NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

VAR Outreach Presentation

Informal Development
Webinar
April 11, 2013

RELIABILITY | ACCOUNTABILITY




Administrative Items

- NERC Antitrust Guidelines
  - It is NERC's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. This policy requires the avoidance of any conduct that violates, or that might appear to violate, the antitrust laws. Among other things, the antitrust laws forbid any agreement between or among competitors regarding prices, availability of service, product design, terms of sale, division of markets, allocation of customers or any other activity that unreasonably restrains competition.
- Notice of Open Meeting
  - Participants are reminded that this webinar is public. Please keep in mind that the audience may include members of the press and representatives of various governmental entities, in addition to the industry stakeholders.

Agenda

- Introductions
- Evolving Standards Process/Informal Development
- VAR Process
- FERC directives
- *Pro forma* VAR standards
- Industry input on VAR-001 and VAR-002
- VAR ad hoc group contact information

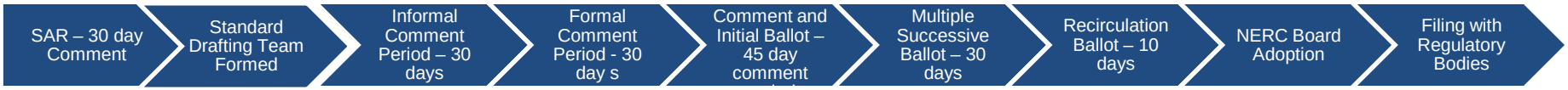
Directives Team

Directives Team

- Vice President and Director of Standards- Mark Lauby
- Director of Standards Development- Val Agnew
- Standard Developers for the Directives Team:
  - Jordan Mallory- PER (Training): PER-002 and PER-005
  - Steven Noess- MOD B (modeling data): MOD-010 through MOD-015
  - Darrel Richardson- MOD C (demand data): MOD-016 through MOD-021
  - Ryan Stewart- MOD A (ATC, TTC, CBM): MOD-001, MOD-004, MOD-008, MOD-028, MOD-029 and MOD-030
  - Soo Jin Kim - VAR: VAR-001 and VAR-002 and Glossary directives

