SGD 3379 for 2 Participants or More

VOLTS-VAR OPTIMISATION (VVO)

28 FEBRUARY - 01 MARCH 2018, PUTRAJAYA, MALAYSIA

TOPICS COVERED

- VAR Control – Reactive Power Control
- Volt-VAR Control Devices and Voltage Optimization Control Schemes
- SCADA, AMI and Communication Infrastructure
- VVO Benefits, Challenges and Future Development
- System Integration, Testing, Deployment and Evaluations of VVOs
- VVO Use Cases
- Relevant Guidelines and Standards for VVO
- VVO Lifecycle Asset Management

Expert Course Faculty Leader

Tuan Vu

B.E (Elec. Hons.), M.E (Systems), FIEAust, CPEng, RPEQ

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Introduction

Voltage/VAR management or control is essential to electrical utilities' ability to deliver power within appropriate voltage limits so that consumers' equipment operates properly, and to deliver power at an optimal power factor to minimize losses. Advanced Volt/Volt-Ampere Reactive Optimization (VVO) can help to reduce distribution line losses through tight control of voltage and current fluctuations. Successful implementation of VVO depends on a variety of factors throughout the distribution network including: SCADA, Communication Infrastructure, Advanced Metering Infrastructure (AMI), substation bus voltages; transformer on load tap changers, length of feeders; conductor sizing; type, size, and location of different loads (resistive, capacitive, inductive, or a combination of these); and the type, size, and location of distributed energy resources (photovoltaics, distributed wind, various storage technologies, etc.); among others. Voltage regulation and VAR regulation are interrelated concepts but they are perhaps easier to understand if described as two separate terms.

VVO solutions provide a higher level of visibility into system operating parameters and a greater degree of control to optimize energy efficient and reliable electricity delivery. VVO technologies help utilities move from flying blind to operating with end-to-end instrumentation on feeders and automated optimization. Utilities are facing a dynamic operating landscape, a landscape that wasn't envisioned when most electrical networks were designed. The increasing penetration of intermittent renewable generation sources, the increasing diversity and variability of loads are driving this volatility. Utilities are also running closer to the operating limits of these systems than ever before, making the ability to optimize within operating parameters extremely important. Successful implementation of fit for purpose VVO schemes requires good knowledge of the technical requirements, challenges and associated cost.

The main focus of this seminar is to provide managers, engineers and technicians with the fundamental knowledge to:

- Research the current and future trend if VVO technologies on the market,
- Assess the network readiness and plan for VVO trial and deployment
- Implement SCADA, Communication Infrastructures, VVO equipment, sensors and
- Operate and maintain VVO Schemes that is fit for purpose.

Learning Outcome

At the end of this course, attendees should:

- Be familiar with the roles of VVO in Active Smart Grids
- Understand the Principles of Voltage and VAr (Reactive Power) Control in Power Systems
- Understand the technological advances and disadvantages of different types Voltage and Reactive Power (VAr) systems and equipment
- Be familiar with the Best Practices of VVO from other utilities
- Be familiar with and application of different Voltage Support or Reactive Power Support Systems and Equipment to minimise Energy Losses in the network.
- Understand the advantages and disadvantages of the Distributed versus Centralised VVO system architectures and its application
- Understand and be able to evaluate the Risks, Cost Benefits and Challenges of implementing VVO in the different network scenarios.

Seminar Overview

This is an "Entry Level" seminar specifically designed to provide the fundamental knowledge, but nevertheless comprehensive, understanding of VVO technologies, operational benefits, technical challenges and associated cost. It is ideally suited to meet the learning requirements of those who are seeking to have fundamental knowledge of VVO technologies, planning, system integration, project implementation, operation and maintenance.

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Who Should Attend

This course will assist DSO personnel with the application knowledge of VVO technologies in the electricity distribution networks. This course has been prepared specifically to meet the requirements of:

- **Asset Strategy Engineers / Asset Managers**: to ensure the appropriate VVO equipment strategy is implemented for their network.
- **Procurement Specialists and Contract Managers**: to ensure that the appropriate contract standards and procurement processes are established between the DSO and equipment suppliers.
- **Network Planning Engineers**: to identify the optimal reactive power requirements and solutions for different network locations and network scenarios.
- **Construction and Project Managers**: to ensure the project execution process optimises coordination between different specialised disciplines and the VVO equipment supplier.
- **Design Engineers (multiple disciplines)**: to have sufficient knowledge to specify VVO equipment and system requirements, review design reports, verify main component ratings and perform system integration design.
- **Commissioning Engineers**: to ensure that the relevant Inspection and Test Plans (ITPs) are implemented and the correct commissioning processes are followed to meet network requirements and project milestones.
- **Maintenance Engineers**: to have sufficient knowledge to develop the maintenance strategies, maintenance and inspection plans to support the VVO systems.
- **Network Operation Engineers and Technical Officers**: to have sufficient knowledge to develop the operational procedures required for VVOs to support the network in the most efficient manners.
- **Field Technicians**: to understand the importance of their role in installing, testing and maintaining effective and reliable VVO systems Equipment.

