



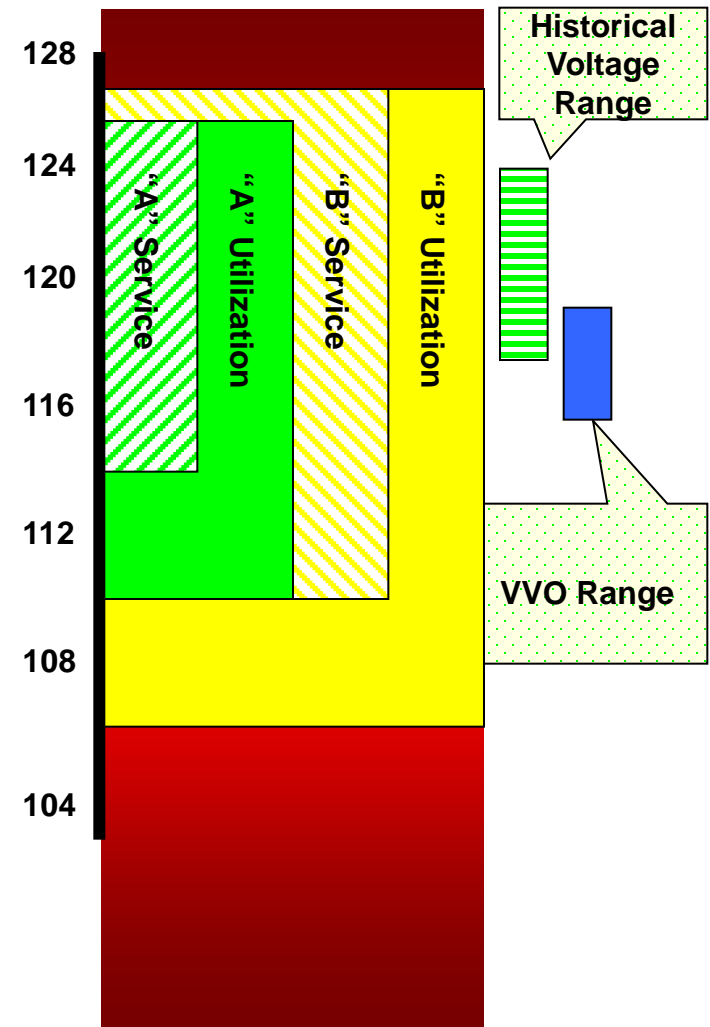
# Volt VAR Optimization at American Electric Power

**Presentation to:**  
National Summit on Smart Grid and Climate  
Change

**December 3, 2014**  
**Tom Weaver, PE**

# Volt VAR Optimization (VVO) Overview

- **Technology and infrastructure upgrades integrated into the electric distribution system to optimize voltage levels**
  - Utilizes communications and computerized intelligence to control voltage regulators and capacitors on the distribution grid
  - Optimizes voltage and power factor based upon selected parameters
  - Algorithm uses end of line monitoring feedback to ensure minimum required voltage maintained