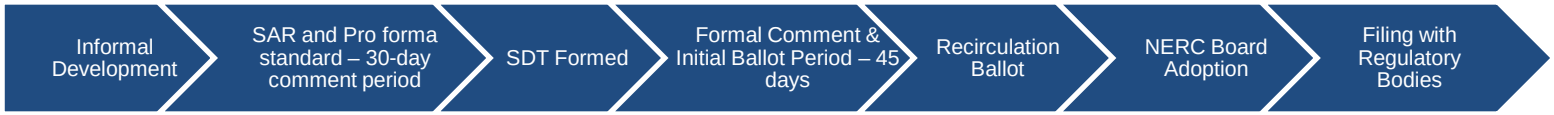
Evolving Standards Process

Old Standards Process – Took multiple years

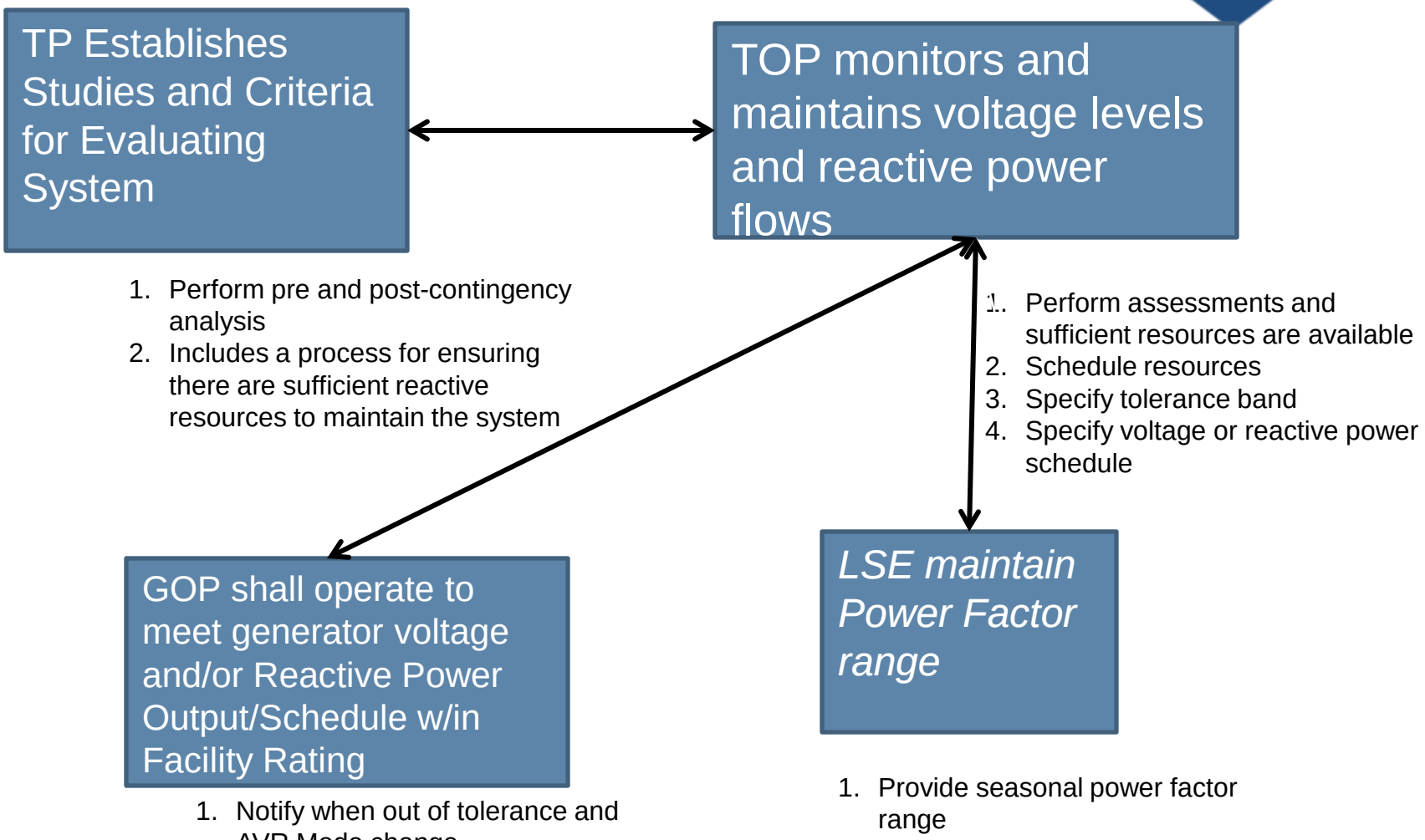


- May 2012: NERC Board adopted SPIG report with recommendations to improve both the timeliness and quality of the standards was adopted.
- August and November 2012 NERC Board of Trustees Meeting:
  - FERC commissioners urged the industry to focus on creating a more efficient standards development process (August 2012)
  - NERC CEO expressed there should be a focus on revamping the standards process for more efficiency and quality (August 2012)
  - NERC Board issued a resolution instructing the SPIG, MRC, SC, NERC staff and industry stakeholders to reform its standards program (November 2012)

Evolving Standards Process – one year



VAR Process


TP Establishes Studies and Criteria for Evaluating System
TOP monitors and maintains voltage levels and reactive power flows
1. Perform pre and post-contingency analysis
2. Includes a process for ensuring there are sufficient reactive resources to maintain the system
1. Perform assessments and sufficient resources are available
2. Schedule resources
3. Specify tolerance band
4. Specify voltage or reactive power schedule
GOP shall operate to meet generator voltage and/or Reactive Power Output/Schedule w/in Facility Rating
1. Notify when out of tolerance and AVR Mode change
2. Notify when there is equipment failure or other plant conditions impacting capability
LSE maintain Power Factor range
1. Provide seasonal power factor range

VAR Directives

- Five Major FERC Directives to the ERO from Order No. 693
  - VAR-001-Summary from P 1880
    - Expand the applicability to include reliability coordinators and LSEs;
    - Include detailed and definitive requirements on “established limits” and “sufficient reactive resources” and identify acceptable margins above the voltage instability points;
    - 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;
    - Include controllable load among the reactive resources to satisfy reactive Requirements; and
    - Address the power factor range at the interface between LSEs and the transmission grid.

