

**Exhibit A**

**Proposed Reliability Standard VAR-001-3**

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-3
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1.** Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2.** Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3.** The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1.** Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2.** For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4.** Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5.** Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

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- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
- R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; and controllable load– to support its voltage under first Contingency conditions.
- R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### D. Compliance

1. **Compliance Monitoring Process**
  - 1.1. **Compliance Enforcement Authority**

Regional Entity.

**1.2. Compliance Monitoring Period and Reset Time Frame**

One calendar year.

**1.3. Compliance Monitoring and Enforcement Processes:**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

**1.4. Data Retention**

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

**1.5. Additional Compliance Information**

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

**2. Violation Severity Levels (no changes)**

**E. Regional Variances**

**E.A. Regional Variance for the Western Electricity Coordinating Council**

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

**Requirements**

**E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.
- A voltage band for a specified period.

- E.A.14.** Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:*
- The generator terminals.
  - The high side of the generator step-up transformer.
  - The point of interconnection.
  - A location designated by mutual agreement between the Transmission Operator and Generator Operator.
- E.A.15.** Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
- E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- E.A.18.** Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.
- E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures<sup>2</sup>

- M.E.A.13.** Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.

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<sup>2</sup> The number for each measure corresponds with the number for each requirement, i.e. M.E.A.13 means the measure for Requirement E.A.13.

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- M.E.A.14.** The Transmission Operator shall have and provide upon request, evidence that it provided one of the voltage schedule reference points in Requirement E.A.14 for each generation resource in its Area to the Generator Operator. Dated letters, e-mail, or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.
- M.E.A.15.** Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.
- M.E.A.16.** The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.17.** The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.18.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

### Violation Severity Levels

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.13</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.

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E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.14</b>	The Transmission Operator did not provide a voltage schedule reference point for at least one but less than or equal to 5% of the generation resources in the Transmission Operator area.	The Transmission Operator did not provide a voltage schedule reference point for more than 5% but less than or equal to 10% of the generation resources in the Transmission Operator Area.	The Transmission Operator did not provide a voltage schedule reference point for more than 10% but less than or equal to 15% of the generation resources in the Transmission Operator Area.	The Transmission Operator did not provide a voltage schedule reference point for more than 15% of the generation resources in the Transmission Operator Area.
<b>E.A.15</b>	The Generator Operator failed to convert at least one voltage schedule in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of the voltage schedules.
<b>E.A.16</b>	The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.	The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.	The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.	The Generator Operator did not provide its voltage set point conversion methodology within 120 days of a request by the Transmission Operator.
<b>E.A.17</b>	The Transmission Operator provided its data to support development of the voltage set point conversion methodology than 30 days but less than or equal to 60 days of a request by the Generator Operator.	The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Generator Operator.	The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Generator Operator.	The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 120 days of a request by the Generator Operator.

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E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.18</b>	N/A	The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.	The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.	The Generator Operator did not meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.

### Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
2	August 5, 2010	Adopted by Board of Trustees; Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
3	May 9, 2012	Adopted by Board of Trustees; Modified to add a WECC region variance	



### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-~~23~~
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4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

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- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4. Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5. Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
- R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; and controllable load– to support its voltage under first Contingency conditions.
- R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### **C. Measures**

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### **D. Compliance**

#### **1. Compliance Monitoring Process**

**1.1. Compliance Enforcement Authority**

Regional Entity.

**1.2. Compliance Monitoring Period and Reset Time Frame**

One calendar year.

**1.3. Compliance Monitoring and Enforcement Processes:**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

**1.4. Data Retention**

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

**1.5. Additional Compliance Information**

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

**2. Violation Severity Levels (no changes)**

**E. Regional ~~Differences~~Variances**

~~None identified.~~

**E.A. Regional Variance for the Western Electricity Coordinating Council**

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

**Requirements**

**E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to

establish a generator bus voltage set point.

- A voltage band for a specified period.

**E.A.14.** Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:

- The generator terminals.
- The high side of the generator step-up transformer.
- The point of interconnection.
- A location designated by mutual agreement between the Transmission Operator and Generator Operator.

**E.A.15.** Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

**E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

**E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

**E.A.18.** Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]

**E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.

**E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

## **Measures<sup>2</sup>**

**M.E.A.13.** Each Transmission Operator shall have and provide upon request, evidence that it

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<sup>2</sup> The number for each measure corresponds with the number for each requirement, i.e. M.E.A.13 means the measure for Requirement E.A.13.

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provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.

**M.E.A.14.** The Transmission Operator shall have and provide upon request, evidence that it provided one of the voltage schedule reference points in Requirement E.A.14 for each generation resource in its Area to the Generator Operator. Dated letters, e-mail, or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.

**M.E.A.15.** Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.

**M.E.A.16.** The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

**M.E.A.17.** The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

**M.E.A.18.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

**Violation Severity Levels**

<u>E #</u>	<u>Lower VSL</u>	<u>Moderate VSL</u>	<u>High VSL</u>	<u>Severe VSL</u>
<u><b>E.A.13</b></u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the</u>

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<u>E #</u>	<u>Lower VSL</u>	<u>Moderate VSL</u>	<u>High VSL</u>	<u>Severe VSL</u>
	<u>on-line and part of the BES in the Transmission Operator Area.</u>	<u>on-line and part of the BES in the Transmission Operator Area.</u>	<u>on-line and part of the BES in the Transmission Operator Area.</u>	<u>Transmission Operator Area.</u>
<u>E.A.14</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for at least one but less than or equal to 5% of the generation resources in the Transmission Operator area.</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for more than 5% but less than or equal to 10% of the generation resources in the Transmission Operator Area.</u>	<u>The Transmission Operator did not a voltage schedule reference point for more than 10% but less than or equal to 15% of the generation resources in the Transmission Operator Area.</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for more than 15% of the generation resources in the Transmission Operator Area.</u>
<u>E.A.15</u>	<u>The Generator Operator failed to convert at least one voltage schedule in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of the voltage schedules.</u>
<u>E.A.16</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.</u>	<u>The Generator Operator did not provide its voltage set point conversion methodology within 120 days of a request by the Transmission Operator.</u>
<u>E.A.17</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology than 30 days but less than or equal to 60 days of a request by the Generator</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Generator.</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Generator.</u>	<u>The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 120 days of a request by the Generator</u>

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<u>E #</u>	<u>Lower VSL</u>	<u>Moderate VSL</u>	<u>High VSL</u>	<u>Severe VSL</u>
	<u>Operator.</u>	<u>Operator.</u>	<u>Operator.</u>	<u>Operator.</u>
<u>E.A.18</u>	<u>N/A</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>

**Version History**

<u>Version</u>	<u>Date</u>	<u>Action</u>	<u>Change Tracking</u>
<u>0</u>	<u>April 1, 2005</u>	<u>Effective Date</u>	<u>New</u>
<u>1</u>	<u>August 2, 2006</u>	<u>BOT Adoption</u>	<u>Revised</u>
<u>1</u>	<u>July 3, 2007</u>	<u>Added “Generator Owners” and “Generator Operators” to Applicability section.</u>	<u>Errata</u>
<u>1</u>	<u>August 23, 2007</u>	<u>Removed “Generator Owners” and “Generator Operators” to Applicability section.</u>	<u>Errata</u>
<u>2</u>	<u><del>TBD</del><u>August 5, 2010</u></u>	<u><del>Adopted by Board of Trustees;</del> Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.</u>	<u>Revised.</u>
<u>3</u>	<u>May 9, 2012</u>	<u><del>Adopted by Board of Trustees;</del> Modified to add a WECC region variance</u>	

**Exhibit C**

**Implementation Plan for Proposed Reliability Standard VAR-001-3**



## Implementation Plan Reliability Standard VAR-001-3 – Voltage and Reactive Control

The Project WECC-0046 Regional Variance Drafting Team proposes that the WECC Variance become effective on the first day of the first calendar quarter six months after applicable regulatory approval, or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after NERC Board of Trustees' approval. Six months will provide Transmission Operators sufficient time to review scheduling practices; to revise existing procedures and other documents that contain scheduling practices; and to distribute any required revisions to those documents in order to be in compliance with the WECC Variance. Six months will also allow time for Generator Operators to develop voltage schedule conversion methodologies from the reference point to the AVR set point as required in the WECC Regional Variance to VAR-001-2 Requirement E.A.16.

## **Exhibit D**

### **NERC Consideration of Comments**

## Consideration of Comments

### Regional Reliability Standards-WECC VAR-001-2

The WECC VAR-001-2 Drafting Team thanks everyone who submitted comments on the proposed revisions (clean and redline) to VAR-001-2. These standards were posted for a 45-day public comment period from October 20, 2011 through December 5, 2011. Stakeholders were asked to provide feedback on the standards and associated documents through a special electronic comment form. There were seven sets of comments, including comments from 11 different people from seven entities representing four of the 10 Industry Segments as shown in the table on the following pages.

All comments submitted may be reviewed in their original format on the standard's project page:

[http://www.nerc.com/filez/regional\\_standards/regional\\_reliability\\_standards\\_under\\_development.html](http://www.nerc.com/filez/regional_standards/regional_reliability_standards_under_development.html)

If you feel that your comment has been overlooked, please let us know immediately. Our goal is to give every comment serious consideration in this process! If you feel there has been an error or omission, you can contact the Vice President of Standards and Training, Herb Schrayshuen, at 404-446-2560 or at [herb.schrayshuen@nerc.net](mailto:herb.schrayshuen@nerc.net). In addition, there is a NERC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is in the Reliability Standards Development Procedures: <http://www.nerc.com/standards/newstandardsprocess.html>.

## Index to Questions, Comments, and Responses

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**The Industry Segments are:**

- 1 — Transmission Owners
- 2 — Regional Transmission Organizations (RTOs), Independent System Operators (ISOs)
- 3 — Load-Serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 — Regional Reliability Organizations, Regional Entities

Group/Individual		Commenter	Organization	Registered Ballot Body Segment										
				1	2	3	4	5	6	7	8	9	10	
1.	Individual	Janet Smith, Regulatory Affairs Supervisor	Arizona Public Service Company	X		X		X	X					
2.	Individual	Sandra Shaffer	PacifiCorp	X		X		X	X					
3.	Individual	Cindy Oder	Salt River Project	X		X		X	X					
4.	Individual	Annie Lauterbach / Frank Puyleart / Steve Hitchens / Bart McManus / Rebecca Berdahl	Bonneville Power Administration	X		X		X	X					
5.	Individual	Brenda Powell	Constellation Energy Commodities Group						X					
6.	Individual	Amir Hammad	Constellation Power Source Generation, Inc					X						
7.	Individual	Michelle R D'Antuono	Elk Hills Power LLC					X						

1. Do you agree the proposed variance is being developed using the associated Regional Reliability Standards Development Procedure?

Summary Consideration: Yes, the Drafting Team followed the WECC Standards Development Process.

Organization	Yes or No	Question 1 Comment
Elk Hills Power LLC	Yes	The variance was initiated under the WECC Standard development process in late 2008. The completed Criterion was approved by the WECC board in June 2011 and is now being proposed as a Regional Variance to VAR-001.
<b>Response: The Drafting Team agrees that the approved Process for Developing and Approving WECC Standards (WECC Standards Development Process) was used to develop this regional variance.</b>		
Arizona Public Service Company	Yes	
PacifiCorp	Yes	
Salt River Project	Yes	
Bonneville Power Administration	Yes	
Constellation Energy Commodities Group	Yes	
Constellation Power Source Generation, Inc	Yes	

2. Does the proposed variance pose an adverse impact to reliability or commerce in a neighboring region or interconnection?

**Summary Consideration: No, the WECC Variance does not pose adverse impacts to reliability or commerce in neighboring regions or interconnections.**

Organization	Yes or No	Question 2 Comment
Elk Hills Power LLC	Yes	<p>In the view of Elk Hills Power, the removal of requirement R3 exempting some generators from adhering to a voltage/Reactive Power schedule is reasonable. Even older units without AVRs should provide some means to adjust generator output as needed to support the local transmission system. The requirements E.A.13 through E.A.18 that look to assure that AVR voltage set points are converted properly from the TOP’s schedule are also a reliability improvement. However, we are concerned that the assignment of responsibility to the GOP to assure that the conversion is optimally performed is misplaced. The following excerpt on page 3 of the draft standard captures our viewpoint.”During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule. It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator’s reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to maintain system reliability: ensuring that generators provide the proper voltage support when generation and transmission outages occur.” Since the TOP is responsible for the voltage stability within their</p>

Organization	Yes or No	Question 2 Comment
		<p>footprint, it is not clear to us why they would want to assume the GOP has the expertise to convert a Reactive Power schedule to a voltage set point - especially when the wrong steps could be taken by a GOP during an incident that would be perfectly correct under normal operating conditions. If the TOP chooses to not provide voltage set points for whatever reason, then we believe that they should provide the proper conversion methodology as well. This would likely involve a technical discussion with the GOP and perhaps the generator vendor, but is based upon the TOP's own decision to provide a Reactive Power schedule only. Of even further concern is requirement E.A.18 regarding the use of control loops external to the AVR. Elk Hills Power takes this to mean Automatic Generation Control (AGC) which is managed by the Balancing Authority in support of secondary frequency response. Similar to the discussion above, AGC operating parameters must be supplied and owned by the BA if they expect proper performance under stress conditions. In this case, the BA may need to engage the GOP and TOP to develop the correct settings, but ultimately it is their responsibility. Furthermore, E.A.18 does not even name the Balancing Authority as an interested party. The way the requirement is written, it is conceivable that the GOP and TOP will agree upon a change to the AGC's voltage response without BA's knowledge - which may then impact the expected frequency response. This seems to Elk Hills Power that a reliability gap is introduced through the improper assignment of responsibility.</p>
<p><b>Response: Transmission Operators (TOPs) and Generator Operators (GOPs) have shared responsibility to provide voltage support. The TOP provides basic direction. The GOP decides how to accomplish the direction within the unit's capability. The GOP cannot see the system voltage profile and know how to respond to system events. The WECC Regional Variance to VAR-001-2 (WECC Variance) provides the needed direction and the clarification of responsibility when voltage schedules are provided. The WECC Variance is designed to only permit voltage schedules. The WECC Variance is designed to enhance the understanding and shared responsibility by requiring improved communication to accomplish voltage and reactive support.</b></p> <p><b>The Drafting Team believes that the TOP is responsible for the Bulk Electric System (BES) system voltage profile. Implementing a voltage schedule is not simple for either the GOP or TOP. The NERC Standards have resulted in a complicated process. The Drafting</b></p>		



Organization	Yes or No	Question 2 Comment
<p>Team believes the GOP has a better understanding of the operation and control of a generator than the TOP. The conversion process is developed in advance and used to translate the TOP’s schedule to an AVR set point during normal operating conditions. There is no specific action taken by the GOP at the time of a system event. The requirement to have the AVR in voltage control mode is so that the unit(s) will respond appropriately and automatically during a system event.</p> <p>NERC Standard VAR-001-2 defines requirements for TOPs when issuing voltage and reactive schedules. In the WECC Variance, the GOP has an integral part in establishing the schedule at the generator terminal. The WECC Variance vacates the issuance of reactive schedules. If the requirements were split between VAR-001-2 and VAR-002-1.1b, there would more confusion than combining the requirement into a WECC Variance. The Drafting Team has crafted the WECC Variance to clarify the communication of schedules, and the GOP response to those schedules, without any reductions in reliability. The WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Western Interconnection more reliable because there are physical differences that require Automatic Voltage Regulators (AVR) to control voltage (see responses to question 5 below). The Drafting Team believes that Elk Hills misread Requirement E.A.18 when it indicated that it referred to AGC. External control is limited to managing VAR output (reactive power) to allow GOPs to share the VAR output on multiple machines without impacting voltage response.</p> <p>With the approval of the VAR-002-WECC-1 WECC Regional Reliability Standard, each GOP is required to have AVRs in service and operating in automatic voltage control mode. The industry in the WECC Region has determined that AVRs must be operated in voltage control mode. The Drafting Team is addressing GOP concerns raised in the development of VAR-002-WECC-1 about operating an AVR when a TOP reactive schedule is given.</p>		
Bonneville Power Administration	No	BPA will not be changing its operations due to this variance, therefore, do not expect impacts to reliability or commerce in a neighboring region or interconnection.
<p><b>Response: The Drafting Team appreciates this comment.</b></p>		
Arizona Public Service Company	No	
PacifiCorp	No	

Organization	Yes or No	Question 2 Comment
Salt River Project	No	
Constellation Energy Commodities Group	No	
Constellation Power Source Generation, Inc	No	

3. Does the proposed variance pose a serious and substantial threat to public health, safety, welfare, or national security?

**Summary Consideration: No, the proposed WECC Variance does not pose any serious threats to public health, safety, welfare, or national security.**

Organization	Yes or No	Question 3 Comment
Elk Hills Power LLC	Yes	NERC and FERC have clearly assigned a high priority to improving the voltage response, and the primary and secondary frequency response of the BES. Within the last six months, very detailed standards have been posted for industry review under Project 2007-09 - Generator Verification and Project 2007-12 - Frequency Response. They leave no doubt that, while complex, the proper identification of voltage and frequency-response settings is crucial to the reliability of the BES. Without tight coordination between planning, owning, and operating entities, it is far too easy to actually make the BES less reliable - which translates to power outages at the worst possible times.
<p><b>Response: Thank you, the Drafting Team appreciates your point that tight coordination between owning, operating, and planning entities is important to the reliable operation of the Interconnection. The WECC Variance provides requirements to enhance the coordination. The Drafting Team disagrees that there is any threat to the public health, safety, welfare, or national security.</b></p>		
Bonneville Power Administration	No	BPA will not be changing its operations due to this variance, therefore, BPA does not expect impacts to public health, safety, welfare or national security.
<p><b>Response: Thank you, the Drafting Team appreciates this comment.</b></p>		
Arizona Public Service Company	No	
PacifiCorp	No	

Organization	Yes or No	Question 3 Comment
Salt River Project	No	
Constellation Energy Commodities Group	No	
Constellation Power Source Generation, Inc	No	

4. Does the proposed variance pose a serious and substantial burden on competitive markets within the interconnection that is not necessary for reliability?

**Summary Consideration: The proposed WECC Variance does not pose a substantial burden on competitive markets within the Western Interconnection that is not necessary for reliability.**

Organization	Yes or No	Question 4 Comment
Elk Hills Power LLC	Yes	By improperly assigning the ownership of the requirements to establish AVR and AGC voltage set points and other parameters not clearly identified by the BA and TOP, Elk Hills Power believes that the potential reliability benefit is lost. In addition, Elk Hills Power will be required to maintain conversion methodologies for which they have no systems or tools to demonstrate that they are optimally supporting the local system.
<p><b>Response: The Drafting Team disagrees that it improperly assigned responsibility because the responsibility assignments are contained within the NERC VAR-001-1 and VAR-002-1.1b Standards. Nothing in the WECC Variance changes that assignment. Unless a GOP is receiving generator terminal voltage schedules, the drafting Team believes the GOP already has to have a conversion methodology. The WECC Variance is just formalizing the process; therefore, there is minimum burden on competitive markets.</b></p>		
Bonneville Power Administration	No	BPA will not be changing its operations due to this variance, therefore, BPA does not expect impacts on competitive markets within the interconnection that is not necessary for reliability.
<p><b>Response: Thank you, the Drafting Team appreciates this comment.</b></p>		
Arizona Public Service Company	No	
PacifiCorp	No	

Organization	Yes or No	Question 4 Comment
Salt River Project	No	
Constellation Energy Commodities Group	No	
Constellation Power Source Generation, Inc	No	

5. Does the proposed variance meet at least one of the following criteria? The proposed variance has more specific criteria for the same requirements covered in a continent-wide standard. The proposed variance has requirements that are not included in the corresponding continent-wide reliability standard. The proposed regional difference is necessitated by a physical difference in the bulk power system.

**Summary Consideration:** Yes, the proposed WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Interconnection more reliable because there are physical differences that require AVRs to control voltage. In the Western Interconnection this physical difference and need for keeping AVRs in service controlling voltage was identified when one of the causes of the 1996 disturbances was identified as insufficient supply of reactive power from generators, including AVRs that were not operating in voltage control mode. As a result of this experience, WECC determined that there should be only very limited circumstances where a GOP should remove its AVR from operating in automatic voltage control mode (see VAR-002-WECC-1). Furthermore, the analyses of many disturbances in the Western Interconnection have demonstrated the need to stabilize system voltage by using AVR response. The development the WECC Variance further supports the need for voltage support during system disturbances by:

1. Requiring that Transmission Operators provide voltage rather than reactive schedules to Generator Operators,
2. Allowing Transmission Operators to provide voltage schedules through reactive power terms,
3. Requiring the conversion of voltage schedules into voltage settings for the AVRs.