# Volt VAR Impacts on Customer's Motors

**EPRI**

EPRI EL-2036  
Volume 1  
Project 1419-1  
Final Report  
September 1981

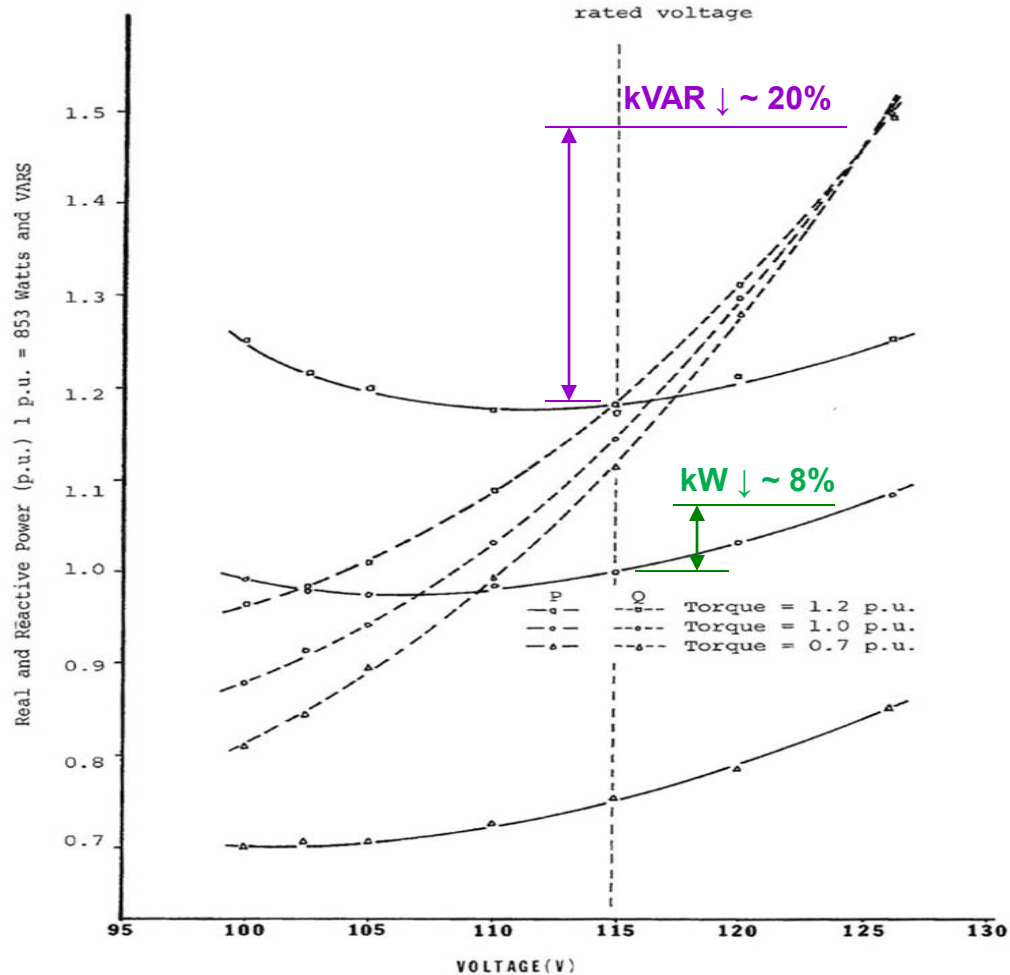
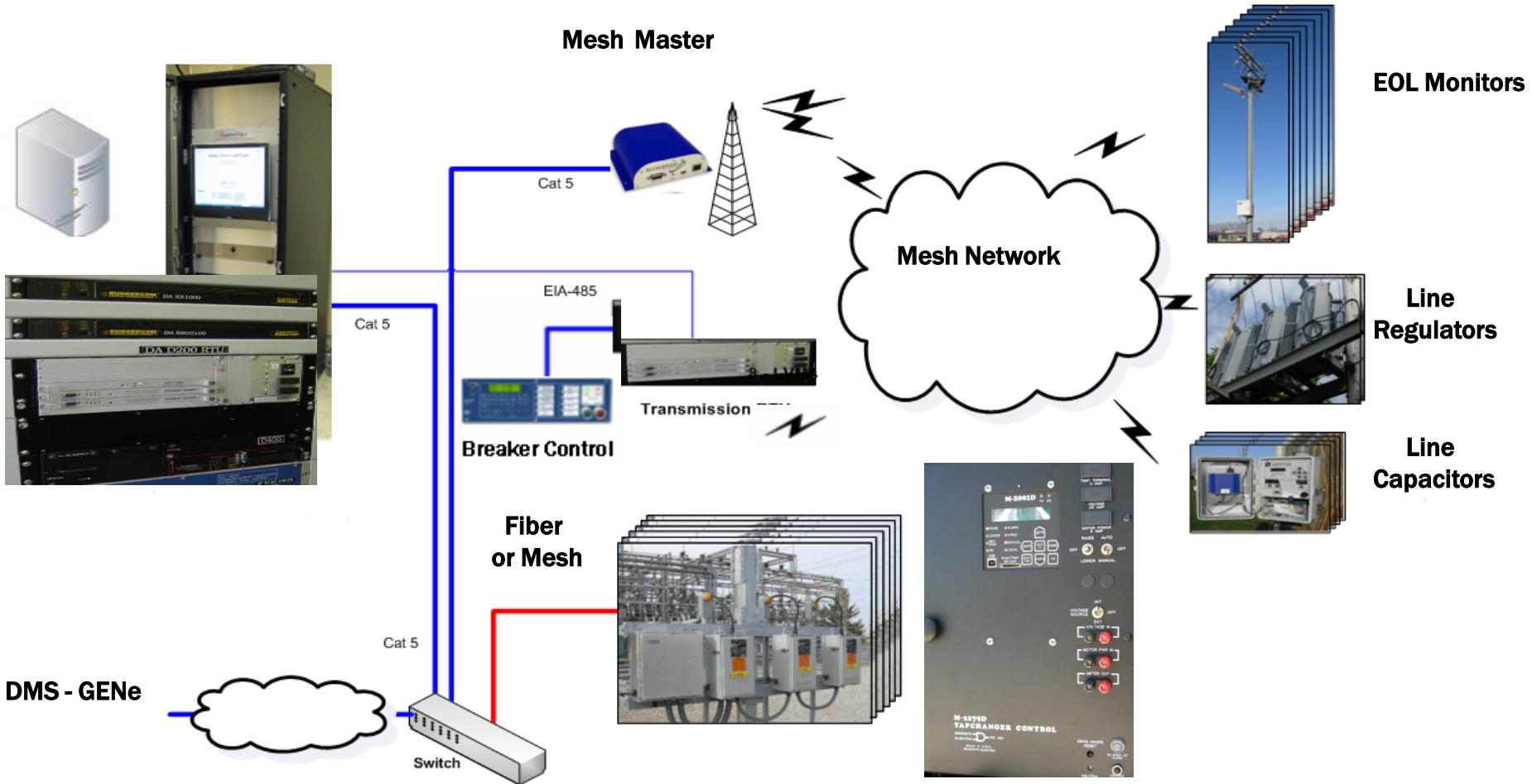