VAR Directives (Cont'd)

- VAR-002- From PP 1881-1885
  - FERC directed NERC to consider modifying VAR-002 to require more detailed and definitive requirements when defining the time frame associated with an "incident" of non compliance (i.e., each 4-second scan, 10-minute integrated value, hourly integrated value).

Approach to VAR-001

- FERC Order No. 693 paragraphs 1840 through 1880 require changes be made to the existing VAR standards.
- The bulk of the directives pointed to the need to:
  - Add clarifying language to the requirements
  - Provide more depth to ensure the veracity of the reactive monitoring and analysis performed in the real time and operations planning horizon
  - Address potential gaps between functions and time horizons
    - Real time and operational planning horizon
      - The TOP/GOP/RC seams
    - Operational planning and planning horizons
      - The TOP/TP/PA seams

Approach to VAR-001

- Provide more depth to the veracity of the reactive monitoring and analysis performed in the real time and operations planning horizon
  - Need to convert dynamic results into operational quantities including margin
    - Did not want to put bounds on the attributes of the required operational margin to be used in operation.
    - This margin will be very dependent on the specific system characteristics as well as the dynamic characteristics driving the limit.
    - Due to the myriad of factors, reactive system performance could vary greatly depending on the procedures that a particular TOP develops.
    - Rather than prescribing continent wide back-off margin requirements the team believes that the TOP should be required to document in an open and transparent process a specific margin and how it will be used in the operation/operations planning time frame.

Approach to VAR-002

- **Basis: Provide Voltage Support**
- **Tasks:**
  - Operate with AVR in automatic voltage control mode
  - Implement and maintain control set point consistent with the voltage or reactive schedule provided by the TOP
  - Notify the TOP when they are not in automatic voltage control so the TOP can update its EMS model (for both short term issues and long term/base case situations)
  - Notify the TOP of equipment and other facility issues that limit reactive power output to a level lower than previously communicated capabilities
  - Notify the TOP if/when the GOP notices that the interconnection facility experiences a period of operation outside of the prescribed voltage or reactive schedule bandwidth lasting longer than 30 minutes
    - The TOP's voltage deviation alarms are not necessarily set at the GOP's voltage schedule bandwidth so they may be unaware of the deviation.
    - If the GOP is compliant with the other VAR-002 requirements, they are doing everything they can do to support grid voltage.
    - In the base case, the grid will swing the generator's bus…not visa versa.

Approach to VAR-002 (Cont'd)

- Tasks (cont'd)
  - Provide the TOP with transformer characteristics (i.e. taps) and coordinate transformer tap setting changes
- Voltage Compliance Window: Judging a Generator Operator's compliance performance based on monitoring and maintaining voltage at its interconnection facility holds them to a requirement that is beyond their control and defined in TOP-004-2 R6 as the responsibility of the TOP.
  - GOP should be required to do what is reasonably within their control to contribute to maintaining the grid voltage and notify the TOP of internal issues and external issues they may see due to their enhanced visibility (i.e. TOP is watching more busses)

VAR-001 *Pro forma*

Applicability of VAR-001- Registered Entities

- Purchasing-Selling Entities- Are they needed for reliability reasons?
- Reliability Coordinator- Added to address a FERC directive.
- Transmission Planners- How should planning requirements be addressed?

VAR-001 *Pro forma*

New R1- Each Transmission Operator shall ensure that formal policies and/or procedures are developed and implemented for monitoring, and controlling voltage levels and Reactive Power flows (Mvar flows) within acceptable limits.

1. These formal policies and/or procedures shall include criteria for the assessment in R3. The criteria shall include but is not limited to documented voltage and/or reactive power operating margins to prevent voltage instability.
2. Each TOP shall also communicate these policies and/or procedures with neighboring TOPs at interfaces or tie points.
3. Each TOP shall provide policies and/or procedures to the Reliability Coordinator.

- M1-The Transmission Operator shall have evidence of documented policies and/or procedures as specified in Requirement 1.