Organization	Yes or No	Question 4 Comment
Bonneville Power Administration	Yes	a. BPA believes the proposed variance has more specific criteria for the same requirements covered in the continent-wide standard. b. BPA believes the proposed variance has requirements that are not included in the corresponding continent-wide reliability standard. c. BPA believes the proposed regional variance is necessitated by a physical difference in the bulk power system. BPA believes the proposed variance has more specific criteria for the same requirements covered in the continent-wide standard and that the WECC reliability requirement for having generators' AVR's Voltage Control Mode necessitates the proposed regional variance.

Organization	Yes or No	Question 4 Comment
<p><b>Response: Thank you, the Drafting Team appreciates this comment.</b></p>		
<p>Elk Hills Power LLC</p>	<p>Yes</p>	<p>The variance clearly has more specific criteria than VAR-001-2. Elk Hills Power believes that with the proper assignment of responsibility, the reliability benefit will be significant.</p>
<p><b>Response: Thank you, the Drafting Team appreciates this comment. The Drafting Team hopes that Elk Hills Power understands the clarification of the responsibilities provide by the WECC Variance.</b></p>		
<p>Constellation Energy Commodities Group</p>	<p>No</p>	<p>The WECC variance to VAR-001 inappropriately mimics VAR-002 for GOPs. The WECC VAR-001 Variance drafting team states “the purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.” Meanwhile, the VAR-002 purpose states “To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.” These purpose statements are very similar, and reflect the coordinated nature of operations and the applicability of these standards. VAR-001 was written to ensure that TOPs, PSEs, and LSEs maintain voltage levels, reactive flows, and reactive resources. VAR-002 was written to ensure that GOPs do the same thing at the direction of TOPs. Adding generator specific requirements to VAR-001 ignores the function of VAR-002 and is counter to the intent of VAR-001 and VAR-002. This variance is not the correct way to ensure that WECC GOPs are operating in auto voltage control. Further, there are no physical differences in the BES in WECC to justify the generator specific requirements in VAR-001. The generator specific requirements being proposed are more specific versions of the requirements found in VAR-002, but do not add any new improvements to reliability. It would be more efficient and effective for the issues raised by the WECC VAR-001 Variance drafting team to be considered within a revision of VAR-002 from a region-wide basis. Aspects in need of improvement within VAR-002- have already been raised</p>



Organization	Yes or No	Question 4 Comment
		<p>at the NERC level. NERC issued a CAN on VAR-002- and an interpretation request is under consideration. WECC should issue a SAR for revision of VAR-002 rather than pursue this variance.</p>
<p><b>Response: NERC Standard VAR-001-2 defines requirements for TOPs when issuing voltage and reactive schedules. In the WECC Variance, the GOP has an integral part in establishing the schedule at the generator terminal. The WECC Variance vacates the issuance of reactive schedules. If the requirements were split between VAR-001-2 and VAR-002-1.1b, there would more confusion than combining the requirement into a WECC Variance. The Drafting Team has crafted the WECC Variance to clarify the communication of schedules, and the GOP response to those schedules, without any reductions in reliability. The WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Interconnection more reliable because there are physical differences that require AVRs to control voltage. In the Western Interconnection this physical difference and need for keeping AVRs in service controlling voltage was identified when one of the causes of the 1996 disturbances was identified as insufficient supply of reactive power from generators, including AVRs that were not operating in voltage control mode. As a result of this experience, WECC determined that there should be only very limited circumstances where a GOP should remove its AVR from operating in automatic voltage control mode (see VAR-002-WECC-1). Furthermore, the analyses of many disturbances in the Western Interconnection have demonstrated the need to stabilize system voltage by using AVR response.</b></p> <p><b>If the concerns that were raised during the development of the WECC Regional Standard VAR-002-WECC-1 could be addressed through the development of a continent-wide standard, we would be supportive of those efforts. However, discussions with the Drafting Team’s liaison with NERC Project 2008-01 indicated that the NERC project was not going to address those concerns, and development of NERC Project 2008-01 was going to be delayed. As a result, the Drafting Team and the industry in the Western Interconnection believe that we should move forward now with the approval of the WECC Variance.</b></p> <p><b>WECC will participate in any NERC effort to revise VAR-001-2 or VAR-002-1.1b to attempt to have the Western Interconnection’s needs included in the continent-wide versions, and if the resulting continent-wide standards meet our needs WECC will move to have the WECC Regional Variances withdrawn.</b></p>		
<p>Constellation Power Source Generation, Inc</p>	<p>No</p>	<p>The proposed variance does not meet any of the above criteria and adds confusion to the relationship between VAR-001 and VAR-002. The WECC variance to VAR-001 inappropriately mimics VAR-002 for GOPs. The WECC VAR-001 Variance drafting team states “the purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable</p>

Organization	Yes or No	Question 4 Comment
		<p>operation of the Western Interconnection.” Meanwhile, the VAR-002 purpose states “To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.” These purpose statements are very similar. They reflect the coordinated nature of operations and the applicability of these standards. VAR-001 was written to ensure that TOPs, PSEs, and LSEs maintain voltage levels, reactive flows, and reactive resources. VAR-002 was written to ensure that GOPs do the same thing at the direction of TOPs. Adding generator specific requirements to VAR-001 ignores the function of VAR-002 and is counter to the intent of VAR-001 and VAR-002. The generator specific requirements proposed in the variance may be more specific than those in VAR-002, but the addition to VAR-001 does not add any improvements to reliability. This variance is not the correct way to ensure that WECC GOPs are operating in auto voltage control. Further, there are no physical differences in the BES in WECC to justify the generator specific requirements in VAR-001. It would be more efficient and effective for the issues raised by the WECC VAR-001 Variance drafting team to be considered within a revision of VAR-002 from a region-wide basis. Aspects in need of improvement within VAR-002- have already been raised at the NERC level. NERC issued a CAN on VAR-002- and an interpretation request is under consideration. WECC should issue a SAR for revision of VAR-002 rather than pursue this variance.</p>
<p><b>Response: NERC Standard VAR-001-2 defines requirements for TOPs when issuing voltage and reactive schedules. In the WECC Variance, the GOP has an integral part in establishing the schedule at the generator terminal. The WECC Variance vacates the issuance of reactive schedules. If the requirements were split between VAR-001-2 and VAR-002-1.1b, there would more confusion than combining the requirements into a WECC Variance. The Drafting Team has crafted the WECC Variance to clarify the communication of schedules, and the GOP response to those schedules, without any reductions in reliability. The WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Interconnection more reliable because there are physical differences that require AVR's to control voltage. In the Western Interconnection this physical difference and need for keeping AVR's in service controlling voltage was identified when one of the causes of the 1996 disturbances was identified as insufficient supply of reactive power from generators, including AVR's that were not operating in voltage control mode. As a result of this experience, WECC determined that there should be only very limited circumstances where a GOP should</b></p>		

Organization	Yes or No	Question 4 Comment
<b>remove its AVR from operating in automatic voltage control mode (see VAR-002-WECC-1). Furthermore, the analyses of many disturbances in the Western Interconnection have demonstrated the need to stabilize system voltage by using AVR response.</b>		
Arizona Public Service Company	Yes	
PacifiCorp	Yes	
Salt River Project	Yes	

6. If you have any other comments that you have not already provided in the response to the prior questions, please provide them here.

**Summary Consideration:** The Drafting Team followed the WECC Standards Development Process and addressed all comments submitted during the public comment periods. The Drafting Team conducted a survey of TOPs and GOPs in order to better understand the issues and concerns raised in the development of VAR-002-WECC-1. The Drafting Team identified three principle GOP concerns and two principle reasons for TOPs to be able to continue existing scheduling practices. From these results, the Drafting Team designed the WECC Variance to address the GOP concerns while allowing TOPs to continue as much as possible existing scheduling practices. The WECC Variance was approved by stakeholders in the Western Interconnection. The approval of the WECC Variance is an indication that the proposed process enhances reliability in the Western Interconnection while adequately addressing GOP and TOP concerns.

Organization	Yes or No	Question 4 Comment
Arizona Public Service Company		<p>E.A.15 to E.A.17 are unnecessary requirements and do not improve reliability in any way. Typically a TO will ask a GO to simply increase or decrease a VAR output of a generator and then leave the generator at that voltage set point till further notified. Thus, there are no set point calculations to be made and typically a GO will not know how to make those calculations. Also, such calculations are unnecessary and do not improve the reliability of the system in anyway and unnecessarily add burden to GO. E.A.15 requires the conversion of voltage schedules to set point for generator excitation system which is typically voltage regulator set point. Voltage regulator set points are not necessarily same as the terminal voltage set points depending upon the excitation system type. There should be an option to convert the voltage schedules to the terminal voltage also. The following wording is suggested: E.A.15 Each Generator Operator shall convert the voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system or generator terminal voltage.</p>
<p><b>Response:</b> The comment identifies one methodology for converting a schedule change to the generator terminals and is permitted under the WECC Variance. The WECC Variance adds a requirement that the methodology has to be documented. The WECC Variance is also written broad enough to permit other GOP methodologies to be developed. The AVR controls the voltage at the generator terminal regardless of where the voltage is sensed. The conversion methodology permits the development of a process</p>		

Organization	Yes or No	Question 4 Comment
<b>that also controls voltage away from the generator terminal.</b>		
PacifiCorp		What is the minimum size of the generation resources which are subject to these requirements?
<b>Response: The WECC Variance applies to all BES generators. The WECC Variance does not change applicability of NERC VAR Standards.</b>		
Constellation Energy Commodities Group		<p>Below, Constellation raises comments on the generator specific requirements. Note that Constellation raised these points during the WECC comment period, but the issues were not addressed in the comment responses.</p> <ul style="list-style-type: none"> <li>• VAR-001-2 E.A.15 states: “Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system” While VAR-002 R2 states “...each GOP shall maintain generator voltage or Reactive Power output (within applicable Facility Ratings) as directed by the TOP.” These are redundant, but potentially confusing. Interconnected entities should not direct how, operationally, a GOP should comply with a request; they should just mandate that they follow through with the request. Documenting how a GOP complies with a voltage set point does not have a reliability impact on the BES.</li> <li>• E.A.16 - This requirement is not clear. The proposed requirements do not require a GOP to have a voltage set point conversion methodology, yet E.A.16 requires that such a methodology be available. A voltage set point conversion methodology should not be required as it does not have a reliability impact on the BES.</li> <li>• E.A.18 - As Constellation stated above regarding E.A.15, how a GOP manages its operations to comply with a voltage set point is inconsequential. The relevant point is that GOPs comply with the requests given to them from their interconnected entities.</li> </ul>

Organization	Yes or No	Question 4 Comment
<p><b>Response:</b> The Drafting Team addressed the Constellation comments raised during the Version 4 posting of the WECC Variance. The Drafting Team did not receive any Constellation comments during public postings for comment periods after the Version 4 posting. The Drafting Team followed the WECC Standards Development Process. The Drafting Team is not obligated to respond to comments submitted outside the public comment periods.</p> <ol style="list-style-type: none"> <li><b>1. The WECC Variance in Requirement E.A.15 requires that a voltage schedule be converted to the set point of the generator excitation system. This is not redundant with VAR-002-1.1b Requirement R2. The AVR controls the voltage at the generator terminal regardless of where the voltage is sensed or where the schedule is issued. The conversion methodology permits the development of a process that the GOPs may use to demonstrate that they complied with the schedule as required by VAR-002-1.1b Requirement R2, particularly when the GOPs do not know the voltage at the point of interconnection.</b></li> <li><b>2. Requirement E.A.15 requires that a GOP must convert a schedule to the voltage set point of the generator excitation system. It is implied that a conversion methodology must be developed to convert the schedule. A proper conversion methodology is essential to reliability. Conveyance of the conversion methodology to the TOP results in a better understanding of the actions that the GOP will take when the TOP issues schedules.</b></li> <li><b>3. The Drafting Team believes it is important that AVRs respond to system disturbances. The development of control loops to control reactive output during steady state conditions should not negate the AVR response to disturbances. Requirement E.A.18 is intended to provide specification for control loops to allow proper AVR response and requires the TOP’s agreement since the TOP is responsible for reliable operation of the BES.</b></li> </ol>		
<p>Constellation Power Source Generation, Inc</p>		<p>Below, Constellation raises comments on the generator specific requirements. Note that Constellation raised these points during the WECC comment period, but the issues were not addressed in the comment responses. VAR-001-2 E.A.15 states: “Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system” While VAR-002 R2 states “...each GOP shall maintain generator voltage or Reactive Power output (within applicable Facility Ratings) as directed by the TOP.” These are redundant, but potentially confusing. Interconnected entities should not direct how, operationally, a GOP should comply with a request; they should just mandate that they follow through with the request. Documenting how a GOP complies with a voltage set point does not have a reliability impact on the BES. E.A.16 - This requirement is not clear. The proposed requirements do not require a GOP to have a voltage set point conversion</p>

Organization	Yes or No	Question 4 Comment
		<p>methodology, yet E.A.16 requires that such a methodology be available. A voltage set point conversion methodology should not be required as it does not have a reliability impact on the BES. E.A.18 - As Constellation stated above regarding E.A.15, how a GOP manages its operations to comply with a voltage set point is inconsequential. The relevant point is that GOPs comply with the requests given to them from their interconnected entities.</p>
<p><b>Response: The Drafting Team addressed the Constellation comments raised during Version 4 posting of the WECC Variance. The Drafting Team did not receive any Constellation comments during public postings for comment periods after the Version 4 posting. The Drafting Team followed the WECC Standards Development Process. The Drafting Team is not obligated to respond to comments submitted outside the public comment periods.</b></p> <ol style="list-style-type: none"> <li><b>1. The WECC Variance in Requirement E.A.15 requires that a voltage schedule be converted to the set point of the generator excitation system. This is not redundant with VAR-002-1.1b Requirement R2. The AVR controls the voltage at the generator terminal regardless of where the voltage is sensed or where the schedule is issued. The conversion methodology permits the development of a process that the GOPs may use to demonstrate that they complied with the schedule as required by VAR-002-1.1b Requirement R2, particularly when GOPs do not know the voltage at the point of interconnection.</b></li> <li><b>2. Requirement E.A.15 requires that a GOP must convert a schedule to the voltage set point of the generator excitation system. It is implied that a conversion methodology must be developed to convert the schedule. A proper conversion methodology is essential to reliability. Conveyance of the conversion methodology to the TOP results in a better understanding of the actions that the GOP will take when the TOP issues schedules.</b></li> <li><b>3. The Drafting Team believes it is important that AVRs respond to system disturbances. The development of control loops to control reactive output during steady state conditions should not negate the AVR response to disturbances. Requirement E.A.18 is intended to provide specification for control loops to allow proper AVR response and requires TOP agreement since the TOP is responsible for reliable operation of the BES.</b></li> </ol>		
Elk Hills Power LLC		<p>It appears to Elk Hills Power that a lot of effort has been expended in this variance to avoid burdening a Transmission Operator who does not specify voltage set points required to maintain stability on their system. Since all GOPs are required to operate their AVRs in voltage control mode when available, we are not sure why TOP voltage set point-based schedules should not be required to be the norm as well. This</p>

Organization	Yes or No	Question 4 Comment
		variance seems to lock in old Reactive Power management methodologies which should be replaced anyways.
<p><b>Response: The comment identifies an alternative scheduling process. The Drafting Team selected a process that is viable and accounts for constraints on both GOPs and TOPs. In 2009 the Drafting Team conducted a survey of TOPs and GOPs in order to better understand the issues and concerns raised in the development of VAR-002-WECC-1. The Drafting Team identified three principle GOP concerns and two principle reasons for TOPs to be able to continue existing scheduling practices. The principle concerns and reasons are:</b></p> <p><b><u>Generator Operator Concerns</u></b></p> <ol style="list-style-type: none"> <li><b>1. Constant and burdensome attention is required by Generator Operator’s to maintain a proper voltage output from the generator when the schedule is not addressed on the bus controlled by the automatic voltage regulator.</b></li> <li><b>2. If a reactive schedule is used, Generator Operator’s viewed their responsibility as maintaining the specified reactive output. This is similar to “1” in that they must give constant attention to the set point to maintain the specified reactive output. This view is consistent with those of NERC that it is the GOP’s responsibility to maintain the reactive schedule (see VAR-002-1.1b Requirement R2), while still having the AVR in service and controlling voltage (see VAR-002-WECC-1 Requirement R1). Generator Operator’s expressed a desire to utilize the AVR to maintain a reactive set point.</b></li> <li><b>3. Some Generator Operators, while working with their Transmission Operators, have utilized external control loops to manage reactive flows in an area with several generators. These control loops provide set points to generator’s AVRs. The generator’s AVRs are in service and controlling voltage.</b></li> </ol> <p><b><u>Transmission Operator Reasons</u></b></p> <ol style="list-style-type: none"> <li><b>1. Transmission Operators identified several scenarios where it is desirable and expedient to provide schedules on a reactive basis (i.e. specifying a power factor or a specific VAR output to a generator).</b></li> <li><b>2. Transmission Operators routinely specify a schedule at different points. Typical locations are the generator bus, the high side of the generator step up transformer, and the point of interconnection to the transmission facility. The latter location can be some distance from the generator facility.</b></li> </ol> <p><b>The Drafting Team designed the WECC Variance to address the GOP concerns while allowing TOPs to continue as much as possible</b></p>		



Organization	Yes or No	Question 4 Comment
<p>existing scheduling practices. The WECC Variance was approved by stakeholders in the Western Interconnection. The approval of the WECC Variance is an indication that the proposed process enhances reliability in the Western Interconnection while adequately addressing GOP and TOP concerns.</p>		
Salt River Project		
Bonneville Power Administration		

END OF REPORT

**Exhibit E**

**NERC Record of Development of Proposed Reliability Standard VAR-001-3**

Regional Reliability Standards - Under Development				
Standard No.	Title	Regional Status	Dates	NERC Status
Western Electricity Coordinating Council (WECC)				
VAR-001-WECC-3	Voltage and Reactive Control	NERC Board Adopted May 9, 2012	10/20/11-12/05/11	<p>Info (7)</p> <p>Submit Comments</p> <p>Comment Form (6)</p> <p>VAR-001-3 (Clean)(5)</p> <p>VAR-001-3 (Redlined)(4)</p> <p>Implementation Plan(3)</p> <p>Comments Received (2)</p> <p>Consideration of Comments (1)</p>
			08/29/11	Monitoring Regional Progress

# Consideration of Comments

## Regional Reliability Standards-WECC VAR-001-2

The WECC VAR-001-2 Drafting Team thanks everyone who submitted comments on the proposed revisions (clean and redline) to VAR-001-2. These standards were posted for a 45-day public comment period from October 20, 2011 through December 5, 2011. Stakeholders were asked to provide feedback on the standards and associated documents through a special electronic comment form. There were seven sets of comments, including comments from 11 different people from seven entities representing four of the 10 Industry Segments as shown in the table on the following pages.

All comments submitted may be reviewed in their original format on the standard's project page:

[http://www.nerc.com/filez/regional\\_standards/regional\\_reliability\\_standards\\_under\\_development.html](http://www.nerc.com/filez/regional_standards/regional_reliability_standards_under_development.html)

If you feel that your comment has been overlooked, please let us know immediately. Our goal is to give every comment serious consideration in this process! If you feel there has been an error or omission, you can contact the Vice President of Standards and Training, Herb Schrayshuen, at 404-446-2560 or at [herb.schrayshuen@nerc.net](mailto:herb.schrayshuen@nerc.net). In addition, there is a NERC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is in the Reliability Standards Development Procedures: <http://www.nerc.com/standards/newstandardsprocess.html>.

## Index to Questions, Comments, and Responses

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**The Industry Segments are:**

- 1 — Transmission Owners
- 2 — Regional Transmission Organizations (RTOs), Independent System Operators (ISOs)
- 3 — Load-Serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 — Regional Reliability Organizations, Regional Entities

Group/Individual		Commenter	Organization	Registered Ballot Body Segment										
				1	2	3	4	5	6	7	8	9	10	
1.	Individual	Janet Smith, Regulatory Affairs Supervisor	Arizona Public Service Company	X		X		X	X					
2.	Individual	Sandra Shaffer	PacifiCorp	X		X		X	X					
3.	Individual	Cindy Oder	Salt River Project	X		X		X	X					
4.	Individual	Annie Lauterbach / Frank Puyleart / Steve Hitchens / Bart McManus / Rebecca Berdahl	Bonneville Power Administration	X		X		X	X					
5.	Individual	Brenda Powell	Constellation Energy Commodities Group						X					
6.	Individual	Amir Hammad	Constellation Power Source Generation, Inc					X						
7.	Individual	Michelle R D'Antuono	Elk Hills Power LLC					X						

1. Do you agree the proposed variance is being developed using the associated Regional Reliability Standards Development Procedure?

