

Standard Authorization Request Form

Title of Proposed Standard: Project 2008-01 VAR-001-2 — Voltage and Reactive Control VAR-002-2 — Generator Operation for Maintaining Network Voltage Schedules	
Request Date	7/15/09
Approved for Posting:	8/7/09

SAR Requester Information	SAR Type (<i>Check a box for each one that applies.</i>)
Name: Eric Mortenson (TIS Chair) on behalf of TIS - Reactive Support and Control Subteam	<input checked="" type="checkbox"/> New Standard (possible)
Primary Contact Jim Robinson (RSCS Chair) Relion Associates LLC	<input checked="" type="checkbox"/> Revision to existing Standards VAR-001 VAR-002
Telephone 610-841-3362 Fax	<input type="checkbox"/> Withdrawal of existing Standard
E-mail JKRobinson@ieee.org	<input type="checkbox"/> Urgent Action

Purpose

Improve the VAR Standards to require appropriate functional entity review of planning and operating protocols necessary to ensure sufficient reactive resources, acceptable voltage and reactive margins, and prevent voltage instability. Also to require an annual review and update of a five-year reactive support and control plan.

Industry Need

Reactive power planning and operational techniques vary across the United States and Canada. In some areas voltage is a major concern and requires extensive study, while in other areas voltage problems rarely arise. However, in all cases reactive power planning and operational techniques should be well documented and made available to those functional entities which have a reliability role within an interconnection.

Reactive support and control involves numerous functional entities. However, bulk reactive power cannot be transmitted as far as real power. Therefore, the functional entities which need to plan, operate, and control reactive power are more localized and close coordination is required. Existing Standards identify many of the functional entities involved but explicit reactive support and control requirements are often not clear, and not well coordinated within the existing Standards. This has led to a variety of implicit understanding of what needs to be done, and resulted in gaps in the Standards regarding which functional entities should be involved in the analysis, planning, and operation of reactive support and control.

The existing Standards related to reactive energy support and voltage control do not require criteria and expectations to be established among key functional entities. The NERC Standards should identify what criteria must be documented for distribution of an interconnection's reactive resource needs among transmission, distribution, and generation facilities. As described in FERC Order 693 directives¹, the planning criteria must include detailed and definitive requirements on established limits and sufficient reactive resources and must identify acceptable margins (i.e. voltage and/or reactive power margins) above voltage instability points to prevent voltage instability and to ensure reliable operations. The standard must include requirements for the appropriate functional entities to clearly define what voltage limits are used and how much reactive resources are needed to ensure voltage instability will not occur under normal and emergency conditions.

Brief Description

The existing VAR standards will be modified to address the FERC directives in Order 693, and to reflect the Transmission Issues Subcommittee's "Reactive Support & Control Whitepaper" dated 05/18/2009, which identifies the technical requirements needed to determine the reactive resources required under each system state. The report identifies the criteria and associated rationale required to be documented to determine the split of dynamic reactive supply (such as reactive power provided by generators and other dynamic devices) and static reactive power supply (such as static capacitors and other static devices). The report also identifies what criteria must be documented for distribution of the Interconnection's reactive resource needs among transmission, distribution, and generation facilities. New requirements may be added to the existing VAR standards or may be added to a new VAR standard.

Detailed Description

The VAR Standards should require specific functional entities to develop a set of system planning and operations planning protocols. Planning Coordinators (PCs) and associated Transmission Planners (TPs) should have documented protocols regarding expectations among the functional entities within the associated Transmission Owner (TO) footprints. Explicit reactive planning criteria may be combined with other planning criteria. However, every logical group of PC/TPs should have a coordinated set of planning criteria. The PC/TP reactive planning criteria should be reviewed and updated periodically with input from best practices of other PC/TPs.

All NERC board approved interpretations of VAR-001 and VAR-002 shall be included in these Standards.

As described in FERC Order 693 directives, the planning criteria must include detailed and definitive requirements on "established limits" and "sufficient reactive resources" and identify acceptable margins (i.e. voltage and/or reactive power margins) above voltage instability points to prevent voltage instability and to ensure reliable operations. The criteria must clearly define what voltage limits are used and how much reactive resources are needed to ensure voltage instability will not occur under normal and emergency conditions.