Figure 3-156 Input real and reactive power as a function of applied voltage for motor No. 1, mfr. A, with constant torque loads.

**Real Power consumption is 8% lower @ 115V than at 125V**

# Volt VAR Optimization Architecture

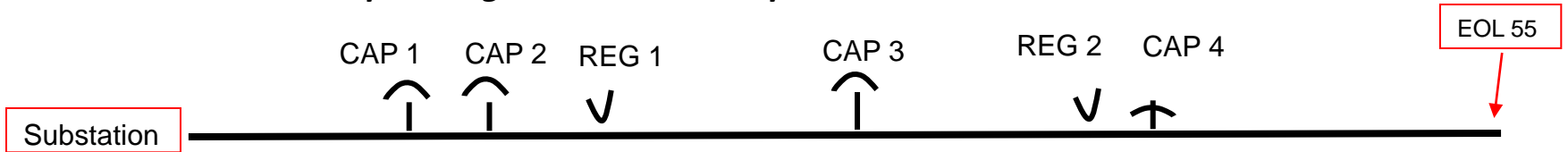
## Volt VAR Controllers



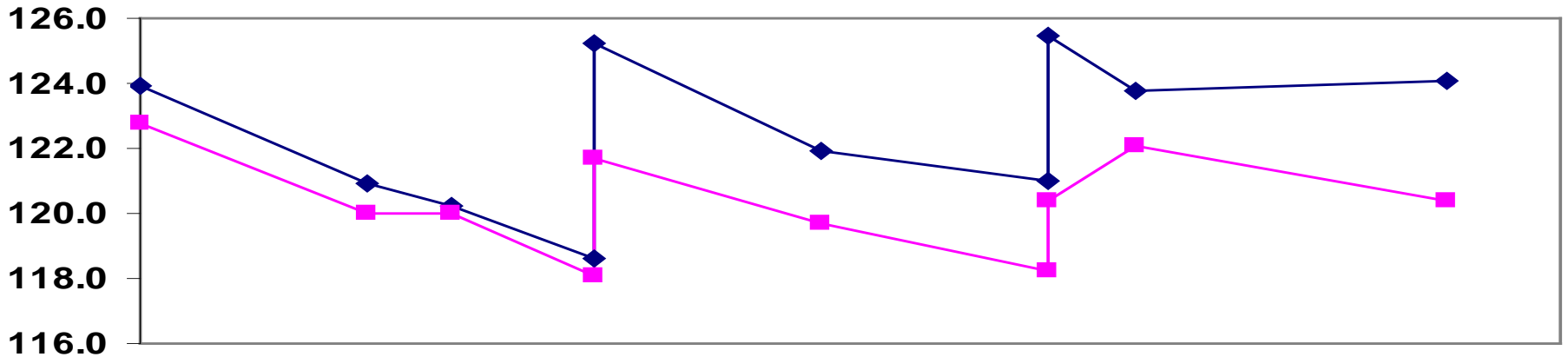
# AEP Ohio: East Broad – 1406 Voltage Profile

