

DRAFT-Consideration of Issues and Directives

Project 2013-04 – Voltage and Reactive Control

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Issue or Directive	Source	Consideration of Issue or Directive
<p>Summary of Directives from FERC:</p> <ol style="list-style-type: none"> 1. VAR-001: FERC ordered that the standard be developed to: (1) expand the applicability to include reliability coordinators and LSEs; (2) include detailed and definitive requirements on “established limits” and “sufficient reactive resources”, and identifies acceptable margins above the voltage instability points; (3) include Requirements to perform voltage stability analysis periodically, using online techniques where commercially available and offline techniques where online techniques are not available, to assist real-time operations, for areas susceptible to voltage instability; (4) include controllable load among the reactive resources to satisfy reactive requirements and (5) addresses the power factor range at the interface between LSEs and the transmission grid. 2. VAR-001: FERC clarified that voltage schedules must have a technical basis and remanded an interpretation of VAR-001 back to NERC for reconsideration. 3. VAR-002: FERC directed NERC to consider Dynegey’s suggestions to improve the standard by providing more detailed and definitive requirements for establishing time frames associated with an incident of non-compliance. 		
Accordingly, the ERO should modify VAR-001-1 to include reliability coordinators as applicable entities and	Order No. 693, P 1855	FERC recently issued a Notice of Proposed Rulemaking on the IRO family of standards. ¹ Although FERC recommended a remand of the IRO filing, the monitoring role of the Reliability

¹ *Monitoring System Conditions - Transmission Operations Reliability Standard Transmission Operations Reliability Standards Interconnection Reliability Operations and Coordination Reliability Standards*, 145 FERC ¶ 61,158 (2013).

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include a new requirement(s) that identifies the reliability coordinator’s monitoring responsibilities.		Coordinator is best addressed in the IRO standards generally. Therefore, this directive will be addressed by a future IRO project.
The Commission directs the ERO to address the reactive power requirements for LSEs on a comparable basis with purchasing-selling entities.	Order No. 693, P 1858	This directive has been met, and is effectively retired. This directive has already been addressed and reviewed by FERC in a prior version VAR-001-2. ² However, the applicable requirement (R5 of the currently effective VAR-001-3) that initially addressed this directive has been removed from the VAR standards due to overlap with the <i>pro forma</i> Open Access Transmission Tariff (“OATT”). ³ Thus, this directive is no longer needed for reliability and should be withdrawn or retired.
In the NOPR, the Commission asked for comments on acceptable ranges of net power factor at the interface at which the LSEs receive service from the Bulk-Power System during normal and extreme load conditions... The Commission believes that Reliability Standard VAR-001-1 is an appropriate place for the ERO to take steps to address these concerns by setting out requirements for transmission owners and LSEs to maintain an appropriate power factor range at their interface. We direct the ERO	Order No. 693, P 1861	This directive is no longer needed for reliability and should be withdrawn. Power factor ranges/requirements are established by contract, and to include such ranges/requirements in the VAR standard would be duplicative. The TPL-001-4 has now been approved and will address requirements for power factors. TPL-001-4, Requirement R1, part 1.1.4 requires system models to include Real and reactive Load forecasts. These two inputs in the TOP’s models ultimately provide the appropriate power factors that should be maintained.

² See FERC letter order, *NERC Petition for Approval of Proposed Modifications to Reliability Standards BAL-002-1; EOP-002-3; FAC-002-1; MOD-021-2; PRC-004-2; and VAR-001-2*, 134 FERC ¶ 61,015 (2011).

³ *Electric Reliability Organization Proposal to Retire Requirements in Reliability Standards*, Order No. 788, 145 FERC ¶ 61,147 (2013).

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<p>to develop appropriate modifications to this Reliability Standard to address the power factor range at the interface between LSEs and the Bulk- Power System.</p>		<p>In addition, the FAC-001-0 standard requires Transmission Owners (TOs) to set interconnection requirements including “Voltage, Reactive Power, and <u>power factor control</u>” (emphasis added). Thus, the power factor controls and requirements are outlined as part of the interconnection studies/process.</p> <p>Finally, as markets have matured the RTO’s have addressed the reliability issues regarding wholesale LSE’s through various governance agreements. These agreements speak to the reliable planning, operation, and coordination between the BPS and LSE’s.</p>
<p>We direct the ERO to include APPA’s concern in the Reliability Standards development process. We note that transmission operators currently have access to data through their energy management systems to determine a range of power factors at which load operates during various conditions, and we suggest that the ERO use this type of data as a starting point for developing this modification.</p>	<p>Order No. 693, P 1862</p>	<p>The directive has been addressed by the VAR SDT, and APPA’s concerns were discussed early in Project 2013-04. In Order No. 693 APPA stated, “it may be difficult to reach an agreement on acceptable ranges of net power factors at the interfaces where LSEs receive service from the Bulk-Power System because the acceptable range of power factors at any particular point on the electrical system varies based on many location-specific factors. APPA further states that system power factors will be affected by the transmission infrastructure used to supply the load.”⁴</p>

⁴ See *Mandatory Reliability Standards for the Bulk-Power System*, Order No. 693, FERC Stats. & Regs. ¶131,242 at P 1861, *order on reh’g*, Order No. 693-A, 120 FERC ¶ 61,053 (2007).