Summary Consideration: Yes, the Drafting Team followed the WECC Standards Development Process.

Organization	Yes or No	Question 1 Comment
Elk Hills Power LLC	Yes	The variance was initiated under the WECC Standard development process in late 2008. The completed Criterion was approved by the WECC board in June 2011 and is now being proposed as a Regional Variance to VAR-001.
<b>Response: The Drafting Team agrees that the approved Process for Developing and Approving WECC Standards (WECC Standards Development Process) was used to develop this regional variance.</b>		
Arizona Public Service Company	Yes	
PacifiCorp	Yes	
Salt River Project	Yes	
Bonneville Power Administration	Yes	
Constellation Energy Commodities Group	Yes	
Constellation Power Source Generation, Inc	Yes	

2. Does the proposed variance pose an adverse impact to reliability or commerce in a neighboring region or interconnection?

**Summary Consideration: No, the WECC Variance does not pose adverse impacts to reliability or commerce in neighboring regions or interconnections.**

Organization	Yes or No	Question 2 Comment
Elk Hills Power LLC	Yes	<p>In the view of Elk Hills Power, the removal of requirement R3 exempting some generators from adhering to a voltage/Reactive Power schedule is reasonable. Even older units without AVRs should provide some means to adjust generator output as needed to support the local transmission system. The requirements E.A.13 through E.A.18 that look to assure that AVR voltage set points are converted properly from the TOP’s schedule are also a reliability improvement. However, we are concerned that the assignment of responsibility to the GOP to assure that the conversion is optimally performed is misplaced. The following excerpt on page 3 of the draft standard captures our viewpoint.”During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule. It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator’s reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to maintain system reliability: ensuring that generators provide the proper voltage support when generation and transmission outages occur.” Since the TOP is responsible for the voltage stability within their</p>



Organization	Yes or No	Question 2 Comment
		<p>footprint, it is not clear to us why they would want to assume the GOP has the expertise to convert a Reactive Power schedule to a voltage set point - especially when the wrong steps could be taken by a GOP during an incident that would be perfectly correct under normal operating conditions. If the TOP chooses to not provide voltage set points for whatever reason, then we believe that they should provide the proper conversion methodology as well. This would likely involve a technical discussion with the GOP and perhaps the generator vendor, but is based upon the TOP's own decision to provide a Reactive Power schedule only. Of even further concern is requirement E.A.18 regarding the use of control loops external to the AVR. Elk Hills Power takes this to mean Automatic Generation Control (AGC) which is managed by the Balancing Authority in support of secondary frequency response. Similar to the discussion above, AGC operating parameters must be supplied and owned by the BA if they expect proper performance under stress conditions. In this case, the BA may need to engage the GOP and TOP to develop the correct settings, but ultimately it is their responsibility. Furthermore, E.A.18 does not even name the Balancing Authority as an interested party. The way the requirement is written, it is conceivable that the GOP and TOP will agree upon a change to the AGC's voltage response without BA's knowledge - which may then impact the expected frequency response. This seems to Elk Hills Power that a reliability gap is introduced through the improper assignment of responsibility.</p>
<p><b>Response: Transmission Operators (TOPs) and Generator Operators (GOPs) have shared responsibility to provide voltage support. The TOP provides basic direction. The GOP decides how to accomplish the direction within the unit's capability. The GOP cannot see the system voltage profile and know how to respond to system events. The WECC Regional Variance to VAR-001-2 (WECC Variance) provides the needed direction and the clarification of responsibility when voltage schedules are provided. The WECC Variance is designed to only permit voltage schedules. The WECC Variance is designed to enhance the understanding and shared responsibility by requiring improved communication to accomplish voltage and reactive support.</b></p> <p><b>The Drafting Team believes that the TOP is responsible for the Bulk Electric System (BES) system voltage profile. Implementing a voltage schedule is not simple for either the GOP or TOP. The NERC Standards have resulted in a complicated process. The Drafting</b></p>		

Organization	Yes or No	Question 2 Comment
<p>Team believes the GOP has a better understanding of the operation and control of a generator than the TOP. The conversion process is developed in advance and used to translate the TOP’s schedule to an AVR set point during normal operating conditions. There is no specific action taken by the GOP at the time of a system event. The requirement to have the AVR in voltage control mode is so that the unit(s) will respond appropriately and automatically during a system event.</p> <p>NERC Standard VAR-001-2 defines requirements for TOPs when issuing voltage and reactive schedules. In the WECC Variance, the GOP has an integral part in establishing the schedule at the generator terminal. The WECC Variance vacates the issuance of reactive schedules. If the requirements were split between VAR-001-2 and VAR-002-1.1b, there would more confusion than combining the requirement into a WECC Variance. The Drafting Team has crafted the WECC Variance to clarify the communication of schedules, and the GOP response to those schedules, without any reductions in reliability. The WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Western Interconnection more reliable because there are physical differences that require Automatic Voltage Regulators (AVR) to control voltage (see responses to question 5 below). The Drafting Team believes that Elk Hills misread Requirement E.A.18 when it indicated that it referred to AGC. External control is limited to managing VAR output (reactive power) to allow GOPs to share the VAR output on multiple machines without impacting voltage response.</p> <p>With the approval of the VAR-002-WECC-1 WECC Regional Reliability Standard, each GOP is required to have AVRs in service and operating in automatic voltage control mode. The industry in the WECC Region has determined that AVRs must be operated in voltage control mode. The Drafting Team is addressing GOP concerns raised in the development of VAR-002-WECC-1 about operating an AVR when a TOP reactive schedule is given.</p>		
Bonneville Power Administration	No	BPA will not be changing its operations due to this variance, therefore, do not expect impacts to reliability or commerce in a neighboring region or interconnection.
<p><b>Response: The Drafting Team appreciates this comment.</b></p>		
Arizona Public Service Company	No	
PacifiCorp	No	

Organization	Yes or No	Question 2 Comment
Salt River Project	No	
Constellation Energy Commodities Group	No	
Constellation Power Source Generation, Inc	No	

3. Does the proposed variance pose a serious and substantial threat to public health, safety, welfare, or national security?

**Summary Consideration: No, the proposed WECC Variance does not pose any serious threats to public health, safety, welfare, or national security.**

Organization	Yes or No	Question 3 Comment
Elk Hills Power LLC	Yes	NERC and FERC have clearly assigned a high priority to improving the voltage response, and the primary and secondary frequency response of the BES. Within the last six months, very detailed standards have been posted for industry review under Project 2007-09 - Generator Verification and Project 2007-12 - Frequency Response. They leave no doubt that, while complex, the proper identification of voltage and frequency-response settings is crucial to the reliability of the BES. Without tight coordination between planning, owning, and operating entities, it is far too easy to actually make the BES less reliable - which translates to power outages at the worst possible times.
<p><b>Response: Thank you, the Drafting Team appreciates your point that tight coordination between owning, operating, and planning entities is important to the reliable operation of the Interconnection. The WECC Variance provides requirements to enhance the coordination. The Drafting Team disagrees that there is any threat to the public health, safety, welfare, or national security.</b></p>		
Bonneville Power Administration	No	BPA will not be changing its operations due to this variance, therefore, BPA does not expect impacts to public health, safety, welfare or national security.
<p><b>Response: Thank you, the Drafting Team appreciates this comment.</b></p>		
Arizona Public Service Company	No	
PacifiCorp	No	

Organization	Yes or No	Question 3 Comment
Salt River Project	No	
Constellation Energy Commodities Group	No	
Constellation Power Source Generation, Inc	No	

4. Does the proposed variance pose a serious and substantial burden on competitive markets within the interconnection that is not necessary for reliability?

**Summary Consideration: The proposed WECC Variance does not pose a substantial burden on competitive markets within the Western Interconnection that is not necessary for reliability.**

Organization	Yes or No	Question 4 Comment
Elk Hills Power LLC	Yes	By improperly assigning the ownership of the requirements to establish AVR and AGC voltage set points and other parameters not clearly identified by the BA and TOP, Elk Hills Power believes that the potential reliability benefit is lost. In addition, Elk Hills Power will be required to maintain conversion methodologies for which they have no systems or tools to demonstrate that they are optimally supporting the local system.
<p><b>Response: The Drafting Team disagrees that it improperly assigned responsibility because the responsibility assignments are contained within the NERC VAR-001-1 and VAR-002-1.1b Standards. Nothing in the WECC Variance changes that assignment. Unless a GOP is receiving generator terminal voltage schedules, the drafting Team believes the GOP already has to have a conversion methodology. The WECC Variance is just formalizing the process; therefore, there is minimum burden on competitive markets.</b></p>		
Bonneville Power Administration	No	BPA will not be changing its operations due to this variance, therefore, BPA does not expect impacts on competitive markets within the interconnection that is not necessary for reliability.
<p><b>Response: Thank you, the Drafting Team appreciates this comment.</b></p>		
Arizona Public Service Company	No	
PacifiCorp	No	

Organization	Yes or No	Question 4 Comment
Salt River Project	No	
Constellation Energy Commodities Group	No	
Constellation Power Source Generation, Inc	No	

5. Does the proposed variance meet at least one of the following criteria? The proposed variance has more specific criteria for the same requirements covered in a continent-wide standard. The proposed variance has requirements that are not included in the corresponding continent-wide reliability standard. The proposed regional difference is necessitated by a physical difference in the bulk power system.

**Summary Consideration:** Yes, the proposed WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Interconnection more reliable because there are physical differences that require AVRs to control voltage. In the Western Interconnection this physical difference and need for keeping AVRs in service controlling voltage was identified when one of the causes of the 1996 disturbances was identified as insufficient supply of reactive power from generators, including AVRs that were not operating in voltage control mode. As a result of this experience, WECC determined that there should be only very limited circumstances where a GOP should remove its AVR from operating in automatic voltage control mode (see VAR-002-WECC-1). Furthermore, the analyses of many disturbances in the Western Interconnection have demonstrated the need to stabilize system voltage by using AVR response. The development the WECC Variance further supports the need for voltage support during system disturbances by:

1. Requiring that Transmission Operators provide voltage rather than reactive schedules to Generator Operators,
2. Allowing Transmission Operators to provide voltage schedules through reactive power terms,
3. Requiring the conversion of voltage schedules into voltage settings for the AVRs.

Organization	Yes or No	Question 4 Comment
Bonneville Power Administration	Yes	a. BPA believes the proposed variance has more specific criteria for the same requirements covered in the continent-wide standard. b. BPA believes the proposed variance has requirements that are not included in the corresponding continent-wide reliability standard. c. BPA believes the proposed regional variance is necessitated by a physical difference in the bulk power system. BPA believes the proposed variance has more specific criteria for the same requirements covered in the continent-wide standard and that the WECC reliability requirement for having generators' AVR's Voltage Control Mode necessitates the proposed regional variance.



Organization	Yes or No	Question 4 Comment
<p><b>Response: Thank you, the Drafting Team appreciates this comment.</b></p>		
<p>Elk Hills Power LLC</p>	<p>Yes</p>	<p>The variance clearly has more specific criteria than VAR-001-2. Elk Hills Power believes that with the proper assignment of responsibility, the reliability benefit will be significant.</p>
<p><b>Response: Thank you, the Drafting Team appreciates this comment. The Drafting Team hopes that Elk Hills Power understands the clarification of the responsibilities provide by the WECC Variance.</b></p>		
<p>Constellation Energy Commodities Group</p>	<p>No</p>	<p>The WECC variance to VAR-001 inappropriately mimics VAR-002 for GOPs. The WECC VAR-001 Variance drafting team states “the purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.” Meanwhile, the VAR-002 purpose states “To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.” These purpose statements are very similar, and reflect the coordinated nature of operations and the applicability of these standards. VAR-001 was written to ensure that TOPs, PSEs, and LSEs maintain voltage levels, reactive flows, and reactive resources. VAR-002 was written to ensure that GOPs do the same thing at the direction of TOPs. Adding generator specific requirements to VAR-001 ignores the function of VAR-002 and is counter to the intent of VAR-001 and VAR-002. This variance is not the correct way to ensure that WECC GOPs are operating in auto voltage control. Further, there are no physical differences in the BES in WECC to justify the generator specific requirements in VAR-001. The generator specific requirements being proposed are more specific versions of the requirements found in VAR-002, but do not add any new improvements to reliability. It would be more efficient and effective for the issues raised by the WECC VAR-001 Variance drafting team to be considered within a revision of VAR-002 from a region-wide basis. Aspects in need of improvement within VAR-002- have already been raised</p>

Organization	Yes or No	Question 4 Comment
		<p>at the NERC level. NERC issued a CAN on VAR-002- and an interpretation request is under consideration. WECC should issue a SAR for revision of VAR-002 rather than pursue this variance.</p>
<p><b>Response: NERC Standard VAR-001-2 defines requirements for TOPs when issuing voltage and reactive schedules. In the WECC Variance, the GOP has an integral part in establishing the schedule at the generator terminal. The WECC Variance vacates the issuance of reactive schedules. If the requirements were split between VAR-001-2 and VAR-002-1.1b, there would more confusion than combining the requirement into a WECC Variance. The Drafting Team has crafted the WECC Variance to clarify the communication of schedules, and the GOP response to those schedules, without any reductions in reliability. The WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Interconnection more reliable because there are physical differences that require AVRs to control voltage. In the Western Interconnection this physical difference and need for keeping AVRs in service controlling voltage was identified when one of the causes of the 1996 disturbances was identified as insufficient supply of reactive power from generators, including AVRs that were not operating in voltage control mode. As a result of this experience, WECC determined that there should be only very limited circumstances where a GOP should remove its AVR from operating in automatic voltage control mode (see VAR-002-WECC-1). Furthermore, the analyses of many disturbances in the Western Interconnection have demonstrated the need to stabilize system voltage by using AVR response.</b></p> <p><b>If the concerns that were raised during the development of the WECC Regional Standard VAR-002-WECC-1 could be addressed through the development of a continent-wide standard, we would be supportive of those efforts. However, discussions with the Drafting Team’s liaison with NERC Project 2008-01 indicated that the NERC project was not going to address those concerns, and development of NERC Project 2008-01 was going to be delayed. As a result, the Drafting Team and the industry in the Western Interconnection believe that we should move forward now with the approval of the WECC Variance.</b></p> <p><b>WECC will participate in any NERC effort to revise VAR-001-2 or VAR-002-1.1b to attempt to have the Western Interconnection’s needs included in the continent-wide versions, and if the resulting continent-wide standards meet our needs WECC will move to have the WECC Regional Variances withdrawn.</b></p>		
<p>Constellation Power Source Generation, Inc</p>	<p>No</p>	<p>The proposed variance does not meet any of the above criteria and adds confusion to the relationship between VAR-001 and VAR-002. The WECC variance to VAR-001 inappropriately mimics VAR-002 for GOPs. The WECC VAR-001 Variance drafting team states “the purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable</p>

Organization	Yes or No	Question 4 Comment
		<p>operation of the Western Interconnection.” Meanwhile, the VAR-002 purpose states “To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.” These purpose statements are very similar. They reflect the coordinated nature of operations and the applicability of these standards. VAR-001 was written to ensure that TOPs, PSEs, and LSEs maintain voltage levels, reactive flows, and reactive resources. VAR-002 was written to ensure that GOPs do the same thing at the direction of TOPs. Adding generator specific requirements to VAR-001 ignores the function of VAR-002 and is counter to the intent of VAR-001 and VAR-002. The generator specific requirements proposed in the variance may be more specific than those in VAR-002, but the addition to VAR-001 does not add any improvements to reliability. This variance is not the correct way to ensure that WECC GOPs are operating in auto voltage control. Further, there are no physical differences in the BES in WECC to justify the generator specific requirements in VAR-001. It would be more efficient and effective for the issues raised by the WECC VAR-001 Variance drafting team to be considered within a revision of VAR-002 from a region-wide basis. Aspects in need of improvement within VAR-002- have already been raised at the NERC level. NERC issued a CAN on VAR-002- and an interpretation request is under consideration. WECC should issue a SAR for revision of VAR-002 rather than pursue this variance.</p>
<p><b>Response: NERC Standard VAR-001-2 defines requirements for TOPs when issuing voltage and reactive schedules. In the WECC Variance, the GOP has an integral part in establishing the schedule at the generator terminal. The WECC Variance vacates the issuance of reactive schedules. If the requirements were split between VAR-001-2 and VAR-002-1.1b, there would more confusion than combining the requirements into a WECC Variance. The Drafting Team has crafted the WECC Variance to clarify the communication of schedules, and the GOP response to those schedules, without any reductions in reliability. The WECC Variance is more restrictive than the NERC standards. The requirements in the WECC Variance are designed to make the Interconnection more reliable because there are physical differences that require AVR's to control voltage. In the Western Interconnection this physical difference and need for keeping AVR's in service controlling voltage was identified when one of the causes of the 1996 disturbances was identified as insufficient supply of reactive power from generators, including AVR's that were not operating in voltage control mode. As a result of this experience, WECC determined that there should be only very limited circumstances where a GOP should</b></p>		

Organization	Yes or No	Question 4 Comment
<p><b>remove its AVR from operating in automatic voltage control mode (see VAR-002-WECC-1). Furthermore, the analyses of many disturbances in the Western Interconnection have demonstrated the need to stabilize system voltage by using AVR response.</b></p>		
Arizona Public Service Company	Yes	
PacifiCorp	Yes	
Salt River Project	Yes	

6. If you have any other comments that you have not already provided in the response to the prior questions, please provide them here.

**Summary Consideration:** The Drafting Team followed the WECC Standards Development Process and addressed all comments submitted during the public comment periods. The Drafting Team conducted a survey of TOPs and GOPs in order to better understand the issues and concerns raised in the development of VAR-002-WECC-1. The Drafting Team identified three principle GOP concerns and two principle reasons for TOPs to be able to continue existing scheduling practices. From these results, the Drafting Team designed the WECC Variance to address the GOP concerns while allowing TOPs to continue as much as possible existing scheduling practices. The WECC Variance was approved by stakeholders in the Western Interconnection. The approval of the WECC Variance is an indication that the proposed process enhances reliability in the Western Interconnection while adequately addressing GOP and TOP concerns.