Normal Operation = 7-23-10 @4:44pm

Volt / Var Control Operating = 7-24-10 @4:44pm



—◆— Normal Operation —■— With VVC

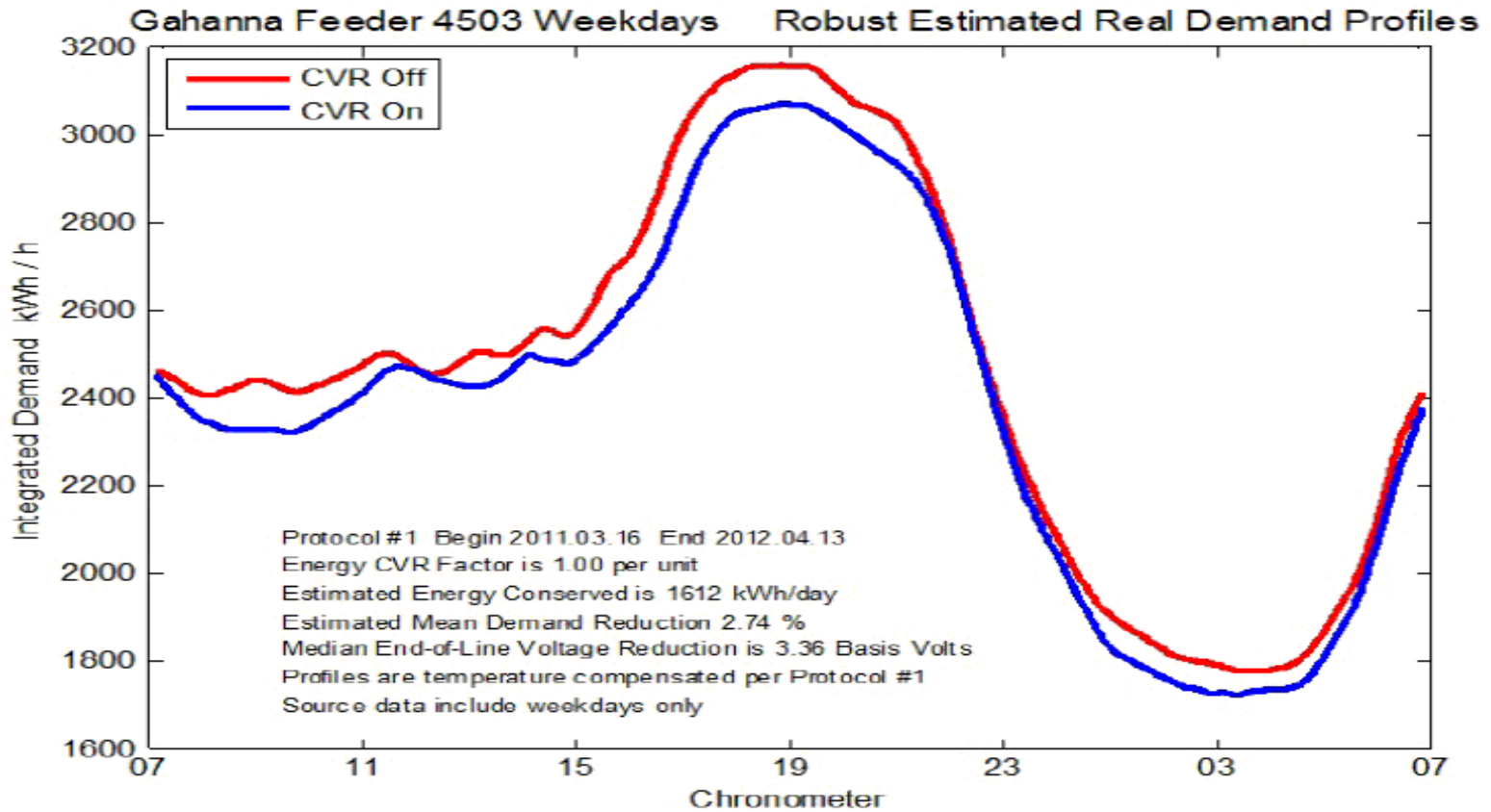


# Demand and Energy Reduction Results