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		As stated above, the VAR SDT determined the power factor will be addressed by interconnection agreements, the OATT, and other standards. In light of how the directives for PP 1858 and 1863 are addressed, the VAR SDT determined the appropriate power factor range is addressed through the OATT and the interconnection process. Therefore, the VAR SDT determined that it was not necessary to add VAR requirements to access power factor data because that would be duplicative, and FERC determined these types of requirement are not needed for reliability, as stated in Order No. 788 which approved certain P81 retirements. ⁵
The Commission expects that the appropriate power factor range developed for the interface between the bulk electric system and the LSE from VAR-001-1 would be used as an input to the transmission and operations planning Reliability Standards. The range of power factors developed in this Reliability Standard provides the input to the range of power factors identified in the modifications to the TPL Reliability Standards.	Order No. 693, P 1863	The Commission clarified that this is not a directive to change or modify a standard. ⁶
In the NOPR, the Commission expressed concern that the technical requirements containing terms such as	Order No. 693, P1868	This directive on established limits is being addressed in an equally effective and efficient manner through the TOP and FAC

⁵ See Order No. 788.

⁶ *Id.* at Attachment A.

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<p>“established limits” or “sufficient reactive resources” are not definitive enough to address voltage instability and ensure reliable operations. To address this concern, the NOPR proposed directing the ERO to modify VAR-001-1 to include more 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. We will keep this direction, and direct the ERO to include this modification in this Reliability Standard.</p>		<p>family of standards. After Order No. 693 was issued, several standards were approved by FERC providing specific requirements on “established limits” and associated margins. FAC-011 and FAC-014 both address SOLs which by definition must include both voltage stability ratings and system voltage limits. An SOL is the value (such as MW, MVar, Amperes, Frequency or Volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:</p> <ul style="list-style-type: none"> • Facility Ratings (Applicable pre- and post-Contingency equipment or facility ratings) • Transient Stability Ratings (Applicable pre- and post-Contingency Stability Limits) • <u>Voltage Stability Ratings (Applicable pre- and post-Contingency Voltage Stability)</u> • <u>System Voltage Limits (Applicable pre- and post-Contingency Voltage Limits).</u>⁷ <p>Further, FAC-014-2 Requirement R2 demands “[t]he Transmission Operator shall establish SOLs (as directed by its</p>

⁷ See NERC Glossary of Terms Used in Reliability Standards, available at http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf.

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		<p>Reliability Coordinator) for its portion of the Reliability Coordinator Area that are consistent with its Reliability Coordinator’s SOL Methodology.” FAC-011-2 Requirement R2 states “[t]he Reliability Coordinator’s SOL Methodology shall include a requirement that <u>SOLs provide BES performance consistent with the following:</u></p> <p>R2.1. In the pre-contingency state, the BES shall demonstrate transient, dynamic and <u>voltage stability</u>; all Facilities shall be within their Facility Ratings and within their thermal, <u>voltage</u> and stability limits. In the determination of SOLs, the BES condition used shall reflect current or expected system conditions and shall reflect changes to system topology such as Facility outages.</p> <p>R2.2. Following the single Contingencies identified in Requirement 2.2.1 through Requirement 2.2.3, the system shall demonstrate transient, dynamic and <u>voltage stability</u>; all Facilities shall be operating within their Facility Ratings and within their thermal, <u>voltage</u> and stability limits; and Cascading or uncontrolled separation shall not occur.” (emphases added).</p> <p>FAC-011-2, R3 states: “The Reliability Coordinator’s methodology for determining SOLs, shall include, as a minimum,</p>

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		<p>a description of the following, along with any <u>reliability margins...</u> (emphasis added).</p> <p>Although FAC standards require the establishment and criteria of SOLs, the TOP standards require operations within SOLs and IROLs. The currently enforceable TOP-002-2.1b requires that “Each Balancing Authority and Transmission Operator shall plan to meet all System Operating Limits (SOLs) and Interconnection Reliability Operating Limits (IROLs).” TOP-004-2 R1 states “Each Transmission Operator shall operate within the Interconnection Reliability Operating Limits (IROLs) and System Operating Limits (SOLs).” Thus, the TOP and FAC standards provide sufficient details on established limits and acceptable margins for voltage by providing vehicles for monitoring and operating within SOLs and IROLs. If a system event were to occur due to voltage, the TOP and FAC standards would be the appropriate place for a violation because a limit would have been violated.</p> <p>With regard to the directive on sufficient reactive resources, VAR-001 R2 has been modified to state the TOP will “schedule sufficient reactive resources to regulate voltage levels under normal and Contingency conditions. Transmission Operators can provide sufficient reactive resources through various means</p>