Organization	Yes or No	Question 4 Comment
Arizona Public Service Company		<p>E.A.15 to E.A.17 are unnecessary requirements and do not improve reliability in any way. Typically a TO will ask a GO to simply increase or decrease a VAR output of a generator and then leave the generator at that voltage set point till further notified. Thus, there are no set point calculations to be made and typically a GO will not know how to make those calculations. Also, such calculations are unnecessary and do not improve the reliability of the system in anyway and unnecessarily add burden to GO. E.A.15 requires the conversion of voltage schedules to set point for generator excitation system which is typically voltage regulator set point. Voltage regulator set points are not necessarily same as the terminal voltage set points depending upon the excitation system type. There should be an option to convert the voltage schedules to the terminal voltage also. The following wording is suggested: E.A.15 Each Generator Operator shall convert the voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system or generator terminal voltage.</p>
<p><b>Response:</b> The comment identifies one methodology for converting a schedule change to the generator terminals and is permitted under the WECC Variance. The WECC Variance adds a requirement that the methodology has to be documented. The WECC Variance is also written broad enough to permit other GOP methodologies to be developed. The AVR controls the voltage at the generator terminal regardless of where the voltage is sensed. The conversion methodology permits the development of a process</p>		

Organization	Yes or No	Question 4 Comment
<b>that also controls voltage away from the generator terminal.</b>		
PacifiCorp		What is the minimum size of the generation resources which are subject to these requirements?
<b>Response: The WECC Variance applies to all BES generators. The WECC Variance does not change applicability of NERC VAR Standards.</b>		
Constellation Energy Commodities Group		<p>Below, Constellation raises comments on the generator specific requirements. Note that Constellation raised these points during the WECC comment period, but the issues were not addressed in the comment responses.</p> <ul style="list-style-type: none"> <li>• VAR-001-2 E.A.15 states: “Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system” While VAR-002 R2 states “...each GOP shall maintain generator voltage or Reactive Power output (within applicable Facility Ratings) as directed by the TOP.” These are redundant, but potentially confusing. Interconnected entities should not direct how, operationally, a GOP should comply with a request; they should just mandate that they follow through with the request. Documenting how a GOP complies with a voltage set point does not have a reliability impact on the BES.</li> <li>• E.A.16 - This requirement is not clear. The proposed requirements do not require a GOP to have a voltage set point conversion methodology, yet E.A.16 requires that such a methodology be available. A voltage set point conversion methodology should not be required as it does not have a reliability impact on the BES.</li> <li>• E.A.18 - As Constellation stated above regarding E.A.15, how a GOP manages its operations to comply with a voltage set point is inconsequential. The relevant point is that GOPs comply with the requests given to them from their interconnected entities.</li> </ul>

Organization	Yes or No	Question 4 Comment
<p><b>Response:</b> The Drafting Team addressed the Constellation comments raised during the Version 4 posting of the WECC Variance. The Drafting Team did not receive any Constellation comments during public postings for comment periods after the Version 4 posting. The Drafting Team followed the WECC Standards Development Process. The Drafting Team is not obligated to respond to comments submitted outside the public comment periods.</p> <ol style="list-style-type: none"> <li><b>1. The WECC Variance in Requirement E.A.15 requires that a voltage schedule be converted to the set point of the generator excitation system. This is not redundant with VAR-002-1.1b Requirement R2. The AVR controls the voltage at the generator terminal regardless of where the voltage is sensed or where the schedule is issued. The conversion methodology permits the development of a process that the GOPs may use to demonstrate that they complied with the schedule as required by VAR-002-1.1b Requirement R2, particularly when the GOPs do not know the voltage at the point of interconnection.</b></li> <li><b>2. Requirement E.A.15 requires that a GOP must convert a schedule to the voltage set point of the generator excitation system. It is implied that a conversion methodology must be developed to convert the schedule. A proper conversion methodology is essential to reliability. Conveyance of the conversion methodology to the TOP results in a better understanding of the actions that the GOP will take when the TOP issues schedules.</b></li> <li><b>3. The Drafting Team believes it is important that AVRs respond to system disturbances. The development of control loops to control reactive output during steady state conditions should not negate the AVR response to disturbances. Requirement E.A.18 is intended to provide specification for control loops to allow proper AVR response and requires the TOP’s agreement since the TOP is responsible for reliable operation of the BES.</b></li> </ol>		
<p>Constellation Power Source Generation, Inc</p>		<p>Below, Constellation raises comments on the generator specific requirements. Note that Constellation raised these points during the WECC comment period, but the issues were not addressed in the comment responses. VAR-001-2 E.A.15 states: “Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system” While VAR-002 R2 states “...each GOP shall maintain generator voltage or Reactive Power output (within applicable Facility Ratings) as directed by the TOP.” These are redundant, but potentially confusing. Interconnected entities should not direct how, operationally, a GOP should comply with a request; they should just mandate that they follow through with the request. Documenting how a GOP complies with a voltage set point does not have a reliability impact on the BES. E.A.16 - This requirement is not clear. The proposed requirements do not require a GOP to have a voltage set point conversion</p>

Organization	Yes or No	Question 4 Comment
		<p>methodology, yet E.A.16 requires that such a methodology be available. A voltage set point conversion methodology should not be required as it does not have a reliability impact on the BES. E.A.18 - As Constellation stated above regarding E.A.15, how a GOP manages its operations to comply with a voltage set point is inconsequential. The relevant point is that GOPs comply with the requests given to them from their interconnected entities.</p>
<p><b>Response: The Drafting Team addressed the Constellation comments raised during Version 4 posting of the WECC Variance. The Drafting Team did not receive any Constellation comments during public postings for comment periods after the Version 4 posting. The Drafting Team followed the WECC Standards Development Process. The Drafting Team is not obligated to respond to comments submitted outside the public comment periods.</b></p> <ol style="list-style-type: none"> <li><b>1. The WECC Variance in Requirement E.A.15 requires that a voltage schedule be converted to the set point of the generator excitation system. This is not redundant with VAR-002-1.1b Requirement R2. The AVR controls the voltage at the generator terminal regardless of where the voltage is sensed or where the schedule is issued. The conversion methodology permits the development of a process that the GOPs may use to demonstrate that they complied with the schedule as required by VAR-002-1.1b Requirement R2, particularly when GOPs do not know the voltage at the point of interconnection.</b></li> <li><b>2. Requirement E.A.15 requires that a GOP must convert a schedule to the voltage set point of the generator excitation system. It is implied that a conversion methodology must be developed to convert the schedule. A proper conversion methodology is essential to reliability. Conveyance of the conversion methodology to the TOP results in a better understanding of the actions that the GOP will take when the TOP issues schedules.</b></li> <li><b>3. The Drafting Team believes it is important that AVRs respond to system disturbances. The development of control loops to control reactive output during steady state conditions should not negate the AVR response to disturbances. Requirement E.A.18 is intended to provide specification for control loops to allow proper AVR response and requires TOP agreement since the TOP is responsible for reliable operation of the BES.</b></li> </ol>		
Elk Hills Power LLC		<p>It appears to Elk Hills Power that a lot of effort has been expended in this variance to avoid burdening a Transmission Operator who does not specify voltage set points required to maintain stability on their system. Since all GOPs are required to operate their AVRs in voltage control mode when available, we are not sure why TOP voltage set point-based schedules should not be required to be the norm as well. This</p>



Organization	Yes or No	Question 4 Comment
		variance seems to lock in old Reactive Power management methodologies which should be replaced anyways.
<p><b>Response: The comment identifies an alternative scheduling process. The Drafting Team selected a process that is viable and accounts for constraints on both GOPs and TOPs. In 2009 the Drafting Team conducted a survey of TOPs and GOPs in order to better understand the issues and concerns raised in the development of VAR-002-WECC-1. The Drafting Team identified three principle GOP concerns and two principle reasons for TOPs to be able to continue existing scheduling practices. The principle concerns and reasons are:</b></p> <p><b><u>Generator Operator Concerns</u></b></p> <ol style="list-style-type: none"> <li><b>1. Constant and burdensome attention is required by Generator Operator’s to maintain a proper voltage output from the generator when the schedule is not addressed on the bus controlled by the automatic voltage regulator.</b></li> <li><b>2. If a reactive schedule is used, Generator Operator’s viewed their responsibility as maintaining the specified reactive output. This is similar to “1” in that they must give constant attention to the set point to maintain the specified reactive output. This view is consistent with those of NERC that it is the GOP’s responsibility to maintain the reactive schedule (see VAR-002-1.1b Requirement R2), while still having the AVR in service and controlling voltage (see VAR-002-WECC-1 Requirement R1). Generator Operator’s expressed a desire to utilize the AVR to maintain a reactive set point.</b></li> <li><b>3. Some Generator Operators, while working with their Transmission Operators, have utilized external control loops to manage reactive flows in an area with several generators. These control loops provide set points to generator’s AVRs. The generator’s AVRs are in service and controlling voltage.</b></li> </ol> <p><b><u>Transmission Operator Reasons</u></b></p> <ol style="list-style-type: none"> <li><b>1. Transmission Operators identified several scenarios where it is desirable and expedient to provide schedules on a reactive basis (i.e. specifying a power factor or a specific VAR output to a generator).</b></li> <li><b>2. Transmission Operators routinely specify a schedule at different points. Typical locations are the generator bus, the high side of the generator step up transformer, and the point of interconnection to the transmission facility. The latter location can be some distance from the generator facility.</b></li> </ol> <p><b>The Drafting Team designed the WECC Variance to address the GOP concerns while allowing TOPs to continue as much as possible</b></p>		

Organization	Yes or No	Question 4 Comment
<p>existing scheduling practices. The WECC Variance was approved by stakeholders in the Western Interconnection. The approval of the WECC Variance is an indication that the proposed process enhances reliability in the Western Interconnection while adequately addressing GOP and TOP concerns.</p>		
Salt River Project		
Bonneville Power Administration		

END OF REPORT

**Individual or group. (7 Responses)**  
**Name (4 Responses)**  
**Organization (4 Responses)**  
**Group Name (3 Responses)**  
**Lead Contact (3 Responses)**  
**Question 1 (7 Responses)**  
**Question 1 Comments (7 Responses)**  
**Question 2 (7 Responses)**  
**Question 2 Comments (7 Responses)**  
**Question 3 (7 Responses)**  
**Question 3 Comments (7 Responses)**  
**Question 4 (7 Responses)**  
**Question 4 Comments (7 Responses)**  
**Question 5 (7 Responses)**  
**Question 5 Comments (7 Responses)**  
**Question 6 (0 Responses)**  
**Question 6 Comments (7 Responses)**

Group
Arizona Public Service Company
Janet Smith, Regulatory Affairs Supervisor
Yes
No
No
No
Yes
E.A. 15 to E.A. 17 are unnecessary requirements and do not improve reliability in any way. Typically a TO will ask a GO to simply increase or decrease a VAR output of a generator and then leave the generator at that voltage set point till further notified. Thus, there are no set point calculations to be made and typically a GO will not know how to make those calculations. Also, such calculations are unnecessary and do not improve the reliability of the system in anyway and unnecessarily add burden to GO. E.A.15 requires the conversion of voltage schedules to set point for generator excitation system which is typically voltage regulator set point. Voltage regulator set points are not necessarily same as the terminal voltage set points depending upon the excitation system type. There should be an option to convert the voltage schedules to the terminal voltage also. The following wording is suggested: E.A.15 Each Generator Operator shall convert the voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system or generator terminal voltage.
Group
PacifiCorp
Sandra Shaffer
Yes
No
No

No
Yes
What is the minimum size of the generation resources which are subject to these requirements?
Individual
Annie Lauterbach / Frank Puyleart / Steve Hitchens / Bart McManus / Rebecca Berdahl
Bonneville Power Administration
Yes
No
BPA will not be changing its operations due to this variance, therefore, do not expect impacts to reliability or commerce in a neighboring region or interconnection.
No
BPA will not be changing its operations due to this variance, therefore, BPA does not expect impacts to public health, safety, welfare or national security.
No
BPA will not be changing its operations due to this variance, therefore, BPA does not expect impacts on competitive markets within the interconnection that is not necessary for reliability.
Yes
a. BPA believes the proposed variance has more specific criteria for the same requirements covered in the continent-wide standard. b. BPA believes the proposed variance has requirements that are not included in the corresponding continent-wide reliability standard. c. BPA believes the proposed regional variance is necessitated by a physical difference in the bulk power system. BPA believes the proposed variance has more specific criteria for the same requirements covered in the continent-wide standard and that the WECC reliability requirement for having generators' AVR's Voltage Control Mode necessitates the proposed regional variance.
Group
Salt River Project
Cindy Oder
Yes
No
No
No
Yes
Individual
Brenda Powell
Constellation Energy Commodities Group
Yes
No
No

No
No
The WECC variance to VAR-001 inappropriately mimics VAR-002 for GOPs. The WECC VAR-001 Variance drafting team states “the purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.” Meanwhile, the VAR-002 purpose states “To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.” These purpose statements are very similar, and reflect the coordinated nature of operations and the applicability of these standards. VAR-001 was written to ensure that TOPs, PSEs, and LSEs maintain voltage levels, reactive flows, and reactive resources. VAR-002 was written to ensure that GOPs do the same thing at the direction of TOPs. Adding generator specific requirements to VAR-001 ignores the function of VAR-002 and is counter to the intent of VAR-001 and VAR-002. This variance is not the correct way to ensure that WECC GOPs are operating in auto voltage control. Further, there are no physical differences in the BES in WECC to justify the generator specific requirements in VAR-001. The generator specific requirements being proposed are more specific versions of the requirements found in VAR-002, but do not add any new improvements to reliability. It would be more efficient and effective for the issues raised by the WECC VAR-001 Variance drafting team to be considered within a revision of VAR-002 from a region-wide basis. Aspects in need of improvement within VAR-002- have already been raised at the NERC level. NERC issued a CAN on VAR-002- and an interpretation request is under consideration. WECC should issue a SAR for revision of VAR-002 rather than pursue this variance.
Below, Constellation raises comments on the generator specific requirements. Note that Constellation raised these points during the WECC comment period, but the issues were not addressed in the comment responses. •VAR-001-2 E.A.15 states: “Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system” While VAR-002 R2 states “...each GOP shall maintain generator voltage or Reactive Power output (within applicable Facility Ratings) as directed by the TOP.” These are redundant, but potentially confusing. Interconnected entities should not direct how, operationally, a GOP should comply with a request; they should just mandate that they follow through with the request. Documenting how a GOP complies with a voltage set point does not have a reliability impact on the BES. •E.A.16 – This requirement is not clear. The proposed requirements do not require a GOP to have a voltage set point conversion methodology, yet E.A.16 requires that such a methodology be available. A voltage set point conversion methodology should not be required as it does not have a reliability impact on the BES. •E.A.18 – As Constellation stated above regarding E.A.15, how a GOP manages its operations to comply with a voltage set point is inconsequential. The relevant point is that GOPs comply with the requests given to them from their interconnected entities.
Individual
Amir Hammad
Constellation Power Source Generation, Inc
Yes
No
No
No
No
The proposed variance does not meet any of the above criteria and adds confusion to the relationship between VAR-001 and VAR-002. The WECC variance to VAR-001 inappropriately mimics VAR-002 for GOPs. The WECC VAR-001 Variance drafting team states “the purpose of this regional variance to a

NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.” Meanwhile, the VAR-002 purpose states “To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.” These purpose statements are very similar. They reflect the coordinated nature of operations and the applicability of these standards. VAR-001 was written to ensure that TOPs, PSEs, and LSEs maintain voltage levels, reactive flows, and reactive resources. VAR-002 was written to ensure that GOPs do the same thing at the direction of TOPs. Adding generator specific requirements to VAR-001 ignores the function of VAR-002 and is counter to the intent of VAR-001 and VAR-002. The generator specific requirements proposed in the variance may be more specific than those in VAR-002, but the addition to VAR-001 does not add any improvements to reliability. This variance is not the correct way to ensure that WECC GOPs are operating in auto voltage control. Further, there are no physical differences in the BES in WECC to justify the generator specific requirements in VAR-001. It would be more efficient and effective for the issues raised by the WECC VAR-001 Variance drafting team to be considered within a revision of VAR-002 from a region-wide basis. Aspects in need of improvement within VAR-002- have already been raised at the NERC level. NERC issued a CAN on VAR-002- and an interpretation request is under consideration. WECC should issue a SAR for revision of VAR-002 rather than pursue this variance.

Below, Constellation raises comments on the generator specific requirements. Note that Constellation raised these points during the WECC comment period, but the issues were not addressed in the comment responses. VAR-001-2 E.A.15 states: “Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system” While VAR-002 R2 states “...each GOP shall maintain generator voltage or Reactive Power output (within applicable Facility Ratings) as directed by the TOP.” These are redundant, but potentially confusing. Interconnected entities should not direct how, operationally, a GOP should comply with a request; they should just mandate that they follow through with the request. Documenting how a GOP complies with a voltage set point does not have a reliability impact on the BES. E.A.16 – This requirement is not clear. The proposed requirements do not require a GOP to have a voltage set point conversion methodology, yet E.A.16 requires that such a methodology be available. A voltage set point conversion methodology should not be required as it does not have a reliability impact on the BES. E.A.18 – As Constellation stated above regarding E.A.15, how a GOP manages its operations to comply with a voltage set point is inconsequential. The relevant point is that GOPs comply with the requests given to them from their interconnected entities.

Individual

Michelle R D'Antuono

Elk Hills Power LLC

Yes

The variance was initiated under the WECC Standard development process in late 2008. The completed Criterion was approved by the WECC board in June 2011 and is now being proposed as a Regional Variance to VAR-001.

Yes

In the view of Elk Hills Power, the removal of requirement R3 exempting some generators from adhering to a voltage/Reactive Power schedule is reasonable. Even older units without AVRs should provide some means to adjust generator output as needed to support the local transmission system. The requirements E.A.13 through E.A.18 that look to assure that AVR voltage set points are converted properly from the TOP's schedule are also a reliability improvement. However, we are concerned that the assignment of responsibility to the GOP to assure that the conversion is optimally performed is misplaced. The following excerpt on page 3 of the draft standard captures our viewpoint. “During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule. It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount

of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to maintain system reliability: ensuring that generators provide the proper voltage support when generation and transmission outages occur." Since the TOP is responsible for the voltage stability within their footprint, it is not clear to us why they would want to assume the GOP has the expertise to convert a Reactive Power schedule to a voltage set point – especially when the wrong steps could be taken by a GOP during an incident that would be perfectly correct under normal operating conditions. If the TOP chooses to not provide voltage set points for whatever reason, then we believe that they should provide the proper conversion methodology as well. This would likely involve a technical discussion with the GOP and perhaps the generator vendor, but is based upon the TOP's own decision to provide a Reactive Power schedule only. Of even further concern is requirement E.A.18 regarding the use of control loops external to the AVR. Elk Hills Power takes this to mean Automatic Generation Control (AGC) which is managed by the Balancing Authority in support of secondary frequency response. Similar to the discussion above, AGC operating parameters must be supplied and owned by the BA if they expect proper performance under stress conditions. In this case, the BA may need to engage the GOP and TOP to develop the correct settings, but ultimately it is their responsibility. Furthermore, E.A.18 does not even name the Balancing Authority as an interested party. The way the requirement is written, it is conceivable that the GOP and TOP will agree upon a change to the AGC's voltage response without BA's knowledge – which may then impact the expected frequency response. This seems to Elk Hills Power that a reliability gap is introduced through the improper assignment of responsibility.

Yes

NERC and FERC have clearly assigned a high priority to improving the voltage response, and the primary and secondary frequency response of the BES. Within the last six months, very detailed standards have been posted for industry review under Project 2007-09 – Generator Verification and Project 2007-12 – Frequency Response. They leave no doubt that, while complex, the proper identification of voltage and frequency-response settings is crucial to the reliability of the BES. Without tight coordination between planning, owning, and operating entities, it is far too easy to actually make the BES less reliable – which translates to power outages at the worst possible times.

Yes

By improperly assigning the ownership of the requirements to establish AVR and AGC voltage set points and other parameters not clearly identified by the BA and TOP, Elk Hills Power believes that the potential reliability benefit is lost. In addition, Elk Hills Power will be required to maintain conversion methodologies for which they have no systems or tools to demonstrate that they are optimally supporting the local system.

Yes

The variance clearly has more specific criteria than VAR-001-2. Elk Hills Power believes that with the proper assignment of responsibility, the reliability benefit will be significant.

It appears to Elk Hills Power that a lot of effort has been expended in this variance to avoid burdening a Transmission Operator who does not specify voltage set points required to maintain stability on their system. Since all GOPs are required to operate their AVRs in voltage control mode when available, we are not sure why TOP voltage set point-based schedules should not be required to be the norm as well. This variance seems to lock in old Reactive Power management methodologies which should be replaced anyways.

## **Implementation Plan**

### **VAR-001-2 WECC Variance**

The Project WECC-0046 Regional Variance Drafting Team proposes that the WECC Variance become effective on the first day of the first calendar quarter six months after applicable regulatory approval, or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after NERC Board of Trustees' approval. Six months will provide Transmission Operators sufficient time to review scheduling practices; to revise existing procedures and other documents that contain scheduling practices; and to distribute any required revisions to those documents in order to be in compliance with the WECC Variance. Six months will also allow time for Generator Operators to develop voltage schedule conversion methodologies from the reference point to the AVR set point as required in the WECC Regional Variance to VAR-001-2 Requirement E.A.16.



## Standard VAR-001-2.3 — Voltage and Reactive Control

### Regional Variance Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

<u>Completed Actions</u>	<u>Completion Date</u>
<u>1. Post draft standard for initial industry comments</u>	<u>December 14, 2009</u>
<u>2. Receive Initial industry comments from First Posting</u>	<u>January 29, 2010</u>
<u>3. Drafting Team to review and respond to initial industry comments</u>	<u>March 4, 2010</u>
<u>4. Post second draft standard for industry comments</u>	<u>May 6, 2010</u>
<u>5. Second draft comment period ended</u>	<u>July 12, 2010</u>
<u>6. Drafting Team to review and respond to industry comments</u>	<u>August 11, 2010</u>
<u>7. Post third draft standard for industry comments</u>	<u>September 24, 2010</u>
<u>8. Industry comments for third draft standard are due</u>	<u>October 25, 2010</u>
<u>9. Drafting Team to review and respond to industry comments</u>	<u>November 24, 2010</u>
<u>10. Post fourth draft as a regional variance to NERC VAR-001-2 Requirements R3 and R4</u>	<u>December 7, 2010</u>
<u>11. Comments from fourth posting are due</u>	<u>January 7, 2011</u>
<u>12. Post draft standard for Operating Committee approval</u>	<u>January 26, 2011</u>
<u>13. Operating Committee approved proposed standard</u>	<u>March 2-4, 2011</u>
<u>14. Posted draft standard for WECC Board approval</u>	<u>May 2011</u>
<u>15. WECC Board approved proposed standard</u>	<u>June 22, 2011</u>
<u>16. Request NERC 45-day Posting</u>	<u>September, 2011</u>
<u>17. Post draft standard for 45-day NERC comment period</u>	<u>October 20, 2011</u>
<u>18. NERC comment period ends</u>	<u>December 5, 2011</u>
<u>19. Drafting Team completes review and consideration of industry comments to NERC posting</u>	<u>December 14, 2011</u>
<u>20. Submit NERC Board approval request</u>	<u>February 27, 2012</u>

#### Description of Current Draft:

The current draft has been converted from a regional reliability standard into a regional variance to the NERC VAR-001-2 Standard. The format incorporates the WECC Regional Variance into the NERC Standard with minor additions to address the scope of the variance. The regional variance specifics are included as Section E and in this case are intended to replace NERC VAR-001-2

## Standard VAR-001-2.3 — Voltage and Reactive Control

Requirements R3 and R4 as noted at the beginning of Section E. The redline version of Section E identifies what was changed from the last posting.

The purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection. The "Rules of Procedure of the North American Electric Reliability Corporation" (Appendix 3A, page 32) permit the development of a regional variance to a NERC Reliability Standard on an Interconnection-wide basis when the Regional Reliability Organization has valid justification, and when the variance is not inconsistent with or less stringent than the NERC Reliability Standard. The variance is an alternative method for obtaining the same reliability objective as the continent-wide standard and is typically necessitated by a physical difference. A variance is embodied within a reliability standard and as such, if adopted by NERC and approved by the electric reliability organization governmental authority, shall be enforced within the applicable regional entity or regional entities pursuant to delegated authority.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator's Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the Bulk Electric System's voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-2 Requirement R3 allows Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC Standard VAR-001-2 Requirement 4 and Requirement 6.1. The drafting team and WECC stakeholders believe that permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

The NERC VAR-001-2 Requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not enhance reliability in the Western Interconnection by ensuring that generators provide the proper voltage support when generation and transmission outages occur. This conclusion is based on the interpretation that generator operators given reactive schedules under NERC VAR-001-2 are required to maintain the reactive output defined in the schedule at all times. This will require generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to a NERC Standard restricts the Transmission Operator to providing only a voltage schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR's automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule — which may be in reactive power terms — is provided by the Transmission Operator.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that the AVRs are in service to control voltage to support the transfer capabilities. As noted below the previous approvals and rulings regarding VAR-002-WECC-1 have directed Generator Operators to operate AVRs in voltage control mode controlling voltage to support transfer capabilities in the Western Interconnection.

## Standard VAR-001-2.3 — Voltage and Reactive Control

- April 16, 2008: the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur.
- October 29, 2008: the NERC Board of Trustees approved VAR-002-WECC-1.
- April 21, 2011: FERC issued an Order approving VAR-002-WECC-1.

The NERC Rules of Procedure allow that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002-1.1b requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service operating in automatic voltage control mode with some defined exceptions. This proposed variance to VAR-001-2 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the requirement. If the Transmission Operator provides voltage schedule information in another format, such as in reactive power terms, compliance with the proposed requirements require conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the automatic voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to maintain system reliability: ensuring that generators provide the proper voltage support when generation and transmission outages occur.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued practice of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

WECC is requesting NERC Board of Trustee approval of the draft regional variance to the NERC VAR-001-2 Standard. The WECC Regional Variance requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing the schedules so as to maintain compliance without burdensome manual intervention by operating personnel.

The WECC Variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 Reliability Standard. The proposed regional variance in

**Standard VAR-001-2.3 — Voltage and Reactive Control**

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Section E contains requirements that are more stringent than the continent-wide Requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

**Standard VAR-001-2.3 — Voltage and Reactive Control**

**Future Development Plan:**

<b><u>Anticipated Actions</u></b>	<b><u>Anticipated Date</u></b>
<del><u>Request NERC 45-day Posting</u></del>	<del><u>September 2011</u></del>
<del><u>Post draft standard for 45-day NERC comment period</u></del>	<del><u>October 2011</u></del>
<del><u>NERC comment period ends</u></del>	<del><u>To be determined</u></del>
<del><u>Drafting Team completes review and consideration of industry comments to NERC posting</u></del>	<del><u>To be determined</u></del>
<del><u>1. Receive NERC Board approval</u></del> <del><u>Submit NERC Board approval request</u></del>	<del><u>To be determined</u></del> <del><u>To be determined</u></del>
<del><u>2. Request FERC approval</u></del> <del><u>Receive NERC Board approval</u></del>	<del><u>To be determined</u></del> <del><u>To be determined</u></del>
<del><u>Request FERC approval</u></del>	<del><u>To be determined</u></del>

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**Standard VAR-001-2.3 — Voltage and Reactive Control**

**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**None**

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## Standard VAR-001-2~~3~~ — Voltage and Reactive Control

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### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-~~23~~
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4. Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5. Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

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## Standard VAR-001-2-3 — Voltage and Reactive Control

scheduling; transmission line and reactive resource switching; and controllable load— to satisfy its reactive requirements identified by its Transmission Service Provider.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
- R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching; and controllable load— to support its voltage under first Contingency conditions.
- R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### D. Compliance

Adopted by Board of Trustees: TBD

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## Standard VAR-001-2.3 — Voltage and Reactive Control

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority

Regional Entity.

#### 1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

#### 1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

#### 1.4. Data Retention

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

#### 1.5. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

### 2. Violation Severity Levels (no changes)

## E. Regional Differences/Variations

None identified.

### E.A. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

#### Requirements

E.A.13. Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a

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## Standard VAR-001-2.3 — Voltage and Reactive Control

voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.

- A voltage band for a specified period.

E.A.14. Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:

- The generator terminals.
- The high side of the generator step-up transformer.
- The point of interconnection.
- A location designated by mutual agreement between the Transmission Operator and Generator Operator.

E.A.15. Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

E.A.16. Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

E.A.17. Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

E.A.18. Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]

E.A.18.1. Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.

E.A.18.2. Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures<sup>2</sup>

<sup>2</sup> The number for each measure corresponds with the number for each requirement, i.e. M.E.A.13 means the measure for Requirement E.A.13.

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**Standard VAR-001-2.3 — Voltage and Reactive Control**

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- M.E.A.13. Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.
- M.E.A.14. The Transmission Operator shall have and provide upon request, evidence that it provided one of the voltage schedule reference points in Requirement E.A.14 for each generation resource in its Area to the Generator Operator. Dated letters, e-mail, or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.
- M.E.A.15. Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.
- M.E.A.16. The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.17. The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.18. If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

**Violation Severity Levels**

<b>E #</b>	<b>Lower VSL</b>	<b>Moderate VSL</b>	<b>High VSL</b>	<b>Severe VSL</b>
<b><u>E.A.13</u></b>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of</u>

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**Standard VAR-001-2.3 — Voltage and Reactive Control**

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<b>E #</b>	<b>Lower VSL</b>	<b>Moderate VSL</b>	<b>High VSL</b>	<b>Severe VSL</b>
	<u>resources that are on-line and part of the BES in the Transmission Operator Area.</u>	<u>resources that are on-line and part of the BES in the Transmission Operator Area.</u>	<u>resources that are on-line and part of the BES in the Transmission Operator Area.</u>	<u>the BES in the Transmission Operator Area.</u>
<b>E.A.14</b>	<u>The Transmission Operator did not provide a voltage schedule reference point for at least one but less than or equal to 5% of the generation resources in the Transmission Operator area.</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for more than 5% but less than or equal to 10% of the generation resources in the Transmission Operator Area.</u>	<u>The Transmission Operator did not a voltage schedule reference point for more than 10% but less than or equal to 15% of the generation resources in the Transmission Operator Area.</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for more than 15% of the generation resources in the Transmission Operator Area.</u>
<b>E.A.15</b>	<u>The Generator Operator failed to convert at least one voltage schedule in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of the voltage schedules.</u>
<b>E.A.16</b>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.</u>	<u>The Generator Operator did not provide its voltage set point conversion methodology within 120 days of a request by the Transmission Operator.</u>
<b>E.A.17</b>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology than 30 days but less than or equal to 60 days of a request by the</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request</u>	<u>The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 120 days of a request by the Generator</u>

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**Standard VAR-001-2-3 — Voltage and Reactive Control**

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<b>E #</b>	<b>Lower VSL</b>	<b>Moderate VSL</b>	<b>High VSL</b>	<b>Severe VSL</b>
	<u>Generator Operator.</u>	<u>by the Generator Operator.</u>	<u>by the Generator Operator.</u>	<u>Operator.</u>
<b>E.A.18</b>	N/A	<u>The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>

**Version History**

<b>Version</b>	<b>Date</b>	<b>Action</b>	<b>Change Tracking</b>
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added "Generator Owners" and "Generator Operators" to Applicability section.	Errata
1	August 23, 2007	Removed "Generator Owners" and "Generator Operators" to Applicability section.	Errata
2	TBD	Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
<u>2</u>		<u>Modified to add a WECC region variance</u>	

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## Standard VAR-001-3 — Voltage and Reactive Control

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### Regional Variance Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 6, 2010
5. Second draft comment period ended	July 12, 2010
6. Drafting Team to review and respond to industry comments	August 11, 2010
7. Post third draft standard for industry comments	September 24, 2010
8. Industry comments for third draft standard are due	October 25, 2010
9. Drafting Team to review and respond to industry comments	November 24, 2010
10. Post fourth draft as a regional variance to NERC VAR-001-2 Requirements R3 and R4	December 7, 2010
11. Comments from fourth posting are due	January 7, 2011
12. Post draft standard for Operating Committee approval	January 26, 2011
13. Operating Committee approved proposed standard	March 2-4, 2011
14. Posted draft standard for WECC Board approval	May 2011
15. WECC Board approved proposed standard	June 22, 2011
16. Request NERC 45-day Posting	September, 2011
17. Post draft standard for 45-day NERC comment period	October 20, 2011
18. NERC comment period ends	December 5, 2011
19. Drafting Team completes review and consideration of industry comments to NERC posting	December 14, 2011
20. Submit NERC Board approval request	February 27, 2012

#### Description of Current Draft:

The current draft has been converted from a regional reliability standard into a regional variance to the NERC VAR-001-2 Standard. The format incorporates the WECC Regional Variance into the NERC Standard with minor additions to address the scope of the variance. The regional variance specifics are included as Section E and in this case are intended to replace NERC VAR-001-2

## Standard VAR-001-3 — Voltage and Reactive Control

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Requirements R3 and R4 as noted at the beginning of Section E. The redline version of Section E identifies what was changed from the last posting.

The purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection. The “Rules of Procedure of the North American Electric Reliability Corporation” (Appendix 3A, page 32) permit the development of a regional variance to a NERC Reliability Standard on an Interconnection-wide basis when the Regional Reliability Organization has valid justification, and when the variance is not inconsistent with or less stringent than the NERC Reliability Standard. The variance is an alternative method for obtaining the same reliability objective as the continent-wide standard and is typically necessitated by a physical difference. A variance is embodied within a reliability standard and as such, if adopted by NERC and approved by the electric reliability organization governmental authority, shall be enforced within the applicable regional entity or regional entities pursuant to delegated authority.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator’s Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the Bulk Electric System’s voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-2 Requirement R3 allows Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC Standard VAR-001-2 Requirement 4 and Requirement 6.1. The drafting team and WECC stakeholders believe that permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

The NERC VAR-001-2 Requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not enhance reliability in the Western Interconnection by ensuring that generators provide the proper voltage support when generation and transmission outages occur. This conclusion is based on the interpretation that generator operators given reactive schedules under NERC VAR-001-2 are required to maintain the reactive output defined in the schedule at all times. This will require generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to a NERC Standard restricts the Transmission Operator to providing only a voltage schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR’s automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule — which may be in reactive power terms — is provided by the Transmission Operator.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that the AVRs are in service to control voltage to support the transfer capabilities. As noted below the previous approvals and rulings regarding VAR-002-WECC-1 have directed Generator Operators to operate AVRs in voltage control mode controlling voltage to support transfer capabilities in the Western Interconnection.

## Standard VAR-001-3 — Voltage and Reactive Control

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- April 16, 2008: the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur.
- October 29, 2008: the NERC Board of Trustees approved VAR-002-WECC-1.
- April 21, 2011: FERC issued an Order approving VAR-002-WECC-1.

The NERC Rules of Procedure allow that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002-1.1b requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service operating in automatic voltage control mode with some defined exceptions. This proposed variance to VAR-001-2 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the requirement. If the Transmission Operator provides voltage schedule information in another format, such as in reactive power terms, compliance with the proposed requirements require conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the automatic voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to maintain system reliability: ensuring that generators provide the proper voltage support when generation and transmission outages occur.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued practice of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

WECC is requesting NERC Board of Trustee approval of the draft regional variance to the NERC VAR-001-2 Standard. The WECC Regional Variance requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing the schedules so as to maintain compliance without burdensome manual intervention by operating personnel.

The WECC Variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 Reliability Standard. The proposed regional variance in



## **Standard VAR-001-3 — Voltage and Reactive Control**

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Section E contains requirements that are more stringent than the continent-wide Requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

## Standard VAR-001-3 — Voltage and Reactive Control

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### Future Development Plan:

Anticipated Actions	Anticipated Date
1. Receive NERC Board approval	To be determined
2. Request FERC approval	To be determined

**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**None**

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-3
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4. Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5. Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

## Standard VAR-001-3 — Voltage and Reactive Control

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scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
  - R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to support its voltage under first Contingency conditions.
  - R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### D. Compliance

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority

Regional Entity.

#### 1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

#### 1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

#### 1.4. Data Retention

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

#### 1.5. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

### 2. Violation Severity Levels (no changes)

## E. Regional Variances

### E.A. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

#### Requirements

**E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.

- A voltage band for a specified period.
- E.A.14.** Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:*
- The generator terminals.
  - The high side of the generator step-up transformer.
  - The point of interconnection.
  - A location designated by mutual agreement between the Transmission Operator and Generator Operator.
- E.A.15.** Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
- E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- E.A.18.** Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.
  - E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures<sup>2</sup>

- M.E.A.13.** Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets,

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<sup>2</sup> The number for each measure corresponds with the number for each requirement, i.e. M.E.A.13 means the measure for Requirement E.A.13.

## Standard VAR-001-3 — Voltage and Reactive Control

reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.

- M.E.A.14.** The Transmission Operator shall have and provide upon request, evidence that it provided one of the voltage schedule reference points in Requirement E.A.14 for each generation resource in its Area to the Generator Operator. Dated letters, e-mail, or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.
- M.E.A.15.** Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.
- M.E.A.16.** The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.17.** The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.18.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

### Violation Severity Levels

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.13</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission



**Standard VAR-001-3 — Voltage and Reactive Control**

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	the BES in the Transmission Operator Area.	the BES in the Transmission Operator Area.	the BES in the Transmission Operator Area.	Operator Area.
<b>E.A.14</b>	The Transmission Operator did not provide a voltage schedule reference point for at least one but less than or equal to 5% of the generation resources in the Transmission Operator area.	The Transmission Operator did not provide a voltage schedule reference point for more than 5% but less than or equal to 10% of the generation resources in the Transmission Operator Area.	The Transmission Operator did not a voltage schedule reference point for more than 10% but less than or equal to 15% of the generation resources in the Transmission Operator Area.	The Transmission Operator did not provide a voltage schedule reference point for more than 15% of the generation resources in the Transmission Operator Area.
<b>E.A.15</b>	The Generator Operator failed to convert at least one voltage schedule in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of the voltage schedules.
<b>E.A.16</b>	The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.	The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.	The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.	The Generator Operator did not provide its voltage set point conversion methodology within 120 days of a request by the Transmission Operator.
<b>E.A.17</b>	The Transmission Operator provided its data to support development of the voltage set point conversion methodology than 30 days but less than or equal to 60 days of a request by the Generator	The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Generator.	The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Generator.	The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 120 days of a request by the Generator Operator.

## Standard VAR-001-3 — Voltage and Reactive Control

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	Operator.	Operator.	Operator.	
<b>E.A.18</b>	N/A	The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.	The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.	The Generator Operator did not meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.

### Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
2	TBD	Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
2		Modified to add a WECC region variance	

## Unofficial Comment Form for Regional Reliability Standard VAR-001-2 – WECC Variance

Please **DO NOT** use this form. Please use the [electronic form](#) located at the link below to submit comments on the Regional Reliability Standard VAR-001-2 – WECC Variance comments must be submitted by **December 5, 2011**. If you have questions please contact Howard Gugel at [howard.gugel@nerc.net](mailto:howard.gugel@nerc.net) or Barb Nutter at [barbara.nutter@nerc.net](mailto:barbara.nutter@nerc.net)

[http://www.nerc.com/filez/regional\\_standards/regional\\_reliability\\_standards\\_under\\_development.html](http://www.nerc.com/filez/regional_standards/regional_reliability_standards_under_development.html)

### Background Information

Any variance from a NERC reliability standard requirement that is proposed to apply to responsible entities within a regional entity organized on an interconnection-wide basis shall be considered an Interconnection-wide Variance and shall be developed through that regional entity's NERC-approved regional reliability standards development procedure.

While an interconnection-wide variance may be developed through the associated Regional Entity standards development process, regional entities are encouraged to work collaboratively with existing continent-wide drafting team to reduce potential conflicts between the two efforts.

An Interconnection-wide Variance from a NERC reliability standard that is determined by NERC to be just, reasonable, and not unduly discriminatory or preferential, and in the public interest, and consistent with other applicable standards of governmental authorities shall be made part of the associated NERC reliability standard. NERC shall rebuttably presume that an Interconnection-wide Variance from a NERC reliability standard that is developed, in accordance with a standards development procedure approved by NERC, by a regional entity organized on an interconnection-wide basis, is just, reasonable, and not unduly discriminatory or preferential, and in the public interest.

### VAR-001-2 – Western Electricity Coordinating Council Variance

The **Western Electricity Coordinating Council** Variance shall enable or support one or more of the NERC reliability principles, thereby ensuring that each standard serves a purpose in support of the reliability of the regional bulk electric system. Each of those standards shall also be consistent with all of the NERC reliability principles, thereby ensuring that no standard undermines reliability through an unintended consequence. The NERC reliability principles supported by this variance are the following:

- Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform under normal and abnormal conditions as defined in the NERC Standards.
- 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.
- 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.

The proposed **WECC** variance is not inconsistent with, or less stringent than established NERC Reliability Standards. Once approved by the appropriate authorities, the **WECC** variance obligates **WECC** to monitor and enforce compliance, apply sanctions, if any, consistent with the NERC rules.

## **VAR-001-2**

### **Requirements**

- E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area:
- E.A.14.** Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator.
- E.A.15.** Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system.
- E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator.
- E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology.
- E.A.18.** Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading:

The approval process for a Interconnection-wide Variance requires NERC to publicly notice and request comment on the proposed variance. Comments shall be permitted only on the following criteria (technical aspects of the standard are vetted through the regional standards development process):

**Unfair or Closed Process** — The Interconnection-wide variance was not developed in a fair and open process that provided an opportunity for all interested parties to participate. Although a NERC-approved regional reliability standards development procedure shall be presumed to be fair and open, objections could be raised regarding the implementation of the procedure.

**Adverse Reliability or Commercial Impact on Other Interconnections** — The Interconnection-wide variance would have a significant adverse impact on reliability or commerce in other interconnections.

**Deficient Standard** — The Interconnection-wide variance fails to provide a level of reliability of the bulk power system such that the regional reliability standard would be likely to cause a serious and substantial threat to public health, safety, welfare, or national security.

**Adverse Impact on Competitive Markets within the Interconnection** — The Interconnection-wide variance would create a serious and substantial burden on competitive markets within the interconnection that is not necessary for reliability.