VAR-001 *Pro forma*

New R2- Each Reliability Coordinator and TOP shall monitor and assess system voltage performance for anticipated normal and Contingency event conditions in real-time operation.

- M2- Each RC and TOP shall have evidence to show that system voltages are being monitored. Evidence may include real-time tool screen shots, data displays.

VAR-001 *Pro forma*

New R3- Each TOP shall perform assessments to ensure sufficient reactive resources are available to maintain steady state and dynamic voltages under normal and contingency operational conditions. Sufficient reactive resources may include, but is not limited to:

- reactive generation scheduling,
- transmission line and reactive resource switching, and
- controllable load.

1. As a result of the assessment, each TOP shall ensure that sufficient reactive resources have been scheduled to meet acceptable voltage limits identified in R1.
2. The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

VAR-001 *Pro forma*

New R3 (cont'd)-

- M3- Each TOP shall have evidence of current or past studies used to schedule sufficient reactive resources. TOP is required to run frequent studies for the areas that are susceptible to voltage instability, and for the areas that are not susceptible to voltage instability periodical update to the study results is required in order to ensure that voltage stability limits are not encountered during real-time operations.

VAR-001 *Pro forma*

New R4 - The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 5 and Requirement 7.1. In the event a Transmission Operator approves a generator as satisfying the criteria, he shall notify the associated Generator Operator.

- M4- The Transmission Operator shall have evidence to show that, for each generating unit in its area that is exempt from following a voltage or Reactive Power schedule, the associated Generator Owner was notified of this exemption.

VAR-001 *Pro forma*

New R5 - Each Transmission Operator shall specify a voltage or Reactive Power schedule **and tolerance band** at the interconnection between the generator facility and the Transmission Owner's facilities to be maintained by each generator. The Transmission Operator shall provide the voltage or Reactive Power schedule to the associated Generator Operator and direct the Generator Operator to comply with the schedule in automatic voltage control mode (AVR in service and controlling voltage). The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

- M5- The Transmission Operator shall have evidence that it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator.

VAR-001 *Pro forma*

New R6 - Each LSE shall maintain a power factor range established by the Transmission Service Provider or the Transmission Planner at the interface between the bulk electric system and the LSE. The LSE shall provide upon request the forecasted seasonal power factor to the TOP/TP.

- M6- Each LSE shall have evidence the power factor range was maintained using metered data at the interface. Each LSE shall also have evidence that the forecasted seasonal power factor was communicated to the TOP/TP as requested.

VAR-001 *Pro forma*

New R7 (staying the same)- The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.

1. When notified of the loss of an automatic voltage regulator control, the Transmission Operator shall direct the Generator Operator to maintain or change either its voltage schedule or its Reactive Power schedule

- **M7- Each TOP shall have evidence showing that each reactive resource is being monitored. Each TOP shall also have evidence to show it issued directives when notified by GOP of loss of an AVR control or Reactive Power resources.**

VAR-001 *Pro forma*

New R8 - Each Transmission Operator shall operate or direct the operation of capacitive and inductive reactive resources within its area – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; controllable load; and, if necessary, load shedding, to maintain system voltages within established limits.

- M8- Each TOP shall provide evidence such as logs or phone recordings to show TOP has operated reactive resources to maintain system voltages or provided directions to operate reactive resources and maintain system voltages within the established limits.

VAR-001 *Pro forma*

New R9 - Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and (if necessary) complete the required IROL or SOL violation reporting.

- M9- Each TOP shall have evidence of correcting deficiencies within 30 minutes.

VAR-001 *Pro forma*

New R10 (stays same) – After consultation with the Generator Owner regarding necessary step-up transformer tap changes, the Transmission Operator shall provide documentation to the Generator Owner specifying the required tap changes, a timeframe for making the changes, and technical justification for these changes.

