
- 50% PV Density
- 75% PV Density
- 100% PV Density

→ Results

- Energy Savings with Volt/ var enabled
- Energy Savings with unity power factor

Impact = Difference in Energy Savings between Volt/ var and unity power factor for each scenario

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Study Feeder Selection

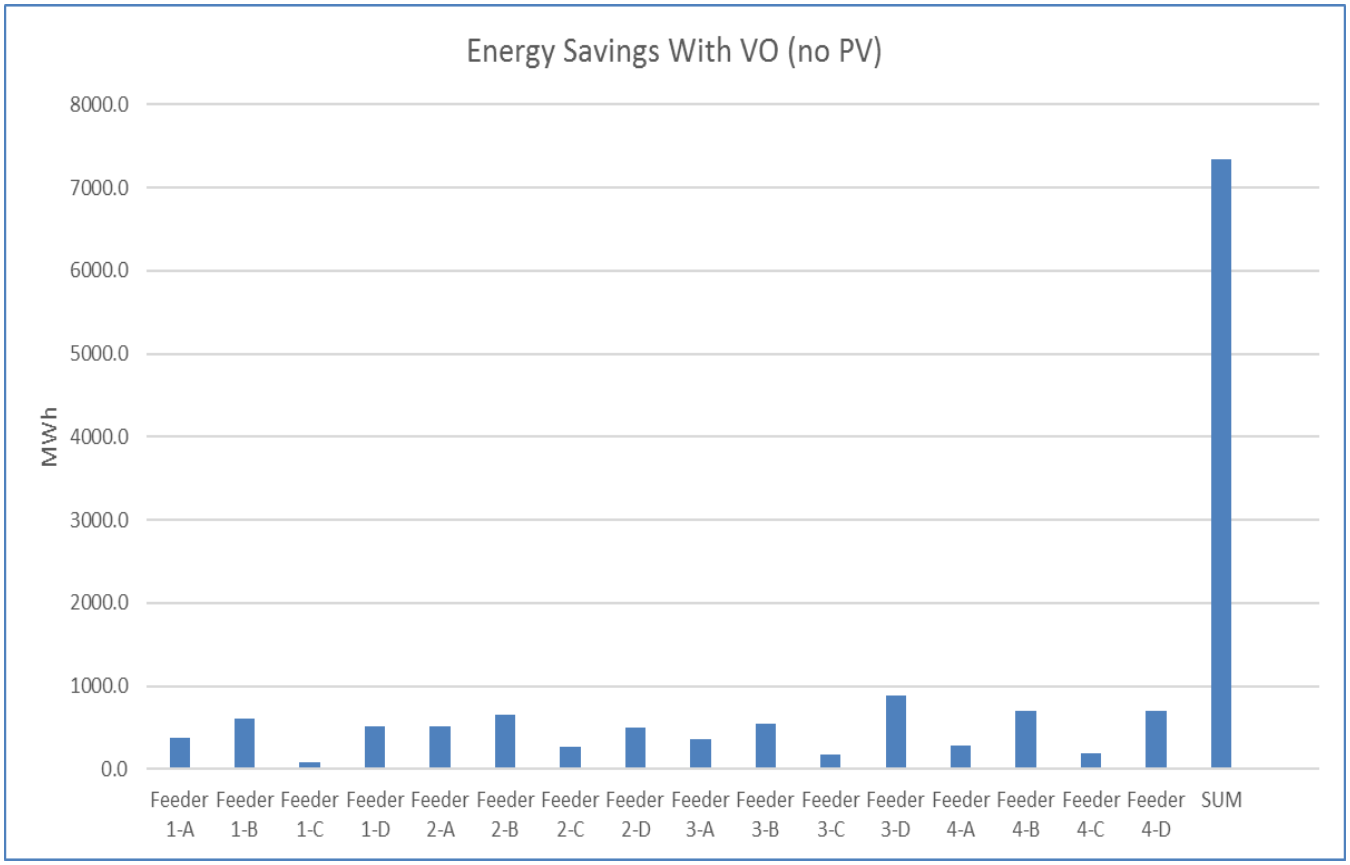
- ✓Representative of feeders where VO is or will be deployed
- ✓Four categories:
  - Urban Residential
  - Urban Non-Residential
  - Non-Urban Residential
  - Non-Urban Non-Residential
- ✓Within each category:
  - One long feeder
  - One short feeder
  - One heavily loaded feeder
  - One lightly loaded feeder

Study Notes

- ✓ Models do not contain service transformers or secondaries
- ✓ All study parameters and data captured are at primary voltage levels
- ✓ Simulations were performed at voltages that caused inverters to inject reactive power during some periods when activation of Volt/ var mode under ComEd DG Rebate settings would generally not occur