Because reactive power needs vary significantly based on system characteristics and since the vast majority of reactive power must be supplied locally, it is not appropriate to establish a NERC wide reactive reserve requirement. The local supply and reactive power requirements must be analyzed and documented on a more local level, possibly consisting of an area the size of a TP or smaller, up to a Reliability Coordinator footprint or a logical cluster of multiple PC/TPs. This electrically nearby group of PC/TPs and their associated functional entities could be called a "Transmission Planning Reactive Cluster" (TPRC). The TPRC coordinators must establish criteria to determine the appropriate

¹ FERC Order 693 directives; paragraphs 1868-1871, 1854-1858, 1861-1863, 1875-1876, 1879-1880, 1884-1885.

TPRC area for consideration. TPRC areas would likely have differing detailed criteria and requirements for static and dynamic reactive support, based on the TPRC area's characteristics.

In addition to establishing reactive planning criteria, the VAR standards should require a *five-year reactive support and control plan ('Plan')*. Multiple TPRCs should review and coordinate plans by the functional entities involved. This includes functional entity local plans for reactive support and control to maintain local system reliability and avoid permanent damage to equipment. The Plan needs to be specific in defining voltage and reactive power schedules. The short range (one year) operations planning protocol should include a requirement for the Transmission Operator (TOP) and Reliability Coordinator (RC) to monitor and take action if reactive power or voltage falls outside identified limits. GO and GOP functional entities may have no expansion plans within a 5 year planning horizon. However, such forecasts of no expansion or no reactive capability changes within 5 years must be made known to each TPRC. Collectively, within a region, multiple TPRCs need to coordinate the development of an integrated 5 year reactive support and control plan.

The following topics must be covered in the reactive planning criteria, and in the Plan.

The TPRC criteria and VAR Plan shall address the following:

- Criteria for Reactive Planning and Operating Technique
- Five-Year VAR Plan
- Planning Documentation and Operations Review Cycle

Topics which must be covered in the criteria and VAR Plan:

- "Equipment Limits" to prevent permanent damage to TO, GO, DP equipment
- "Local Automatic and Manual Control" design (TO, GO and DP)
- "System Bus Voltage Collapse Control"
- "Reactive Energy Conservation Plan"

Distribution of the Interconnection's Reactive Resource Needs;

- Transmission to Distribution boundary
- Transmission to Generation boundary
- TPRC to TPRC boundary
- Dynamic Var Requirements

The whitepaper provides the reliability concepts and foundation for the SAR and subsequent work by the Standards development team and includes the directives contained in FERC Order 693. As this Project 2008-1 progresses to modify the VAR Standards, other related Standards and the NERC *Glossary of Terms Used in Reliability Standards (Glossary)* will need to be reviewed and updated for consistency with Version 2 of the VAR Standards. The creation of new SARs for other Standards may cause work to overlap with Project 2008-1. However, the VAR Standards should contain all the necessary explicit Requirements and reference other existing Standard requirements as appropriate. Explicit reactive energy related Requirements should not be duplicated in other Standards. However, during the overlapping SAR work, such duplication may occur until the other related Standards and NERC *Glossary* are updated for consistency with VAR Standards Version 2. As a reference document, the complete whitepaper can be found at the following link:

<http://www.nerc.com/docs/pc/tis/Reactive%20Support%20and%20Control%20Whitepaper%20&%20SAR.zip>