Course Leader's Profile

Tuan Vu, B.E (Elec. Hons.), M.E (Systems), FIEAust, CPEng, RPEQ

Tuan Vu is a Fellow Member of the Institute of Engineers Australia, a Chartered Professional Engineer and a Registered Professional Engineer of Queensland, Australia. He holds a Bachelor of Electrical Engineering (Honours), Master of Systems Engineering - Specialised in Complex Electrical Systems, and is currently undertaking PhD research in the field of Power System Harmonics and System Modelling for Major Loads in Transmission System.

With more than 20 years of experience in the electricity supply industry, Tuan has extensive working knowledge in SCADA, Control Systems, Voltage Regulation Systems, Q Optimisation, Reactive Power Compensation covering a wide range of disciplines, including technical specification, design, contract and project management, construction, commissioning, investigation and training. From 2004 to 2010, Tuan was the Technical Project Manager, Technical Superintendent Representative and SVC Subject Matter Expert for 16 SVC projects with total project budget in excess of $235M.

Tuan has successfully led a number of technical investigation tasks identifying the main contributing factors to a wide range of power network equipment and power systems faults or mal-operation. He has presented a number of papers on specialized aspects of SCADA, Control Systems, Power Systems Modelling, Power Systems Harmonic, Voltage Regulation, Reactive Power (VArs) regulation and SVC projects at CIGRE and CIRED conferences within Australia and Internationally. Tuan has also delivered training courses and provided consultant services for internal and external customers.

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2 Day Course Outline

1. Introduction to Volt-VAR Optimization (VVO)

- Why VVO, What benefits does VVO offer?
- How does VVO work?
- Traditional Control Versus VVO
- Power flow equations (for multi-phase, multi-source, unbalanced, meshed system)
- Energy Losses, Line Losses
- CRV Factors
- Voltage constraints (phase to neutral or phase to phase)
- Current constraints (cables, overhead lines, transformers, neutral, grounding resistance)
- Tap change constraints (operation ranges)
- Shunt capacitor change constraints (operation ranges)

2. VAR Control – Reactive Power Control

- Power System Improvements with Reactive Power Control
- Voltage Regulation
- Load Balancing
- Power Factor Correction
- Steady State Power Transfer Capacity
- Transient Stability

3. Volt-VAR Control Devices and Voltage Optimization Control Schemes

- System Architecture – Distributed vs Centralised
- Voltage and VAR Control (VVC)
- Voltage Optimisation (VO)
- Conservation Voltage Reduction (CVR)
- Transformer On Load Tap Changers (OLTCs)
- Line Drop Compensation for Radial Feeders
- Controllable Optimisation Schemes:
  - Automatic Voltage Regulator (AVR)
  - Emergency Voltage Regulation (EVR)
  - Q-Optimisation
  - Switchable Shunts (Capacitor Banks and Reactors)
  - STATCOM
  - SVC
- VVO Measurement Requirement:
  - Voltage Measurements
  - Power Factor Correction
  - Voltage Violation and Correction
  - Conservation Voltage Reduction (CVR)

4. SCADA, AMI and Communication Infrastructure

- SCADA, Monitoring and Control Requirements
- Communication Infrastructure Requirements

5. VVO Benefits, Challenges and Future Development

- VVO Benefits
- VVO Challenges:
  - Technical Challenges
  - Cost
- System Challenges
- Measure Economic Benefits and Verification
- Future VVO – Very Large VVO

6. System Integration, Testing, Deployment and Evaluations of VVOs

- System Integration
- Testing
- Deployment Plan
- Evaluation of VVO Benefits
- Business Case Evaluation
- VVO Challenges:
  - Technical Challenges
  - Cost
- Future VVO – Very Large VVO

7. VVO Use Cases

- Share Best Practices from Other Utilities
- Examine VVO Implementation by other Utilities
- Monitoring Inside the Distribution Grid:
  - Business Use Case
  - Device / Equipment UseCase

8. Relevant Guidelines and Standards for VVO

- Smart Grid Model and Guidelines
- Framework for VVO in Distribution System
- VVO and other Standards e.g. IEC 61850

9. VVO Lifecycle Asset Management – Workshop with All Training Participants

- Training
- Specialist Skills
- Improve Operations and Maintenance
- Spare Parts and Inventory Management
- Refurbishment and Replacement Plan

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	PER PARTICIPANT	2 PARTICIPANTS OR MORE	IN-HOUSE TRAINING
2 Day Programme	SGD 3,579 Per Participant	SGD 3,379 Per Participant	Guaranteed Minimum 40% Off Normal Price

ATTENDEE DETAILS

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