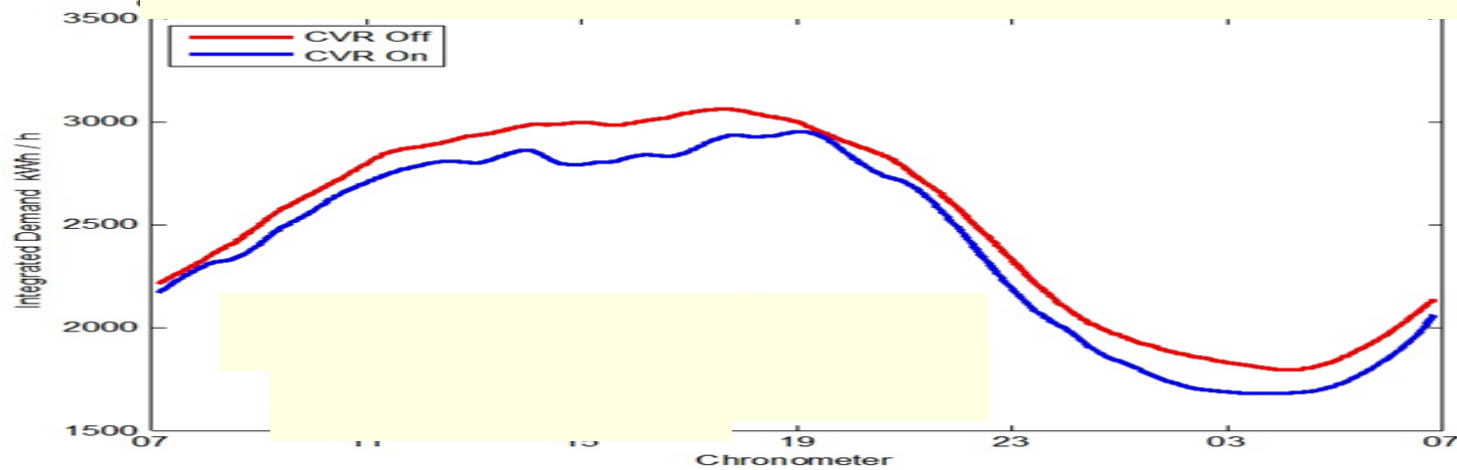
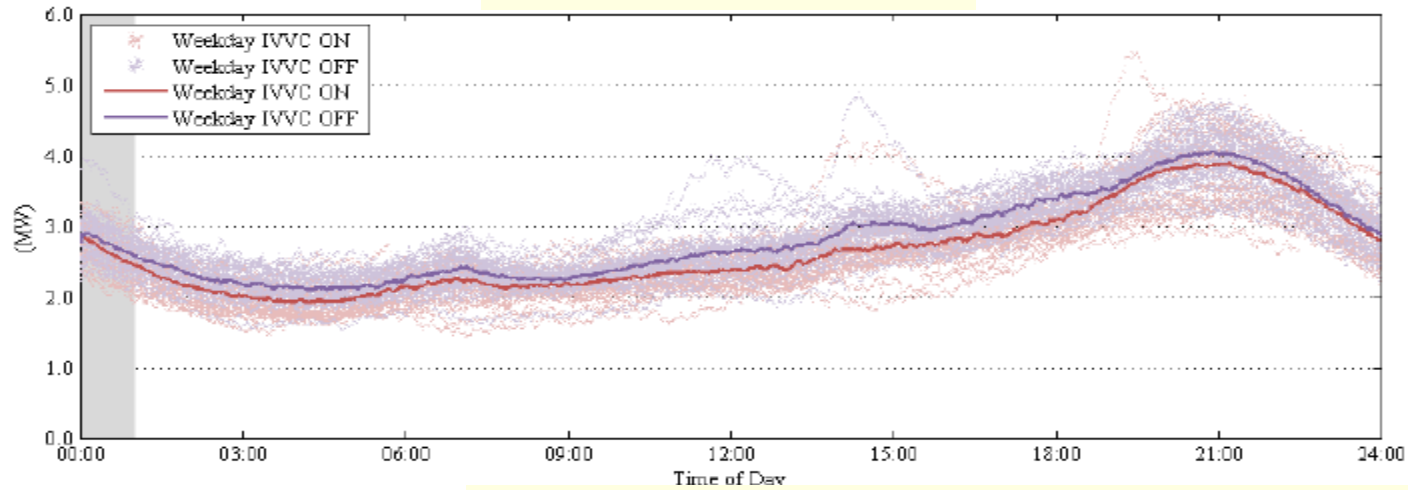
- **VVO technology works as-expected**
  - Testing demonstrates ~2-4% energy and demand reduction is achievable.