**1. Do you agree the proposed variance is being developed using the associated Regional Reliability Standards Development Procedure?**

Yes

No

Comments:

**2. Does the proposed variance pose an adverse impact to reliability or commerce in a neighboring region or interconnection?**

Yes

No

Comments:

**3. Does the proposed variance pose a serious and substantial threat to public health, safety, welfare, or national security?**

Yes

No

Comments:

**4. Does the proposed variance pose a serious and substantial burden on competitive markets within the interconnection that is not necessary for reliability?**

Yes

No

Comments:

**5. Does the proposed variance meet at least one of the following criteria?**

- **The proposed variance has more specific criteria for the same requirements covered in a continent-wide standard**
- **The proposed variance has requirements that are not included in the corresponding continent-wide reliability standard**

- **The proposed regional difference is necessitated by a physical difference in the bulk power system.**

Yes

No

Comments:

**6. If you have any other comments that you have not already provided in the response to the prior questions, please provide them here.**

## Regional Reliability Standards Announcement

Comment Period Open for VAR-001-2 WECC Variance

October 20 – December 5, 2011

Now available at:

[http://www.nerc.com/filez/regional\\_standards/regional\\_reliability\\_standards\\_under\\_development.html](http://www.nerc.com/filez/regional_standards/regional_reliability_standards_under_development.html)

### **Proposed Interconnection-wide Variance for the Western Electricity Coordinating Council**

WECC has requested NERC to post the Interconnection-wide Variance VAR-001-2 — Voltage and Reactive Control for a 45-day industry review as permitted by the NERC Rules of Procedure.

#### **Instructions**

Please use this [electronic form](#) to submit comments. If you experience any difficulties in using the electronic form, please contact Eleanor Crouch at [eleanor.crouch@nerc.net](mailto:eleanor.crouch@nerc.net). An off-line, unofficial copy of the comment form is posted on the regional standards development page:

[http://www.nerc.com/filez/regional\\_standards/regional\\_reliability\\_standards\\_under\\_development.html](http://www.nerc.com/filez/regional_standards/regional_reliability_standards_under_development.html)

#### **Background**

The purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

The WECC Variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 Reliability Standard. The proposed regional variance in Section E contains requirements that are more stringent than the continent-wide Requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

#### **Regional Reliability Standards Development Process**

Section 300 of the [Rules of Procedure for the Electric Reliability Organization](#) governs the regional reliability standards development process. The success of the NERC standards development process depends on stakeholder participation. We extend our thanks to all those who participate.

For more information or assistance, please contact Eleanor Crouch at [eleanor.crouch@nerc.net](mailto:eleanor.crouch@nerc.net)  
(via email) or at 404.446.2572

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**RELIABILITY | ACCOUNTABILITY**



**Exhibit F**

**WECC Record of Development of Proposed Reliability Standard VAR-001-3**

## WECC Standards/Regional Criteria Request Form:

### VAR-001-WECC-1 Voltage and Reactive Control

<b>Title</b>	VAR-001-WECC-1 Voltage and Reactive Control
<b>First Name</b>	John
<b>Last Name</b>	Stout
<b>Email</b>	jstout@marinerconsult.com
<b>Phone Number</b>	(713) 252-0535
<b>Fax</b>	(281) 474-2570
<b>Organization</b>	Representative for Mirant
<b>Alternate Contact</b>	Anne Cleary 678-579-5248 (office) 678-579-5848 (fax) 404-863-3630 (cell)
<b>Request Type</b>	New Standard
<b>Issue</b>	See the attached minority opinion regarding VAR-002-WECC-1
<b>Purpose</b>	To mitigate the reliability and non-compliance risks described in the attachment.
<b>Responsible Entities</b>	Transmission Operator
<b>Notes</b>	Based on discussions between the Standards Request Routing Committee and the requestor of this standard action, it has been determined that two alternatives to address the concern identified in the minority opinion exist. A new regional reliability standard could be developed with requirements applicable to the Transmission Operator or modifications to VAR-002-WECC-1 could be developed identifying clear and limited instances when the TOP could direct the GOP to operate their Automatic Voltage Regulator in a mode other than automatic voltage control mode. If the second alternative is chosen, it shall be clear in the revisions to the existing standard that the responsibility is with the TOP to direct the GOP to operate in an mode other than automatic voltage control, and that the decision to do so cannot be made strictly by the GOP.
<b>Detailed Description</b>	We believe that the TOPs should be required to provide voltage schedules to be used by GOPs when complying with VAR-002-WECC-1. We are requesting that a WECC Regional Reliability Standard VAR-001-WECC-1 be developed which would incorporate such a requirement. If there are legitimate circumstances for which a voltage schedule cannot be provided, such should be clearly limited and defined by the new VAR-001-WECC-1 standard.
<b>Preliminary Technical Assessment and Reference Documents</b>	
<b>Does the proposed request comply with all of</b>	1. The planning and operation of bulk electric systems shall recognize that reliability is an essential requirement of a robust North American economy

<b>the following Market Interface Principles?</b>	
<b>Reliability Principles</b>	1. Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions, 3. Information necessary for planning and operation of interconnected bulk electric systems shall be made available to those entities responsible for planning and operating the system reliably, 5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk electric systems
<b>Merchant Function</b>	
<b>Related Standards/Criterion</b>	VAR-002-WECC-1
<b>Is this Request in response to a NERC "Fill-in-the-Blank" Standard?</b>	
<b>Attachments</b>	

\*\*\*\*\* STAFF ONLY \*\*\*\*\*

<b>Status</b>	Coordinating with NERC. Posted for 45-Day NERC Comment. Open: 10/20/2011. Closed: 12/5/2011.
<b>Comment</b>	10/26 asked Rueckert if we will send full notice for "Standards.".
<b>WECC Tracking Number</b>	WECC-0046
<b>Date Assigned to SC</b>	9/15/2008
<b>Drafting Next Meeting</b>	2/28/2011
<b>Standing</b>	3/2/2011
<b>SC Assigned to Draft</b>	OC/Padilla/Wilson
<b>Board</b>	6/22/2011
<b>Archive/Withdrawn Date</b>	
<b>URL</b>	<a href="http://sps.wecc.biz/Standards/Development/WECC0046/default.aspx">http://sps.wecc.biz/Standards/Development/WECC0046/default.aspx</a>
<b>Grouping</b>	WECC Standards
<b>NERC/WECC Standard/Criterion Number</b>	VAR-001-WECC-1

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Last modified at 10/21/2011 1:12 PM by [sblack@wecc.biz](mailto:sblack@wecc.biz)

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

### **Standard Development Roadmap**

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### **Development Steps Completed:**

<b>Completed Actions</b>	<b>Completion Date</b>
1. Post draft standard for initial industry comments	December 14, 2009

#### **Description of Current Draft:**

The purpose of this standard is to ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that Automatic Voltage Regulators (AVR) are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the generator provides the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

During the VAR-002-WECC-1 standard development process, commenters noted that not all WECC Transmission Operators provide voltage schedules to their Generation Operators. They are allowed to do this because the NERC VAR-001-1a requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules. The practice of providing reactive power or power factor schedules forces Generation Operators to manually adjust their AVR voltage setting by trial and error to find a voltage setting that will provide the exact amount of reactive power directed by the Transmission Operator. Since the voltage on the transmission grid varies throughout the day, the Generation Operator is forced to continuously reset the voltage on the AVR. This is an unnecessary and distracting manual control burden on the Generation Operator.

NERC VAR-002 requires the Generation Operator to comply exactly with the voltage schedule or reactive power schedule directed by the Transmission Operator. If the Transmission Operator provides a voltage schedule, the AVR can automatically maintain compliance with the NERC requirement. If the Transmission Operator does not provide a voltage schedule, and instead provides a reactive power schedule, compliance can no longer depend on the automatic operation of the AVR. The proposed WECC VAR-002-WECC-1 standard prohibits the AVR from being switched to a constant reactive power mode of operation. Instead compliance becomes totally dependent on constant attention and readjustment by the Generation Operator. This significantly increases the risk of reliability standard non-compliance for the generator.

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Even more disturbing is the fact that this situation (the Transmission Operator specifying a constant reactive power output rather than a constant voltage level) defeats the intended purpose of the WECC VAR-002-WECC-1 standard, to prevent a voltage collapse. If the voltage does begin to collapse, the generator AVR — operating in constant voltage mode — will increase the reactive power output from the unit. That increase in reactive output means that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. Once this occurs, the Generation Operator must immediately reduce the reactive power provided by the generator or risk noncompliance with NERC standard VAR-002, R2. That will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and exposes the Western Interconnection to a risk of blackout.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion between the Transmission Operators and Generator Operators. The survey results identified a rationale for the continued use of schedules other than a simple voltage schedule. This posting is the first 45-day comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generation Owners for implementing them so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by January 20, 2010.

WECC Standard VAR-001-WECC-1 is more stringent than a continent-wide standard.

### **Future Development Plan:**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
1. Receive Initial industry comments from First Posting	January 29, 2010
2. Drafting Team to review and respond to initial industry comments	February 26, 2010
3. Post second draft standard for industry comments	February 26, 2010
4. Drafting Team to review and respond to industry comments	April 2010
5. Post draft standard for Operating Committee approval	May 2010
6. Operating Committee approves proposed standard	June 2010
7. Post draft standard for WECC Board approval	June 2010
8. WECC Board approves proposed standard	August 2010
9. Post draft standard for NERC comment period	September 2010
10. NERC comment period ends	October 2010
11. Drafting Team completes review and consideration of industry comments to NERC posting	November 2010
12. Submit NERC Board approval request	December 2010
13. Request FERC approval	January 2011

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### Definitions of Terms Used in Standard

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**Tolerance Band:** The maximum amount that the voltage may deviate from the target voltage and still be considered meeting the Voltage Schedule.

**Voltage Schedule:** A target voltage (i.e., setpoint) to be maintained within a tolerance band during a specified period.

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-WECC-1
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability**
  - 4.1. Generator Operators
  - 4.2. Transmission Operators
5. **(Proposed) Effective Date:** On the first day of the second quarter, after applicable regulatory approval.

### B. Requirements

- R1. Each Transmission Operator shall issue any of the following acceptable types of schedules, Tolerance Bands and durations to Generator Operators. [*Violation Risk Factor: Medium*] [*Time Horizon: Same-day Operations*]
  - 1.1. A Voltage Schedule with a voltage setpoint and a voltage Tolerance Band that is within the capability of the Facilities.
  - 1.2. A Reactive Schedule that is based on either volt-ampere reactive (Var) output or power factor where the Generator Operator moves the generator operating point to the Var or power factor as directed and then holds the resulting generator terminal voltage that is within the capability of the Facilities (see R4).
- R2. The Transmission Operator's schedules in R1 shall be technically based or based upon experience in order for a Generator Operator to maintain the voltage within Facility Ratings. [*Violation Risk Factor: Medium*] [*Time Horizon: Same-day Operations*]
- R3. The Transmission Operator shall designate the schedule in R1 at any of the following points:
  - 3.1. The generator terminals.
  - 3.2. The high side of the generator step-up transformer.
  - 3.3. The point of interconnection.
  - 3.4. A location designated by mutual agreement between the Transmission Operator and Generator Operator.

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*[Violation Risk Factor: Medium] [Time Horizon: Same-day Operations]*

- R4.** If Reactive Schedules are supplied by the Transmission Operator, the Generator Operator shall use the Reactive Schedule to establish a generator terminal voltage that achieves the reactive output at the time of direction by adjusting the voltage setpoint of the automatic voltage regulator to provide the scheduled reactive power or power factor. This voltage setpoint will be maintained as the voltage schedule. This methodology (process) will hold true for subsequent modifications to the Reactive Schedule by the Transmission Operator whether it is identified to be performed on a fixed-time schedule or is an order received to modify operation. *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- R5.** If the Generator Operator uses outside control loops to manage MVar production, the Generator Operator shall be subject to the following:
- 5.1.** Operates the control loop such that the Automatic Voltage Regulator's (AVR) automatic response to voltage deviations is not modified to the point of negating the voltage response during a system disturbance.
  - 5.2.** Utilizes control loops only by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.
  - 5.3.** Keeps the AVR in voltage control mode.

*[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

### **C. Measures**

- M1.** Each Transmission Operator shall have evidence that it provided a schedule as specified in Requirement 1 to each Generator Operator.
- M2.** Each Transmission Operator shall have evidence that it provided a schedule that was technically based or based on experience in order for a Generator Operator to maintain the voltage within Facility Ratings as required by R2.
- M3.** Each Transmission Operator shall have evidence that it provided a schedule at one of the designated points in R3.
- M4.** If Reactive Schedules are supplied by the Transmission Operator, each Generator Operator shall have evidence that it used the Reactive Schedule to establish a generator terminal voltage that achieved the reactive output at the time of direction by adjusting the voltage setpoint of



## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

the automatic voltage regulator to provide the scheduled reactive power or power factor, and that the voltage setpoint was maintained as the voltage schedule for the specified period.

- M5.** If the Generator Operator uses outside control loops to manage MVar production, each Generator Operator shall have evidence that:
- 5.1.** The Transmission Operator agrees that the outer control loop does not negate the voltage response during a disturbance.
  - 5.2.** The Generator Operator obtained mutual agreement with the Transmission Operator affected by the control loop.
  - 5.3.** The Generator Operator's AVR is in voltage control mode and controlling voltage.

### **D. Compliance**

#### **1. Compliance Monitoring Process**

##### **1.1 Compliance Monitoring Responsibility**

Regional Entity

##### **1.2 Compliance Monitoring Period and Reset Time Frame**

Not applicable.

##### **1.3 Data Retention**

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 through M5 for three years plus the current year, or since the last audit, whichever is longer.

##### **1.4 Compliance Monitoring and Assessment Processes**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

##### **1.5 Additional Compliance Information**

None

#### **2. Violation Severity Levels**

**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1				
R2				
R3				
R4				
R5				

**E. Regional Differences**

None.

**F. Associated Documents**

**Version History**

Version	Date	Action	Change Tracking
1			



**WECC-0046**  
**Posting 1 Responses**  
**Comment Report Form**  
**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

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The WECC-0046 (VAR-001-WECC-1 Voltage and Reactive Control) Standard Drafting Team thanks everyone who submitted comments on the VAR-001-WECC-1 Voltage and Reactive Control Standard. This standard was posted for a 45-day public comment period from December 14, 2009 through January 29, 2010. WECC distributed the notice for this posting on December 14, 2009. The Standard Drafting Team asked stakeholders to provide feedback on the standard through a special Standard Comment Form. WECC received comments from 10 companies representing five of the 10 Industry Segments, as shown in the table on the following pages.

In this 'Consideration of Comments' document, stakeholder comments have been organized so that it is easier to see the responses associated with each question. All comments received on the standard can be viewed in their original format at:

<http://www.wecc.biz/Standards/Development/WECC0046/Shared%20Documents/WEC C-0046%20VAR-001-WECC-1%20Posting%201%20Comments.docx>

If you feel that your comment has been overlooked, please let WECC know immediately. WECC's goal is to give every comment serious consideration in this process. If you feel there has been an error or omission, please contact the Director of Standards, Steve Rueckert at [steve@wecc.biz](mailto:steve@wecc.biz). In addition, there is a WECC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is described in the Process for Developing and Approving WECC Standards:  
[http://www.wecc.biz/Standards/Development/Documents/Standards\\_Development\\_Process\\_Approved.pdf](http://www.wecc.biz/Standards/Development/Documents/Standards_Development_Process_Approved.pdf)

## Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

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The Industry Segments are:

- 1 — Transmission Owners
- 2 — RTOs, ISOs
- 3 — Load-serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 — Regional Reliability Organizations, Regional Entities

Commenter		Organization	Industry Segment											
			1	2	3	4	5	6	7	8	9	10		
1.	Koehn, Denise	Bonneville Power Administration	✓											
2.	Franklin, William L. ,	Excel Energy/PSCO	✓											
3.	Simpson, John L., Director,	Reliant Energy, Inc						✓						
4.	Tarantino, Joe	Sacramento Municipal Utility District	✓											
5.	Seitz, Jay	US Department of the Interior						✓						
6.	Thompson, Mark,	Alberta Electric System Operator		✓										
7.	Glock, Tom	APS	✓											
8.	Nietfeld, Sam	Snohomish County Public Utility District				✓								
9.	Black, Shannon	WECC												✓
10.	Unknown	Unknown												

## Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

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**1. Do you have any concerns for maintaining compliance with points in requirement R3?**

**Summary Consideration:**

<b>Commenter</b>	<b>Yes</b>	<b>No</b>	<b>Comment</b>
Koehn, Denise, BPA dekoehn@bpa.gov		X	No, BPA notifies at the point of interconnection.
<a href="#">Response: Thank you.</a>			
Franklin, William L. , Excel Energy william.l.franklin@xcelenergy.com		X	
<a href="#">Response: Thank you.</a>			
Simpson, John L., Director, Reliant Energy, Inc jsimpson@rrienergy.com	X		The generator AVR is set to control voltage at the generator terminals. This is the only location that can be counted on to be within the AVR's tolerance band during normal operation without manual operator intervention. The voltage on the high side of the generator step up transformer will vary as loading on the generator varies and therefore will not be within the same tolerance. Likewise, the voltage at the point of interconnection (POI) will vary depending on the distance to the POI and the impedance between the generator and the POI. Also, the generator does not always have indication of the voltage at either the high side of the generator step up transformer or the POI. Therefore, RRI Energy believes that the only points listed in R3 should be R3.1, the generator terminals, or R3.4, a location designated by mutual agreement between the Transmission Operator and the Generator Operator. Having R3.4 allows the TOP and GOP to discuss this issue and arrive at a mutually acceptable location and tolerance band if a location other than the generator terminals is desired by either party.
<a href="#">Response: The drafting team believes listing only R3.1 and R3.4 may conflict with NERC standard VAR-001-1 R4. The drafting team is evaluating the resolution of this conflict either through adding a requirement to convert the voltage from the interconnection point to the generator terminals or working to revise the NERC VAR-001-1 standard.</a>			
Seitz, Jay, US Department of the Interior	X		It should be noted the Generator Operator (GOP) may not have voltage visibility at some points of on the high side of the generation facility.
<a href="#">Response: The drafting team appreciates this comment and the revised standard will address this issue.</a>			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

**2. Are there any other points to consider including in requirement R3?**

**Summary Consideration:**

Commenter	Yes	No	Comment
Thompson, Mark, Alberta Electric System Operator mark.thompson@aeso.ca	X		The AESO does not use either a voltage or a VAR schedule we dispatch a voltage level with a range for various areas on the grid is published in the Rules. The voltage levels are based on the high side of the generator step up transformer. The ISO operator will direct a generator operator to a specific voltage within that range and once that voltage is achieved the generator operator may not adjust the AVR or transformer taps without another directive from the ISO.  In regards to R1 of this WECC standard, a Requirement 1.3 should be added to allow for the use of voltage levels as described above. All subsequent Requirements should be changed to include references to this type of operation as well. Specifically R3 should be reworded to “The Transmission Operator shall designate the schedule or voltage level in R1……”.
Response: The drafting team is making revisions to requirement R1 to permit a voltage band as requested.			
Franklin, Will Xcel Energy/PSCo		X	No. The proposed draft contains R3.4 which allows any mutually agreed upon point.
Response: Thank you for the comment. The drafting team believes there may be a conflict with NERC standard VAR-001-1 R4 and proposed VAR-001-WECC-1 R3.4 as discussed above.			
Koehn, Denise, BPA dekoehn@bpa.gov		X	No, BPA notifies at the point of interconnection and BPA feels that R3 encompasses any and all points that may be needed to maintain system reliability.
Response: Thank you.			
Simpson, John L., Director, Reliant Energy, Inc jsimpson@rrienergy.com		X	
Response: Thank you.			

**3. Will the conversion of all reactive schedules into a voltage schedule address system operational needs?**

**Summary Consideration:**

Commenter	Yes	No	Comment
Thompson, Mark, Alberta Electric System Operator mark.thompson@aeso.ca			The AESO feels this is not applicable in Alberta.
Response: The drafting team added language to address AESO's voltage band practice.			
Franklin, Will Xcel Energy/PSCo			No comment.

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Commenter	Yes	No	Comment
<a href="#">Response:</a>			
Koehn, Denise, BPA dekoehn@bpa.gov		X	<p><i>During the last Drafting Team Conference Call, all agreed to delete the last part of 1.1 and 1.2, but the posted version of the standard does not reflect that change. Need to delete "that is within the capability of the Facilities" from R1.1 and R1.2.</i></p> <p>BPA has a reliability concern regarding conversion of a reactive schedule to a voltage schedule that if done too frequently, it will negate the purpose of having a generator's AVR in Voltage Control mode and decrease the reliability of the system. A requirement must be given that "Reactive Schedule conversion must NOT be cycled at a frequency of less than 30 minutes." Per the requirement in VAR-002-WECC-1 Reliability Standard that a generator's AVR must be in service and in Voltage Control, BPA sees no reason for anything other than a Voltage Schedule to be issued to all Generators.</p>
<p><a href="#">Response:</a> This refinement was an oversight. The drafting team will make the refinement in the next draft.  <a href="#">The drafting team will make refinement to the language to clarify what is meant and will remove the use of reactive schedule.</a></p>			
Simpson, John L., Director, Reliant Energy, Inc jsimpson@rrienergy.com	X		
<a href="#">Response:</a> Thank you.			
Seitz, Jay, US Department of the Interior		X	<p>No, a reactive schedule does not convert to a voltage schedule. An operator can adjust a voltage regulator setpoint until a specific Var output is achieved. But this is just an instant in time; as system conditions change so will the output. The system operational needs are for all generators to be responding to voltage excursions and that Transmission Operators provide voltage setpoints based on knowledge of their system's requirements from operational experience and planning studies.</p> <p>If some generating units are not responding to system voltage changes, those that are responding must pick up more of the response. System operational needs are best served by all units responding within their capability.</p> <p>No - R1 requires the TOP to provide a tolerance band; a default if this does not happen seems to be an implied exemption to this requirement that it be provided. If there is a requirement to provide a tolerance band, it should be provided.</p>
<a href="#">Response:</a> The drafting team will make refinements to the language to clarify what is meant and will remove the use of reactive schedule.			