Standards Authorization Request Form

Reliability Functions

The Standard will Apply to the Following Functions <i>(Check box for each one that applies.)</i>		
<input checked="" type="checkbox"/>	Reliability Coordinator	Responsible for the real-time operating reliability of its Reliability Coordinator Area in coordination with its neighboring Reliability Coordinator's wide area view.
<input type="checkbox"/>	Balancing Authority	Integrates resource plans ahead of time, and maintains load-interchange-resource balance within a Balancing Authority Area and supports Interconnection frequency in real time.
<input type="checkbox"/>	Interchange Authority	Ensures communication of interchange transactions for reliability evaluation purposes and coordinates implementation of valid and balanced interchange schedules between Balancing Authority Areas.
<input checked="" type="checkbox"/>	Planning Coordinator	Assesses the longer-term reliability of its Planning Coordinator Area.
<input checked="" type="checkbox"/>	Resource Planner	Develops a >one year plan for the resource adequacy of its specific loads within a Planning Coordinator area.
<input checked="" type="checkbox"/>	Transmission Planner	Develops a >one year plan for the reliability of the interconnected Bulk Electric System within its portion of the Planning Coordinator area.
<input type="checkbox"/>	Transmission Service Provider	Administers the transmission tariff and provides transmission services under applicable transmission service agreements (e.g., the pro forma tariff).
<input checked="" type="checkbox"/>	Transmission Owner	Owns and maintains transmission facilities.
<input checked="" type="checkbox"/>	Transmission Operator	Ensures the real-time operating reliability of the transmission assets within a Transmission Operator Area.
<input checked="" type="checkbox"/>	Distribution Provider	Delivers electrical energy to the End-use customer.
<input checked="" type="checkbox"/>	Generator Owner	Owns and maintains generation facilities.
<input checked="" type="checkbox"/>	Generator Operator	Operates generation unit(s) to provide real and reactive power.
<input checked="" type="checkbox"/>	Purchasing-Selling Entity	Purchases or sells energy, capacity, and necessary reliability-related services as required.
<input checked="" type="checkbox"/>	Market Operator	Interface point for reliability functions with commercial functions.
<input checked="" type="checkbox"/>	Load-Serving Entity	Secures energy and transmission service (and reliability-related services) to serve the End-use Customer.

Reliability and Market Interface Principles

Applicable Reliability Principles <i>(Check box for all that apply.)</i>	
<input checked="" type="checkbox"/>	1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
<input checked="" type="checkbox"/>	2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
<input checked="" type="checkbox"/>	3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably.
<input checked="" type="checkbox"/>	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
<input checked="" type="checkbox"/>	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
<input checked="" type="checkbox"/>	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
<input checked="" type="checkbox"/>	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.
<input type="checkbox"/>	8. Bulk power systems shall be protected from malicious physical or cyber attacks.
Does the proposed Standard comply with all of the following Market Interface Principles? <i>(Select 'yes' or 'no' from the drop-down box.)</i>	
1. A reliability standard shall not give any market participant an unfair competitive advantage. Yes	
2. A reliability standard shall neither mandate nor prohibit any specific market structure. Yes	
3. A reliability standard shall not preclude market solutions to achieving compliance with that standard. Yes	
4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards. Yes	

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Related Standards

Standard No.	Explanation
MOD-025-1 MOD-026-1	<i>Project 2007-09 Generator Verification</i> includes reactive control related standards; MOD-025-1 — Verification of Generator Gross and Net Reactive Power Capability and MOD-026-1 — Verification of Models and Data for Generator Excitation System Functions.
PRC-011-0	<i>Project 2007-17 Protection System Maintenance and Testing</i> includes voltage control related standards; PRC-011-0 — Under Voltage Load Shedding System Maintenance and Testing.
PRC-10-0 PRC-022-1	<i>Project 2008-02 Under voltage Load Shedding</i> includes voltage control related standards; PRC-10-0 — Assessment of the Design and Effectiveness of UVLS Program and PRC-022-1 — Under voltage Load Shedding Program Performance.
EOP-003-1 IRO-004-1 TOP-002-2 TOP-006-1 VAR-001-1a	<i>Project 2009-02 Real-time Tools</i> includes several voltage and reactive control related standards including but not limited to; EOP-003-1 — Load Shedding Plans, IRO-004-1 — Reliability Coordination — Operations Planning, TOP-002-2 — Normal Operations Planning, TOP-006-1 — Monitoring System Conditions, and VAR-001-1a — Voltage and Reactive Control

Related SARs

SAR ID	Explanation
Several	See above.

Regional Variances

Region	Explanation
ERCOT	

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FRCC	
MRO	
NPCC	
SERC	
RFC	
SPP	
WECC	