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		including, but not limited to, reactive generation scheduling, transmission line and reactive resource switching, and using controllable load.” As explained in the rationale for the new requirement ensures sufficient reactive resources are online or scheduled to regulate voltage levels. The old requirement used the term “acquire” instead of schedule, and there was industry confusion on how to acquire sufficient reactive resources.
We recognize that our proposed modification does not identify what definitive requirements the Reliability Standard should use for “established limits” and “sufficient reactive resources.” Rather, the ERO should develop appropriate requirements that address the Commission’s concerns through the ERO Reliability Standards development process.	Order No. 693, P 1869	The Commission clarified that this is not a directive to change or modify a standard. ⁸
In response to the concerns of APPA, SDG&E and EEI on the availability of tools, the Commission recognizes that transient voltage stability analysis is often conducted as an offline study, and that steady-state voltage stability analysis can be done online. The Commission clarifies that it does not wish to require anyone to use tools that are not validated for real-time operations. Taking these comments into consideration, the Commission clarifies its	Order No. 693, P 1875	Analytical tools or online techniques in general will be addressed in Project 2009-02, Real-time Monitoring and Analysis Capabilities. Therefore, this directive will be addressed in that project. Further, the VAR SDT determined that the Commission is not requiring TOPs to purchase new online models or to implement tools that will not adequately study a TOP’s reactive power requirements. The VAR SDT also

⁸ See Order No. 788 at Attachment A.

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<p>proposed modification from the NOPR. For the Final Rule, we direct the ERO, through its Reliability Standards development process, to modify Reliability Standard VAR-001-1 to include Requirements to perform voltage stability analysis periodically, using online techniques where commercially-available, and offline simulation tools where online tools are not available, to assist real-time operations. The ERO should consider the available technologies and software as it develops this modification to VAR-001-1 and identify a process to assure that the Reliability Standard is not limiting the application of validated software or other tools.</p>		<p>determined that the most reliable models are the ones proven over time to correctly model the system.</p> <p>Further, the VAR SDT also determined the TOP standards require periodic voltage stability analysis. The currently enforceable standards: TOP-004-2 and TOP-006-2 require actively monitoring voltage in order to operate within SOLs.</p>
<p>The Commission noted in the NOPR that in many cases, load response and demand-side investment can reduce the need for reactive power capability in the system. Based on this assertion, the Commission proposed to direct the ERO to include controllable load among the reactive resources to satisfy reactive requirements for incorporation into Reliability Standard VAR-001-1. While we affirm this requirement, we expect the ERO to consider the comments of SoCal Edison with regard to</p>	<p>Order No. 693, P 1879</p>	<p>NERC addressed this directive in a prior version of the VAR standard, but as mentioned above, examples of sufficient reactive resources including controllable load are listed in VAR-001 R2.⁹</p>

⁹ *supra* at note 2.

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<p>reliability and SMA in its process for developing the technical capability requirements for using controllable load as a reactive resource in the applicable Reliability Standards.</p>		
<p>Dynegy has suggested an improvement to Reliability Standard VAR-002-1, and NERC should consider this in its Reliability Standards development process.</p>	<p>Order No. 693, P 1885</p>	<p>Dynegy stated that VAR-002-1 should be modified to require detailed and definitive requirements when defining the timeframe associated with an “incident” of non-compliance. The VAR SDT, NERC staff, and industry participants could not agree on an appropriate number for creating a non-compliance window for the continent. Instead, VAR-001 was modified to require TOPs to create notification requirements for their GOPs in VAR-001-4 Requirement 5, part 5.2. The TOPs can then tailor their notification requirements based on their area’s reliability needs/voltage constraints.</p>
<p>The Commission remands to the ERO the proposed interpretation of VAR-001-1, Requirement R4 and directs the ERO to revise the interpretation consistent with the Commission’s discussion below.</p>	<p>Order No. 724, P 47.</p>	<p>P 49 of Order No. 724 explains this directive by stating “the Commission adopts its NOPR proposal, and finds that a voltage schedule should reflect sound engineering, as well as operating judgment and experience. The Commission remands NERC’s proposed VAR-001-1, Requirement R4 interpretation, in order</p>

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		<p>that NERC may reconsider its interpretation consistent with this order.”¹⁰</p> <p>NERC staff and TOPs expressed concern that having to justify a schedule could provide a forum for disputing voltage schedules in general. This could harm reliability if GOPs were permitted to not implement a schedule until there was consensus on the technical merits of a voltage schedule. Therefore, in order to maintain a TOPs authority for setting schedules, the VAR SDT determined the standard should require sharing study data for how a voltage schedule was determined. The VAR SDT determined that in order to show voltage schedules reflect sound engineering and judgment, a TOP should provide the criteria for developing schedules and tolerance bands when requested by a GOP. This is reflected in VAR-001-4 Requirement 5, part 5.3. This requirement allows the GOP to understand the technical basis for a voltage schedule, but it does not create a vehicle for the GOPs to approve the voltage schedule.</p>

¹⁰ *Electric Reliability Organization Interpretations of Specific Requirements of Frequency Response and Bias and Voltage and Reactive Control Reliability Standards*, 127 FERC ¶ 61,158 at P 49 (2009).

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