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Commenter	Yes	No	Comment
Black, Shannon, WECC			<p>Will the conversion of all reactive schedules into a voltage schedule address system operational needs?</p> <p>It would seem that the conversion of reactive schedules into voltage setpoints/voltage schedules will not address the operational needs of the TOP that specified the reactive schedule unless the TOP is providing frequent changes in the reactive schedules. Frequent changes in reactive schedules would be unduly burdensome to generators.</p> <p>If the WECC Region has overarching reliability concerns about voltage levels and voltage stability, why not just direct the TOP's to provide voltage schedules instead of reactive schedules.</p>

Response: The drafting team will make refinements to the language to clarify what is meant and will remove the use of reactive schedule.

**4. When a Transmission Operator does not define a tolerance band with its voltage schedule, should the tolerance band default to the Automatic Voltage Regulator (AVR) equipment ability to maintain voltage?**

**Summary Consideration:**

Commenter	Yes	No	Comment
Thompson, Mark, Alberta Electric System Operator mark.thompson@aeso.ca	X		Yes, this is how the AESO operates.
Response: Thank you.			
Franklin, Will Xcel Energy/PSCo	X		Not clear on what this question is asking. A Tolerance Band is required by this proposed standards as well as VAR-001. If the question is proposing to infer that the 'default' Tolerance Band is the AVR tolerance characteristic, then that is ok.
Response: The drafting team will make refinements to the language to clarify what is meant. The AVR capability will not be used as the tolerance band.			
Koehn, Denise, BPA dekoehn@bpa.gov		X	No, per VAR-001-1, BPA believes a Transmission Operator should be required to issue a tolerance band with a Voltage Schedule.

Response: The drafting team refined the language to clarify that a tolerance band will be required as part of the voltage schedule.

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Commenter	Yes	No	Comment
Simpson, John L., Director, Reliant Energy, Inc jsimpson@rrienergy.com	X		Yes, as long as the point of measurement of the voltage is the generator terminals, R3.1. If a different point of measurement is designated by mutual agreement as in R3.4, then the TOP must designate a tolerance band. As stated in our response to question 1, the tolerance band of the AVR at the generator terminals will not carry forward linearly to the high side of the generator step up transformer or the point of interconnection due to the impedance between the generator and these other locations. In those cases, a separate tolerance band must be specified.
Response: The drafting team will make refinements to the language to clarify what is meant. The AVR capability will not be used as the tolerance band.			
Unknown			NERC Standard VAR-001-1 and this proposed WECC Standard both require the TOP to provide a tolerance band with the voltage schedule. The TOP would be in violation of these Standards if it did not provide a tolerance band.
Response: The drafting team will make refinements to the language to clarify what is meant. The AVR capability will not be used as the tolerance band.			

**5. Is requirement R4 burdensome to Generator Operators?**

**Summary Consideration:**

Commenter	Yes	No	Comment
Unknown	X		Yes. Requirement R4 will require generators to capture and store the setpoint from the AVR to demonstrate compliance that the setpoint has been maintained. This may or may not be possible given the vintage of the AVR.  In addition, if the TOP ends up providing numerous changes in reactive schedules to cope with static voltage set points this will require the generator to make multiple voltage set point changes and the associated log entries to demonstrate compliance.
Response: The existing measurement in VAR-002-1 M2 and M3 require evidence to demonstrate compliance with schedule. The drafting team does not believe the AVR type should impact this process.			
Thompson, Mark, Alberta Electric System Operator mark.thompson@aeso.ca			This is not an issue in Alberta because the AESO Operating Policies require Generators to operate in voltage control mode.
Response: Thank you.			
Franklin, Will Xcel Energy/PSCo		X	R4 appears to be duplicative of what is simply stated in R1.2. Consider merging the two requirements, and also consider indicating that a Tolerance Band should be provided for the 'new' voltage setpoint (associated with the Reactive Schedule). We do not for see any burdens.

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Commenter	Yes	No	Comment
<p><a href="#">Response: Thank you, the drafting team will consider the requests when it posts a revised standard.</a></p>			
<p>Koehn, Denise, BPA dekoehn@bpa.gov</p>			<p>Not Applicable. As a TOP, BPA does not issue anything other than Voltage Schedules and, therefore, GOPs associated with BPA do not receive anything other than Voltage Schedules.</p>
<p><a href="#">Response: The drafting team will make refinements to the requirements to clarify that all schedules are voltage schedules.</a></p>			
<p>Simpson, John L., Director, Reliant Energy, Inc jsimpson@rrienergy.com</p>		<p>X</p>	<p>No.</p>
<p><a href="#">Response: Thank you.</a></p>			
<p>Seitz, Jay, US Department of the Interior</p>			<p>Reactive Schedule is not defined. This draft defines Voltage Schedule but does not define Reactive Schedule. A Reactive Schedule implies, for example, Generator X is scheduled to output 10 MVars from 12:00 hours until 24:00 hours. Establishing a terminal voltage setpoint based on 10 MVars at 12:00 is not a Reactive Schedule. Let’s not confuse this issue, WECC should only allow Voltage Schedules and not allow VAR/PF Schedules on the Western Interconnection; this is a lesson learned from our 1996 Outage. A major finding of the August 10, 1996 Disturbance Report addressed the increasing system oscillations that finally resulted in voltage collapse. From page 17 of this report: “f. Generation-owning and operating entities in WSCC shall ensure that generating units will provide proper steady state and dynamic voltage support, through actions such as keeping voltage regulators on automatic voltage control. The MORC Work Group shall develop suitable modifications to the criteria, including criteria relating to constant power factor control.” This Work Group’s found several machines were not controlling voltage on August 10 and thus did not respond to the voltage excursions. Addressing this issue resulted in the AVR provision in the WECC RMS Program which required generators to operate in voltage control mode. This requirement of the RMS evolved into existing WECC Regional Standard VAR-STD-002a which is very specific: “All synchronous generators with automatic voltage control equipment shall normally be operated in voltage control mode and set to respond effectively to voltage deviations.” GOPs are required to report on a quarterly basis the number of hours each machine operated and any time the machine was not in voltage control mode. GOPs are subject to penalties for not operating in this mode.</p> <p>Requirement R4 of this draft could place GOPs in violation of existing WECC Standard VAR-STD-002a</p> <p>NERC Standard VAR-002-1, Requirement R2 is more permissive than the WECC Standard cited above. However, a Regional Standard may be more restrictive than the NERC Continental Standard and the existing WECC Standard has been approved by both NERC and FERC.</p>
<p><a href="#">Response: The drafting team will make refinements to the language to clarify what is meant and will remove the use of reactive schedule. The intent of the drafting team is for all generators to operate in voltage control mode.</a></p>			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

**6. Are there any other control loops that should be considered than is allowed in requirement R5?**

**Summary Consideration:**

Commenter	Yes	No	Comment
Franklin, Will Xcel Energy/PSCo			No comment.
<a href="#">Response:</a>			
Koehn, Denise, BPA dekoehn@bpa.gov		X	BPA feels that R5 of the proposed standard encompasses all cases of existing and new outside control loops.
<a href="#">Response: Thank you.</a>			
Simpson, John L., Director, Reliant Energy, Inc jsimpson@rrienergy.com		X	No.
<a href="#">Response: Thank you.</a>			

**7. If the standard is implemented as currently drafted, please comment on how its implementation will affect either the industry-at-large or your specific firm in any of the following areas:**

- 1) Financial impacts,
- 2) Reliability impacts,
- 3) Environmental impacts,
- 4) Impacts on existing and developing markets,
- 5) Impacts and interactions with other standards, criterion and mandates, (and/or)
- 6) Personnel impacts.

**Summary Consideration:**

Commenter	Yes	No	Comment
Unknown			<p>If implemented, the conversion of reactive schedules to static voltage set points/voltage schedules would seem to not meet the reliability needs of the TOP that specified the reactive schedule without multiple subsequent changes in reactive schedules and associated voltage set points. These multiple changes in schedules would be a distraction to both TOP and GOP Plant Operators and detract from reliable system operation.</p> <p>If the overarching reliability concern in the WECC Region is overall voltage and voltage instability, this proposed Standard should just direct TOPs to provide voltage schedules instead of reactive schedules.</p>

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Commenter	Yes	No	Comment
<p>Response: The drafting team will make refinements to the requirements to clarify that all schedules are voltage schedules.</p>			
<p>Franklin, Will Xcel Energy/PSCo</p>		<p>X</p>	<p>R1, 1.1, and 1.2 appears to be duplicative of VAR-001 R4. Can the WECC requirement be modified such that it supplements rather than overlaps the NERC standard? Also, there is some question as to whether R5 meets the intent of VAR-002 R1 with respect to maintaining AVR in voltage control mode. Regarding measures, consider wording that allows being outside of schedules during system disturbances/events during the event and recovery phase of the AVR equipment and BES.</p>
<p>Response: The drafting team will clarify R1 to only permit voltage schedules that are more restrictive than NERC standard VAR-001-1 R4.</p> <p>The drafting team in R5 requires agreement with the TOP that outside control loops will not negate the AVR response.</p> <p>The drafting team believes the comment about schedules during a disturbance applies to NERC VAR-002-1 R2. This issue will not be addressed in the proposed VAR-001-WECC-1 standard.</p>			
<p>Koehn, Denise, BPA dekoehn@bpa.gov</p>			<p>Comments from BPA:</p> <p>2) Reliability Impacts are addressed in Question 3 (above).</p> <p>5) The WECC SDT needs to ensure that it coordinates this effort with the current NERC VAR Standard work.</p>
<p>Response: The drafting team will refine the language to clarify what is meant and will remove the use of reactive schedule.</p> <p>The second draft of the SAR for NERC project 2008-01 is posted for comment. The WECC drafting team will work to coordinate efforts between the two drafting teams.</p>			
<p>Simpson, John L., Director, Reliant Energy, Inc jsimpson@rienergy.com</p>			<p>The standard as currently drafted will improve reliability by allowing generators that receive Reactive Power Schedules in lieu of Voltage Schedules to convert their Reactive Power Schedule into an equivalent voltage set point that can be followed by the generator's automatic voltage regulator without manual operator intervention. This will decrease the burden on Generator Operators and allow the GOP to maintain compliance with WECC VAR-002. Some operator training will be required to be sure Generator Operators correctly implement R4 when given a Reactive Power schedule. Transmission Operator training will also be required so the TOPs will provide the appropriate tolerance bands for their schedules.</p>
<p>Response: Thank you.</p>			
<p>Seitz, Jay, US Department of the Interior</p>			<p>1) see responses above concerning converting reactive schedules to voltage schedules and R4 burdensome.</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Committer	Yes	No	Comment
Response: The drafting team will make refinements to the requirements to clarify that all schedules are voltage schedules.			

8. Other Comments.

**Summary Consideration:**

Committer	Yes	No	Comment
Tarantino, Joe, Sacramento Municipal Utility District~ System Operations and Reliability jtarantino@smud.org			<p>1) M2. Each Transmission Operator shall have evidence that it provided a schedule that was technically based or based on experience in order for a Generator Operator to maintain the voltage within Facility Ratings as required by R2.</p> <p>What does “based on experience” mean? Not sure who’s experience we would need to provide to meet the requirement.</p> <p>2) It seems R4 (reactive schedules) may still result in some ongoing manual intervention each time the TOP requests a new reactive schedule. Did the drafting team provide the survey results that identified the rationale for continued use of reactive schedules?</p>
Response: The drafting team removed the language “based on experience.” The drafting team removed reference to reactive schedules. However, every time a TOP provides a new schedule, the GOP may have to manually intervene. The survey results will be posted on the WECC Web site.			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
Nietfeld, Sam, SNPD			<p><b>VAR 001-WECC-1 R1</b>                      Recommend adding a third type of schedule that the TO can issue that provides an acceptable voltage range or band, but not a specific setpoint. SNPD's TO has issued a voltage range that we are allowed to operate within, but no specific setpoint within that range. Our outside control loop controls the plant to a VAR schedule as long as the point of interconnection voltage is within the band. If interconnection voltage moves outside the band, then the outside control loop either moves or maintains the AVR setpoint in an attempt to move the voltage back into the band.</p> <p>I would like to see the standard include additional information on how to prove compliance. For the current NERC standard, our point of interconnection is the 115kV substation bus and we essentially have 5 115kV PT's one for each bus phase and one on each of the 115kV lines leaving the plant. Due to differences in PT's, the values recorded vary by a few tenths of a kV. So one PT may indicate that we are within the voltage band issued by our TO and therefore compliant, and a different PT may indicate that we are slightly outside the band. Additionally, what frequency of recorded data is acceptable to prove compliance? Is 15 minute data acceptable? How about hourly? If the voltage slightly drifts outside of the band for a few minutes, is that considered non-compliant?</p> <p><b>VAR 001-WECC-1 R2</b>                      Need additional clarification regarding the phrase "maintain the voltage within the Facility Ratings". Our small generating plant, connected to a 115kV line and close to a very large BPA substation, can barely budge the system voltage one way or the other when all generators are at maximum lead or lag VAR production. Additionally, this BPA substation bus moves from 113kV to 117kV throughout the day and seasonally and is based on system loading. If we are required to set AVR to 115kV, our generators will be at max lead or lag VAR production/consumption 24/7 and we will not be able to maintain the voltage within facility ratings. Additionally, there is no voltage schedule that the TO could provide that could come close to following the BPA bus voltage because it changes with system load and is not related to any type of schedule.</p> <p>Stating that a TO's schedules shall be based upon experience seems vague and may be difficult to prove compliance. Is this the TO's experience or the GO's experience?</p> <p><b>VAR 001-WECC-1 R5 5.1</b>                      Recommend clarifying what is meant by "system disturbance". Is a system disturbance a fault that is cleared in 5 cycles? Or is it a long term decay of the voltage that occurs over a period of several hours due to excessive loading and a lack of VAR support?</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
			<p>Response: VAR 001-WECC-1 R1                      The drafting team is making revisions to requirement R1 to permit a voltage band as requested.                      The drafting team believes this comment applies to NERC VAR-002-1 R2. This issue will not be addressed in the proposed VAR-001-WECC-1 standard.                      VAR 001-WECC-1 R2                      The drafting team will remove the phrases referenced.                      VAR 001-WECC-1 R5 5.1                      The coordination between the GOP and the TOP is meant to address these types of issues. System and Disturbance are NERC defined terms.</p>
Glock, Tom, APS			<p><b>VAR -001 R-2, R-3.1, R-3.2</b>                      Requirement R2 is not needed. The Transmission Operator's schedules in R1 are always either technically based or are based upon his experience. Having this requirement creates unnecessary paper work and is burdensome.                       Requirements R3.1 and R3.2 should be deleted. The generator owner may not have the capability to control the voltage the high side of the generator step-up transformer or at the point of interconnection. When the Generator Owner does have the capability, the point of control should be mutually agreed upon and R3.4 is the appropriate requirement for that.</p>
			<p>Response: The drafting team will remove R2.                      The drafting team believes listing only R3.1 and R3.4 may conflict with NERC standard VAR-001-1 R4. The drafting team is evaluating the resolution of this conflict either through adding a requirement to convert the voltage from the interconnection point to the generator terminals or working to revise the NERC VAR-001-1 standard.</p>



## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### Standard Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 7, 2010

#### Description of Current Draft:

The purpose of this standard is to ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that Automatic Voltage Regulators (AVR) are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the generator provides the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generation Operators. The practice is allowed to do this because the NERC VAR-001-1a requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules. Providing reactive power or power factor schedules forces Generation Operators to manually adjust their AVR voltage setting by trial and error to find a voltage setting that will provide the exact amount of reactive power directed by the Transmission Operator. Since the voltage on the transmission grid varies throughout the day, the Generation Operator is forced to continuously reset the voltage on the AVR. This is an unnecessary and distracting manual control burden on the Generation Operator.

NERC VAR-002 requires the Generation Operator to comply exactly with the voltage schedule or reactive power schedule directed by the Transmission Operator. If the Transmission Operator provides a voltage schedule, the AVR can automatically maintain compliance with the NERC requirement. If the Transmission Operator does not provide a voltage schedule, and instead provides a reactive power schedule, compliance can no longer depend on the automatic operation of the AVR. The proposed WECC VAR-002-WECC-1 standard prohibits the AVR from being switched

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

to a constant reactive power mode of operation. Instead compliance becomes totally dependent on constant attention and readjustment by the Generation Operator. This significantly increases the risk of reliability standard non-compliance for the generator.

Even more disturbing that this situation (the Transmission Operator specifying a constant reactive power output rather than a constant voltage level) defeats the intended purpose of the WECC VAR-002-WECC-1 standard, to prevent a voltage collapse. If the voltage does begin to collapse, the generator AVR — operating in constant voltage mode — will increase the reactive power output from the unit. That increase in reactive output means that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. Once this occurs, the Generation Operator must immediately reduce the reactive power provided by the generator or risk noncompliance with NERC standard VAR-002, R2. That will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale for the continued use of schedules other than a simple voltage schedule. This posting is the second 30-day comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generation Owners for implementing them so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by June 7, 2010.

WECC Standard VAR-001-WECC-1 is more stringent than a continent-wide standard.

### **Future Development Plan:**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
1. Industry comments for second draft standard are due	June 8, 2010
2. Drafting Team to review and respond to industry comments	June 30, 2010
3. Post third draft standard for industry comments	July 16, 2010
4. Industry comments for third draft standard are due	August 16, 2010
5. Drafting Team to review and respond to industry comments	September 15, 2010
6. Post draft standard for Operating Committee approval	September 17, 2010
7. Operating Committee approves proposed standard	October 20, 2010
8. Post draft standard for WECC Board approval	October 29, 2010
9. WECC Board approves proposed standard	December 8, 2010
10. Post draft standard for NERC comment period	December 2010
11. NERC comment period ends	February 2011
12. Drafting Team completes review and consideration of industry comments to NERC posting	March 2011
13. Submit NERC Board approval request	May 2011

**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
14. Request FERC approval	August 2011

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

### **Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-WECC-1
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability**
  - 4.1. Generator Operators
  - 4.2. Transmission Operators
5. **Effective Date:** On the first day of the second quarter, after applicable regulatory approval.

### B. Requirements

- R1. Each Transmission Operator shall issue to Generator Operators any of the following acceptable types of voltage schedules. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
  - 1.1. A voltage set point with a voltage tolerance band and a specified period.
  - 1.2. An initial volt-ampere reactive (Var) output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.
  - 1.3. A voltage band for a specified period.
- R2. Generator Operator shall convert any voltage schedule in R1 into the voltage set point for the Automatic Voltage Regulators (AVR). *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
  - R2.1. When the Transmission Operator requests, the Generator Operator shall provide within 30 days its voltage set point conversion methodology from the point in R3 to the generator terminals. *[Violation Risk Factor: Low] [Time Horizon: Operations Planning]*
  - R2.2. When the Generator Operator requests, Transmission Operator shall provide within 30 days data to support development of the voltage set point conversion methodology. *[Violation Risk Factor: Low] [Time Horizon: Operations Planning]*

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

**R3.** The Transmission Operator shall designate the schedule in R1 at any of the following points:

- 3.1.** The generator terminals.
- 3.2.** The high side of the generator step-up transformer.
- 3.3.** The point of interconnection.
- 3.4.** A location designated by mutual agreement between the Transmission Operator and Generator Operator.

*[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

**R4.** If the Generator Operator uses outside control loops to manage MVar production, the Generator Operator shall be subject to the following:

- 4.1.** Each control loop's design incorporates the Automatic Voltage Regulator's (AVR) automatic voltage controlled response to voltage deviations during System Disturbances.
- 4.2.** Utilizes control loops only by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

*[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

### **C. Measures**

**M1.** Each Transmission Operator shall have evidence that it provides voltage schedules with set points, tolerance bands and specified periods as required in Requirement 1 to each Generator Operator.