Circuit Level Results Averaged Across 11 Circuits	Industry Experience	Battelle Projections AEP Ohio Project	Initial Results AEP Ohio Project
Customer Energy Reduction	2.0%	3.3%	2.9%
Customer Peak Demand Reduction	2.0%	3.0%	2 - 3 %

# Example of Energy Savings on Circuit 4503 using Utilidata AdaptiVolt System



# Circuit Performance





# Customer Demand and Energy Savings



1,056 KW  
607,600 kwh

1,034 KW  
595,448 kwh

***Volt VAR Optimization will reduce customer peak demand and energy consumption***

# VVO for Energy Efficiency / Capacity Reduction

- **Energy Efficiency (24/7 Operation)**
  - Help meet state Energy Efficiency targets
  - Receive incentives / participate in DR markets
  - TRCs 2 to 3 – better than many current programs
  - Reduce Energy Consumption by Customers
  - Not limited by “participation rates”
  - Reduce Emissions
  - Relieve Transmission Congestion

Levelized cost of VVO is in the low part of the Energy Efficiency range due to low initial capital cost and no on-going fuel cost

- **Capacity (Demand Reduction Only )**
  - Reduce amount of capacity required at peak / critical times
  - Short payback period if generation charges are based on peak demand
  - Defer investment in capacity replacement or upgrades
  - Engage in DR Market
  - Relieve Transmission Congestion

# *Future Application of VVO*

- Meet Energy Efficiency Targets
- Evaluate as an energy resource in the IRP
- Evaluate as a Demand Reduction Resource
- Help meet EPA 111D reductions
- Increase ability to host renewable energy resources

# gridSMART<sup>®</sup>

From



## Questions?

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