Impact of the Effectiveness of VO

- ✓ Annual energy savings from VO is 7,338 MWh or 2.6% of the annual energy consumption



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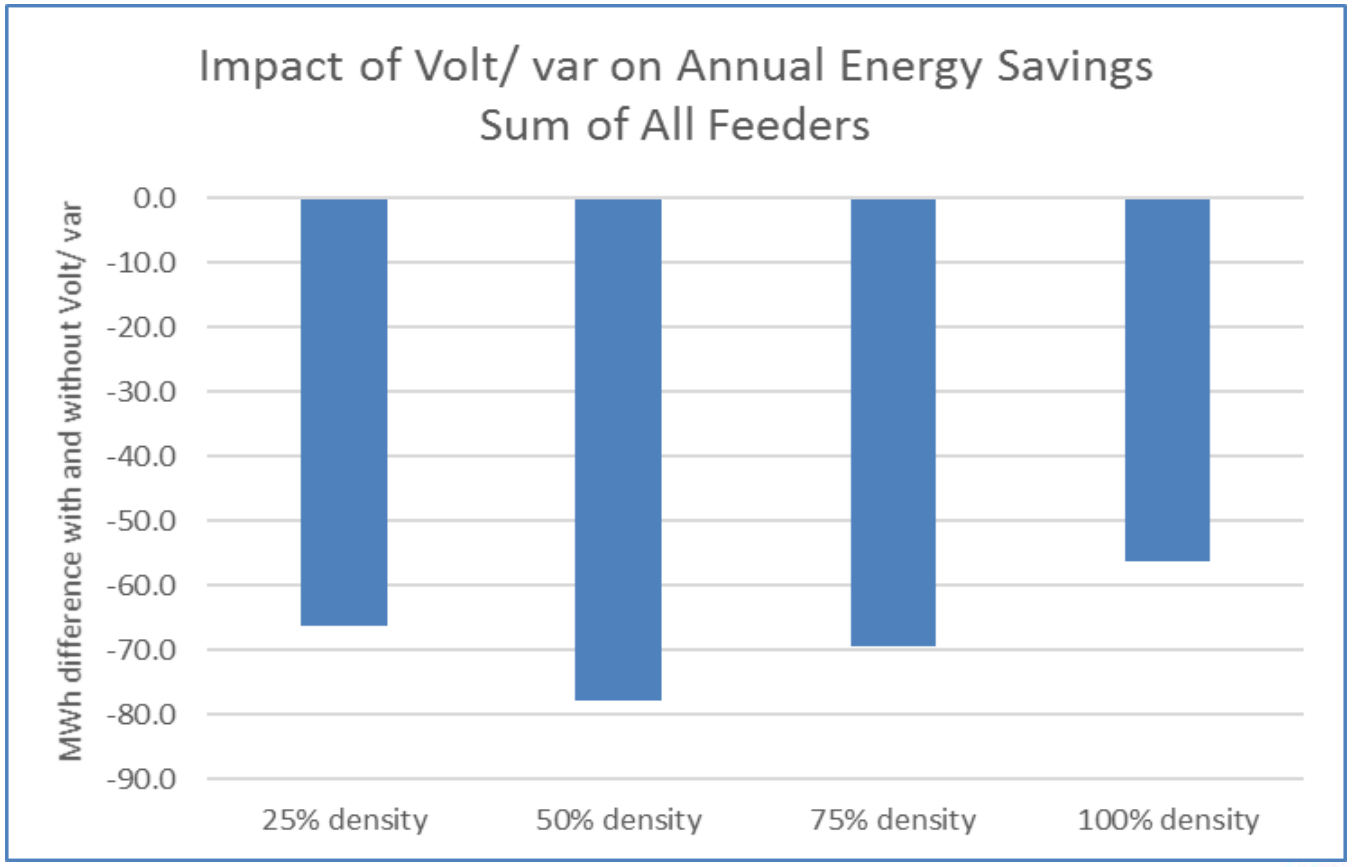
Impact of the Effectiveness of VO

- ✓ At most a 78 MWh change in annual energy savings
- ✓ Negligible impact of smart inverters with Volt/ var on the effectiveness of VO



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Conclusions of Investigation

- ✓Smart inverters with Volt/ var have a negligible impact on the effectiveness of ComEd's VO program
  - Required feeder conditioning with smart inverters in Volt/ var mode is identical to smart inverters using unity fixed power factor
- ✓ComEd does not recommend amendments to its VO Plan

Questions?

✓THANK YOU!

✓Any Questions?