IEEE PES Volt/Var Control Task Force (VVCTF)

D. Tom Rizy
Chair of the VVCTF
Senior Research Engineer at ORNL

EPRI PQ and Smart Distribution
2010 Conference and Exhibition

Transporting You into the 21st Century Distribution System

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Volt/Var Control Challenges – Near Term

• High Penetration of Renewables
  – Distributed generation becoming the norm
  – Variable generation can impact volt/var control schemes
  – Especially when it is a large percentage of the feeder capacity

• Inverter-based distributed resources
  – Capable of providing local volt/var control but not currently allowed by 1547 standard
  – Multiple inverter control interaction and interaction with system level volt/var control
  – 1547.8 standards working group being formed to addressed new requirements such as volt-var control
Volt/Var Control Challenges – Near Term

- Fault Induced Delayed Voltage Recovery (FIDVR)
  - High SEER Air Conditioners and/or Heat Pumps Present
  - Low-inertia compressor motors with low starting torque; plus torque falls off by square of the voltage
  - Voltage sag due initially to sub-transmission
  - At 60 to 70% of nominal voltage, A/C susceptible to compressor stall during high temperature and humidity
  - A/C units draw 5-6 times their normal current (mostly reactive) when stalled; switch from motor load to constant impedance
  - Growing problem both in the west (WECC) and east with increased A/C use and high SEER HVAC
Volt/Var Control Challenges – Long Term

• Paradigm Shift in how “Generation and Load are Balanced”
  – More distributed generation and this trend will continue
  – More power electronic devices both on control and load side
  – Use of loads to balance generation especially for peaks

• Smart Grid Technologies
  – Responsive load to shift peaks and provide spinning reserve
  – Electric transportation (such as PHEV)
  – Energy Storage is the key
  – System reconfiguration with distribution automation
  – Smart meters
Volt/Var Control Challenges – Long Term

- Smart Grid Applications
  - GPS-based time synchronized measurements (IED, PMUs) at the substation
  - Faster Applications based on State Measurements
  - Verification of modeling/analysis with real-time measurements
  - Distribution Automation Schemes for system reconfiguration, capacitor control, adaptive protection and automatic controls
  - Micro-grids for generation redundancy to increase power delivery reliability and operate islanded from the grid when the system is in distress or system outage
Volt/Var Control Challenges – Overall

• How does this affect current volt/var control schemes used on the system?
• How will inverter controls (especially multiple units) interact these schemes?
• How does future volt/var control needs to evolve to accommodate?:
  – High Penetration Renewables
  – Electric and Plug-In Hybrid Vehicles
  – Energy Storage
  – Smart Grid Technologies, Applications and Control
• For these reasons, we have formed a new IEEE PES Task Force
Vision

• Look at how volt/var control needs to change for the smart grid.

• Start by looking at how volt/var control is presently implemented with and without DAC for example and how it needs to change for the smart grid.
Scope

• Understand how new technologies such as distributed resources, renewables, plug-in hybrids and their increased penetration in the distribution system will impact volt/var control and how it needs to change for the future.

• The smart grid can benefit from technologies such as smart inverters that can not only provide active power but also non-active power control and thus provide volt/var control. But they must be compatible with system level equipment.

• Along with the technology issues, we need to drive how the standards are developed so that they evolve or shift to account for needed technology and system changes.
Deliverables

• Provide a forum for discussion of issues on volt/var control in the distribution system
  – What are current concerns
  – What are impacts/benefits/costs of smart grid
• Provide input to the standards process to address volt/var procedures and hardware issues
• Conduct panel and technical sessions at IEEE meetings
• Develop white papers on key interest areas
• Hold workshops
  – To exchange information on experiences with technologies and applications
  – Provide lessons learned and guidance
Panel Session for 2010 IEEE PES GM

• Session Title: Volt/Var Control: Present & Future (morning of July 27)
  – “Volt/VAR Control at Progress Energy Carolinas Past, Present and Future”, Glenn Lampley
  – “Volt-VAR Control in the Smart Grid Era”, Bob Uluski (EPRI)
Task Force Contact Information

• D. Tom Rizy, Chair
  – Oak Ridge National Laboratory, Oak Ridge, TN
  – Phone: (865) 574-5203, 207-6769 cell
  – Email: DTom@ornl.gov

• Herve Delmas, Vice Chair
  – Hydro-Quebec
  – Delmas.Herve@hydro.qc.ca

• Bob Uluski, Secretary
  – EPRI
  – ruluski@epri.com

• Website: http://grouper.ieee.org/groups/td/dist/da/vvtf.html
• Website related: http://wiki.powerdistributionresearch.com
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