- M10- The Transmission Operator shall have evidence that it provided documentation to the Generator Owner when a change was needed to a generating unit's step-up transformer tap in accordance with the new **Requirement 10**. (Old M4)

VAR-002 *Pro forma*

Applicability-

- GO & GOP with dispersed power producing resources with a common collector system and an aggregate capacity greater than 75 MVA" (gross aggregate nameplate rating) utilizing a system designed primarily for aggregating capacity, connected at a common point at a voltage of 100 kV or above.
  - The issue is how to address small dispersed power generators. For wind farms, must consider they are coming from a collector bus.
- TOP for new non-compliance window communication requirement

VAR-002 *Pro forma*

- **New R2-** Unless exempted by the Transmission Operator, each Generator Operator shall **implement and maintain** a voltage control set-point consistent with the generator voltage or Reactive Power schedule provided by the Transmission Operator (within applicable Facility Ratings). The voltage or Reactive Power schedule is a target value communicated by the Transmission Operator to the Generator Operator establishing a tolerance band within which the target value is to be maintained during a specified period.

VAR-002 *Pro forma*

- **New R2-**
  - When a generator's automatic voltage regulator is out of service, the Generator Operator shall use an alternative method to control the generator voltage and reactive output to meet the voltage or Reactive Power schedule directed by the Transmission Operator.
  - When directed to modify voltage, the Generator Operator shall comply or provide an explanation of why the schedule cannot be met.
  - Each generator is operated within systems and equipment limits. The reason(s) for any equipment limitations resulting in not meeting voltage schedule shall be documented. (For example, exciter or generator field current limitations, generator terminal voltage, auxiliary or safety -related bus voltage limitations, volts per Hz alarms, excessive generator vibration, generator temperature limits, hydrogen coolers restrictions, shorted rotor turns, safety, other protection, etc.)
    - This language is from MOD-025 standard developed for RFC and approved by NERC.

VAR-002 *Pro forma*

- **New R3 sub-requirements-**
  - 3.4- The GOP will notify the Transmission Operator of any period of operation-outside-of-the prescribed voltage or reactive schedule bandwidth lasting longer than 30 minutes.
    - 3.4.1- GOP will provide future updates consistent with TOP instructions.
  - 3.5- The TOP will acknowledge communication and provide instruction on future communication that defines a condition warranting further update.

Industry Input Needed

WE VALUE YOUR INPUT!!!

- VAR-001- What is the definition for “voltage stability?” May need suggestions on the proper hand-off from VAR to the TPL requirements. Several other issues are being discussed, and we will need industry input.

- VAR-002- What is technical support for notifications? We need technical justifications

- We hope to present a new SAR, the *pro formas*, and the RSAW to the SC in late May. We hope to also present a list for the formal SDT. Please let us know if you want to join that team.

TPL Requirement Comparison

- **Please compare proposed VAR requirements and the Board Approved TPL standard.**
- Please take a very close look at TPL R2, R5, and R6. Do you believe those requirements address FERC's directive to conduct periodic studies?

VAR-002

- **How do we justify the timeframes? –**There must a technical reason that support why the non-compliance window makes sense from a reliability perspective.
  - **Please address frequency of calls and if there is a reset period for when to notify the TOP.**

Upcoming Key Dates

- Upcoming Technical Conferences
  - Industry Technical Conferences- April 18, 2013 (Atlanta, GA) and April 23rd (Denver, CO)–
    - As of now, WebEx has not been set up for these meetings
- Key Dates
  - Mid to late May, 2013 – Submit SAR, *pro forma,* and RSAW to SC
  - July 26, 2013 – Initial ballot posting: *pro forma* Standard and RSAW for 45 day comment
  - October 24, 2013 – Recirculation Ballot
  - November 7, 2013 – Board of Trustees Adoption
  - December 31, 2013 – File with FERC

Ad-Hoc Group Members

Participant	Entity Represented
Dennis Chastain	Tennessee Valley Authority
Bill Harm	PJM Interconnection L.L.C.
Steve Hitchens	Bonneville Power Administration
Sharma Kolluri	Entergy Services Inc.
Martin Kaufman	ExxonMobil Research and Engineering Company
Joshua Pierce	Southern Company
Hari Singh	Xcel Energy
Hamid Zakery	Calpine Corporation

Other Standards Projects

UVLS is looking for new drafting team members

Link to nomination: http://www.nerc.com/filez/standards/Project2008-02_UVLS.html

Please contact: erika.chanzes@nerc.net

Questions and Answers

Thank you for your time!

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