

International Energy Program Evaluation Conference

Conservation Voltage Reduction – On the Other Side of the Meter

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What is CVR / VO / VVO / IVVC?

• "CVR" vs. "VO" vs. "VVO" vs. "IVVC"



What is CVR / VO / VVO / IVVC?

- ANSI C84.1 Range A for 120 V service: 120 V ± 5%
- Utilities typically try to stay in upper half (120-126 V)
- Goal of CVR: operate in lower half (114-120 V)
 - Save energy (kWh)
 - Lower peaks (kW)



What is CVR / VO / VVO / IVVC?

- Voltage declines as power flows away from substation
- SS LTCs/regulators reduce voltage at substation
- Voltage drop limits how much voltage can be reduced



"CVR 1.0"

Strategies utilities use to overcome EOL voltage sag

Line voltage regulators

- Doesn't change slope of voltage profile
- Static or respond to local voltage



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"CVR 1.0"

> Capacitors

- For voltage support, reactive power compensation
- Changes slope of voltage profile
- Static or switched





Real-time measurement at multiple locations on line



- Dynamic feedback controlling LTCs, SS and line regulators, switchable capacitor banks
- Achieves flatter voltage profiles, thus more savings
- Responds to transient changes in conditions





Avista IVVC Project



- Involved extensive upgrades to distribution systems in 2 cities
 - o 58 feeders at 14 substations in Spokane
 - o Entire distribution system in Pullman

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Avista IVVC Project

- Navigant randomly selected 25 study feeders
- IVVC controls alternated on and off daily
- Study covered fall, winter, spring 2013-14
- Mean voltage reduction of 2%



Avista IVVC Project Results

- Mean Energy Savings
 - o 1.4% **-** 2.0%
 - CVRf values 0.71 0.94
 - Sensitive to season, day type
- Results robust with respect to methodology

- Critical features for quantifying impacts
 - Feeder-level analysis
 - Model should incorporate seasonal, day-type, and exogenous load-shape factors

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Issues

- Key experimental design features
 - Exogenous cycling between CVR-on/CVR-off states (dayon/day-off or random assignment)
 - Sufficiently long test to cover all relevant seasons, operating conditions recommended
 - Re-testing when loads or circuit configurations change

- Results robust with respect to statistical model as long as they incorporated the features identified
- Key research questions:
 - Impact of distributed generation (esp. PV)
 - Addressing impacts on reactive power (var)
 - o AMI data to estimate customer-specific impacts