**M2.** Each Generator Operator shall have evidence that it converted any voltage schedule in R1 into the voltage set point for the AVR.

**M2.1.** When the Transmission Operator requests, the Generator Operator shall have evidence that it provided within 30 days its voltage set point conversion methodology from the point in R3 to the generator terminals.

**M2.2.** When the Generator Operator requests, Transmission Operator shall have evidence that it provided within 30 days data to support development of the voltage set point conversion methodology.

**M3.** Each Transmission Operator shall have evidence that it provided its schedules at one of the designated points in R3.

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

- M4.** If the Generator Operator uses outside control loops to manage MVar production, each Generator Operator shall have evidence that:
- 4.1.** Each Generator Operator’s control loop design incorporates the AVR’s automatic voltage response to voltage deviations during System Disturbances.
  - 4.2.** The Generator Operator obtained mutual agreement with the Transmission Operator affected by each control loop.

### **D. Compliance**

#### **1. Compliance Monitoring Process**

##### **1.1 Compliance Monitoring Responsibility**

Regional Entity

##### **1.2 Compliance Monitoring Period and Reset Time Frame**

Not applicable.

##### **1.3 Data Retention**

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 through M4 for one year plus the current year.

##### **1.4 Compliance Monitoring and Assessment Processes**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

##### **1.5 Additional Compliance Information**

None

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### 2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>R1</b>	The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for 5% or less of the operating hours in a quarter for each generating unit.	The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for more than 5% up to (and including) 10% of the operating hours in a quarter for each generating unit.	The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for more than 10% up to (and including) 15% of the operating hours in a quarter for each generating unit.	The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for more than 15% of the operating hours in a quarter for each generating unit.
<b>R2</b>	The Generator Operator failed to convert any voltage schedule in R1 into the voltage set point for the AVR for 5% or less of the operating hours in a quarter. (No single generating unit should be higher than low VSL.)	N/A	N/A	The Generator Operator failed to convert any voltage schedule in R1 into the voltage set point for more than 5% of the operating hours in a quarter.
<b>R2.1</b>	The Generator Operator failed to provide within 30 days its voltage set point conversion methodology.	N/A	N/A	N/A
<b>R2.2</b>	The Transmission Operator failed to provide within 30 days its data to support development of the voltage set point conversion methodology.	N/A	N/A	N/A
<b>R3</b>	The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for 5% or less of the	The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for more than 5% up	The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for more than 10%	The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for more than 15%



**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	operating hours in a quarter to each generating unit as required in R3.	to (and including) 10% of the operating hours in a quarter to each generating unit as required in R3.	up to (and including) 15% of the operating hours in a quarter to each generating unit as required R3.	of the operating hours in a quarter to each generating unit as required in R3.
<b>R4</b>	N/A	N/A	N/A	Generator Operator failed to provide evidence that the design for each outside control loop incorporates the AVR's automatic voltage controlled response to voltage deviations or failed to receive Transmission Operator agreement to utilize the outside control loop.

**E. Regional Differences**

None.

**F. Associated Documents**

**Version History**

Version	Date	Action	Change Tracking
1			

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### Standard Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
<u>2. Receive Initial industry comments from First Posting</u>	<u>January 29, 2010</u>
<u>3. Drafting Team to review and respond to initial industry comments</u>	<u>March 4, 2010</u>
<u>4. Post second draft standard for industry comments</u>	<u>May 7, 2010</u>

#### Description of Current Draft:

The purpose of this standard is to ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that Automatic Voltage Regulators (AVR) are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the generator provides the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

During the VAR-002-WECC-1 standard development process, ~~commenter~~the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generation Operators. ~~They are~~ The practice is allowed to do this because the NERC VAR-001-1a requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules. ~~The practice of providing~~ Providing reactive power or power factor schedules forces Generation Operators to manually adjust their AVR voltage setting by trial and error to find a voltage setting that will provide the exact amount of reactive power directed by the Transmission Operator. Since the voltage on the transmission grid varies throughout the day, the Generation Operator is forced to continuously reset the voltage on the AVR. This is an unnecessary and distracting manual control burden on the Generation Operator.

NERC VAR-002 requires the Generation Operator to comply exactly with the voltage schedule or reactive power schedule directed by the Transmission Operator. If the Transmission Operator provides a voltage schedule, the AVR can automatically maintain compliance with the NERC requirement. If the Transmission Operator does not provide a voltage schedule, and instead provides a reactive power schedule, compliance can no longer depend on the automatic operation of the AVR. The

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

proposed WECC VAR-002-WECC-1 standard prohibits the AVR from being switched to a constant reactive power mode of operation. Instead compliance becomes totally dependent on constant attention and readjustment by the Generation Operator. This significantly increases the risk of reliability standard non-compliance for the generator.

Even more disturbing ~~is the fact~~ that this situation (the Transmission Operator specifying a constant reactive power output rather than a constant voltage level) defeats the intended purpose of the WECC VAR-002-WECC-1 standard, to prevent a voltage collapse. If the voltage does begin to collapse, the generator AVR — operating in constant voltage mode — will increase the reactive power output from the unit. That increase in reactive output means that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. Once this occurs, the Generation Operator must immediately reduce the reactive power provided by the generator or risk noncompliance with NERC standard VAR-002, R2. That will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and ~~exposes~~will expose the Western Interconnection to a risk of blackout.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion ~~between the Transmission Operators and Generator Operators.~~ The survey results identified a rationale for the continued use of schedules other than a simple voltage schedule. This posting is the ~~first 45~~second 30-day comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generation Owners for implementing them so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by ~~January 20~~June 7, 2010.

WECC Standard VAR-001-WECC-1 is more stringent than a continent-wide standard.

### **Future Development Plan:**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
1. <del>Receive Initial industry</del> <u>Industry</u> comments <del>from First Posting for second draft standard are due</del>	<del>January 29</del> <u>June 8</u> , 2010
2. Drafting Team to review and respond to <del>initial</del> industry comments	<del>February 26</del> <u>June 30</u> , 2010
3. Post <del>second</del> <u>third</u> draft standard for industry comments	<del>February 26</del> <u>July 16</u> , 2010
<u>4. Industry comments for third draft standard are due</u>	<u>August 16, 2010</u>
<del>4.5.</del> Drafting Team to review and respond to industry comments	<del>April</del> <u>September 15</u> , 2010
<del>5.6.</del> Post draft standard for Operating Committee approval	<del>May</del> <u>September 17</u> , 2010
<del>6.7.</del> Operating Committee approves proposed standard	<del>June</del> <u>October 20</u> ,

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
	2010
<del>7.8.</del> Post draft standard for WECC Board approval	<del>June</del> <u>October 29,</u> 2010
<del>8.9.</del> WECC Board approves proposed standard	<del>August</del> <u>December 8,</u> 2010
<del>9.10.</del> Post draft standard for NERC comment period	<del>September</del> <u>December</u> 2010
<del>10.11.</del> NERC comment period ends	<del>October-</del> <del>2010</del> <u>February 2011</u>
<del>11.12.</del> Drafting Team completes review and consideration of industry comments to NERC posting	<del>November-</del> <del>2010</del> <u>March 2011</u>
<del>12.13.</del> Submit NERC Board approval request	<del>December 2010</del> <u>May</u> <u>2011</u>
<del>13.14.</del> Request FERC approval	<del>January</del> <u>August</u> 2011

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### Definitions of Terms Used in Standard

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

~~**Tolerance Band:** The maximum amount that the voltage may deviate from the target voltage and still be considered meeting the Voltage Schedule.~~

~~**Voltage Schedule:** A target voltage (i.e., setpoint) to be maintained within a tolerance band during a specified period.~~

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-WECC-1
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability**
  - 4.1. Generator Operators
  - 4.2. Transmission Operators
5. **(Proposed) Effective Date:** On the first day of the second quarter, after applicable regulatory approval.

### B. Requirements

- R1. Each Transmission Operator shall issue to Generator Operators any of the following acceptable types of voltage schedules, ~~Tolerance Bands and durations to Generator Operators.~~ *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
- 1.1. A ~~Voltage Schedule~~ voltage set point with a voltage ~~setpoint~~ tolerance band and a ~~voltage Tolerance Band that is within the capability of the Facilities~~ specified period.
  - 1.2. ~~A Reactive Schedule that is based on either~~ An initial volt-ampere reactive (Var) output or initial power factor ~~where the output with a voltage tolerance band for a specified period that the~~ Generator Operator moves the uses to establish a generator operating point to the Var or power factor as directed and then holds the resulting generator terminal voltage that is within the capability of the Facilities (see R4) bus voltage set point.
  - 1.3. ~~The Transmission Operator's schedules in R1 shall be technically based or based upon experience in order for a~~ A voltage band for a specified period.
- R2. Generator Operator ~~to maintain the voltage within Facility Ratings~~ shall convert any voltage schedule in R1 into the voltage set point for the Automatic Voltage Regulators (AVR). *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
- R2.1. When the Transmission Operator requests, the Generator Operator shall provide within 30 days its voltage set point conversion methodology from the point in R3 to the generator

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

terminals. [Violation Risk Factor: Low] [Time Horizon: Operations Planning]

R2.2. When the Generator Operator requests, Transmission Operator shall provide within 30 days data to support development of the voltage set point conversion methodology. [Violation Risk Factor: Low] [Time Horizon: Operations Planning]

R3. The Transmission Operator shall designate the schedule in R1 at any of the following points:

- 3.1. The generator terminals.
- 3.2. The high side of the generator step-up transformer.
- 3.3. The point of interconnection.
- 3.4. A location designated by mutual agreement between the Transmission Operator and Generator Operator.

*[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

~~R4. If Reactive Schedules are supplied by the Transmission Operator, the Generator Operator shall use the Reactive Schedule to establish a generator terminal voltage that achieves the reactive output at the time of direction by adjusting the voltage setpoint of the automatic voltage regulator to provide the scheduled reactive power or power factor. This voltage setpoint will be maintained as the voltage schedule. This methodology (process) will hold true for subsequent modifications to the Reactive Schedule by the Transmission Operator whether it is identified to be performed on a fixed-time schedule or is an order received to modify operation. [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]~~

**R5.R4.** If the Generator Operator uses outside control loops to manage MVar production, the Generator Operator shall be subject to the following:

~~Operates the~~

~~5.1.4.1. Each control loop such that loop's design incorporates the Automatic Voltage Regulator's (AVR) automatic voltage controlled response to voltage deviations is not modified to the point of negating the voltage response during a system disturbance System Disturbances.~~

~~5.2.4.2. Utilizes control loops only by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.~~

~~4.3. Keeps the AVR in voltage control mode.~~

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

*[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

### C. Measures

**M1.** Each Transmission Operator shall have evidence that it ~~provided a schedule as specified~~provides voltage schedules with set points, tolerance bands and specified periods as required in Requirement 1 to each Generator Operator.

**M2.** Each ~~Transmission~~Generator Operator shall have evidence that it ~~provided a converted any voltage schedule that was technically based or based on experience in order for a Generator Operator to maintain R1 into~~ the voltage set point for the AVR.

**M2.M2.1.** When the Transmission Operator requests, the Generator Operator shall have evidence that it provided within Facility Ratings as required by R230 days its voltage set point conversion methodology from the point in R3 to the generator terminals.

**M2.2.** When the Generator Operator requests, Transmission Operator shall have evidence that it provided within 30 days data to support development of the voltage set point conversion methodology.

**M3.** Each Transmission Operator shall have evidence that it provided a ~~schedule~~its schedules at one of the designated points in R3.

**M4.** ~~If Reactive Schedules are supplied by the Transmission Operator, each Generator Operator shall have evidence that it used the Reactive Schedule to establish a generator terminal voltage that achieved the reactive output at the time of direction by adjusting the voltage setpoint of the automatic voltage regulator to provide the scheduled reactive power or power factor, and that the voltage setpoint was maintained as the voltage schedule for the specified period.~~

**M5.M4.** If the Generator Operator uses outside control loops to manage MVar production, each Generator Operator shall have evidence that:

**5.1.4.1.** The Transmission Operator agrees that the outer ~~Each Generator Operator's~~ control loop ~~does not negate the design~~ incorporates the AVR's automatic voltage response to voltage deviations during a disturbance~~System Disturbances.~~

**5.2.4.2.** The Generator Operator obtained mutual agreement with the Transmission Operator affected by ~~the~~each control loop.



## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

~~4.3. The Generator Operator's AVR is in voltage control mode and controlling voltage.~~

### D. Compliance

#### 1. Compliance Monitoring Process

##### 1.1 Compliance Monitoring Responsibility

Regional Entity

##### 1.2 Compliance Monitoring Period and Reset Time Frame

Not applicable.

##### 1.3 Data Retention

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 through ~~M5~~M4 for ~~three years~~one year plus the current year, ~~or since the last audit, whichever is longer.~~

##### 1.4 Compliance Monitoring and Assessment Processes

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

##### 1.5 Additional Compliance Information

None

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### 2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>R1</b>	<u>The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for 5% or less of the operating hours in a quarter for each generating unit.</u>	<u>The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for more than 5% up to (and including) 10% of the operating hours in a quarter for each generating unit.</u>	<u>The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for more than 10% up to (and including) 15% of the operating hours in a quarter for each generating unit.</u>	<u>The Transmission Operator failed to provide one of the types of voltage schedules specified in R1 for more than 15% of the operating hours in a quarter for each generating unit.</u>
<b>R2</b>	<u>The Generator Operator failed to convert any voltage schedule in R1 into the voltage set point for the AVR for 5% or less of the operating hours in a quarter. (No single generating unit should be higher than low VSL.)</u>	<u>N/A</u>	<u>N/A</u>	<u>The Generator Operator failed to convert any voltage schedule in R1 into the voltage set point for more than 5% of the operating hours in a quarter.</u>
<b><u>R3R2.1</u></b>	<u>The Generator Operator failed to provide within 30 days its voltage set point conversion methodology.</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<b><u>R4R2.2</u></b>	<u>The Transmission Operator failed to provide within 30 days its data to support development of the voltage set point conversion methodology.</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<b><u>R5R3</u></b>	<u>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the</u>	<u>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules</u>	<u>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules</u>	<u>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules</u>

**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<u>points designated for 5% or less of the operating hours in a quarter to each generating unit as required in R3.</u>	<u>at the points designated for more than 5% up to (and including) 10% of the operating hours in a quarter to each generating unit as required in R3.</u>	<u>at the points designated for more than 10% up to (and including) 15% of the operating hours in a quarter to each generating unit as required R3.</u>	<u>at the points designated for more than 15% of the operating hours in a quarter to each generating unit as required in R3.</u>
<b><u>R4</u></b>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>Generator Operator failed to provide evidence that the design for each outside control loop incorporates the AVR's automatic voltage controlled response to voltage deviations or failed to receive Transmission Operator agreement to utilize the outside control loop.</u>

**E. Regional Differences**

None.

**F. Associated Documents**

**Version History**

Version	Date	Action	Change Tracking
1			



## Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control

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The WECC-0046 (VAR-001-WECC-1 Voltage and Reactive Power Control) Standard Drafting Team thanks everyone who submitted comments on the VAR-001-WECC-1 Voltage and Reactive Power Control Standard. This standard was posted for two 30-day public comment periods from May 7, 2010 through July 12, 2010. WECC distributed the notice for these postings on May 7, 2010 and June 12, 2010. The Standard Drafting Team asked stakeholders to provide feedback on the standard through a special Standard Comment Form. WECC received comments from 12 companies representing five of the 10 Industry Segments, as shown in the table on the following pages.

In this 'Consideration of Comments' document, stakeholder comments have been organized so that it is easier to see the responses associated with each question. All comments received on the standard can be viewed in their original format at:

<http://www.wecc.biz/Standards/Development/WECC0046/Shared%20Documents/WEC C-0046%20VAR-001-WECC-1%20Posting%201%20Comments.docx>

If you feel that your comment has been overlooked, please let WECC know immediately. WECC's goal is to give every comment serious consideration in this process. If you feel there has been an error or omission, please contact the Director of Standards, Steve Rueckert, at [steve@wecc.biz](mailto:steve@wecc.biz). In addition, there is a WECC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is described in the Process for Developing and Approving WECC Standards: [http://www.wecc.biz/Standards/Development/Documents/Standards\\_Development\\_Process\\_Approved.pdf](http://www.wecc.biz/Standards/Development/Documents/Standards_Development_Process_Approved.pdf)

## Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

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The Industry Segments are:

- 1 — Transmission Owners
- 2 — RTOs, ISOs
- 3 — Load-serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 — Regional Reliability Organizations, Regional Entities

Commenter		Organization	Industry Segment											
			1	2	3	4	5	6	7	8	9	10		
1.	Thompson, Mark,	Alberta Electric System Operator		✓										
2.	Boucher, Chris	BCTC		✓										
3.	Koehn, Denise	Bonneville Power Administration	✓											
4.	Rust, R.	CSU				✓								
5.	Franklin, William L. ,	Excel Energy/PSCO	✓											
6.	Jenkins, Robert	First Solar					✓							
7.	Adamski, Gerard	NERC												✓
8.		Northwestern Energy	✓											
9.	Campbell, Jay	NVENERGY	✓											
10.		Tacoma Power				✓								
11.	Seitz, Jay	US Department of the Interior					✓							
12.	Black, Shannon	WECC												✓

## **Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

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### **Index to Questions, Comments, and Responses**

<b>Question</b>	<b>Page</b>
<b>1. The WECC-0046 VAR-001-WECC-1 Voltage and Reactive Control Standard Drafting Team is soliciting comments on all aspects of the proposed standard, during the period of May 7, 2010 through midnight (Mountain) on June 7, 2010 Your input is appreciated. Other Comments.</b>	<b>4</b>
<b>2. Do the refinements to the conversion of all reactive schedules into a voltage schedule address system operational needs? If your answer is no to any of the above elements, please specify which of the elements should be changed and suggest remedial language.</b>	<b>5</b>
<b>3. Are the measures, risk factors, and Violation Severity Levels of the proposed VAR-001-WECC-1 standard appropriate? If your answer is no to any of the above elements, please specify which of the elements should be changed and suggest remedial language.</b>	<b>6</b>
<b>4. Are there issues with obtaining mutual agreements between the Generator Operator and Transmission Operator as specified in R4? If yes, please specify the issues you have identified and suggest remedial action.</b>	<b>8</b>
<b>5. Are there any conflicts with the proposed VAR-001-WECC-1 standard and any NERC reliability standard? If yes, please specify the NERC Standard and the specific language within the Requirement that raises the conflict.</b>	<b>9</b>
<b>6. Does the proposed VAR-001-WECC-1 standard address all the issues previously raised regarding VAR-002-WECC-1? If no, please specify any outstanding issues and suggest remedial language or action.</b>	<b>11</b>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

1. The WECC-0046 VAR-001-WECC-1 Voltage and Reactive Control Standard Drafting Team is soliciting comments on all aspects of the proposed standard, during the period of May 7, 2010 through midnight (Mountain) on June 7, 2010 Your input is appreciated. Other Comments.

**Summary Consideration:**

Commenter	Yes	No	Comment
rrust@csu.org			NERC Standard VAR-001 is sufficient to guide AVR operation and voltage schedule dissemination from TO to GO. The extra language in VAR-001-WECC-1 adds no value and is unnecessary.
Response: The NERC VAR-001-1 standard allows TOPs to provide power factor and reactive power schedules. The purpose of VAR-001-WECC-1 is to convert all schedules to voltage schedules so the GOPs can comply with the requirements of VAR-002-WECC-1. Initial reactive power schedules are converted by the GOP to a voltage schedule.			
jcampbell@nvenergy.com			The term "outside control loops" is used in R4. Please define the term.
Response: An outside control loop is any control system external to the AVR that automatically adjusts the AVR set point of plants. In R4 (new R6), the drafting team replaced the term "outside control loop" with "control loop external to the AVR" to clarify the requirement.			
Chris Boucher, BCTC chris.boucher@bctc.com			BCTC feels that voltage schedules are inappropriate for British Columbia. Voltage profiles in BC are affected more significantly by generation patterns and interchange schedules than by daily load patterns. BCTC manages voltage in BC with system operating orders that provide minimum and maximum bus voltage levels. The Transmission Coordinator is responsible for the voltage profile and reactive dispatching. He/she will communicate with generator operators in real time to keep bus voltage levels in an acceptable range. BCTC also uses industry leading advanced applications for voltage stability analysis and dynamic var reserves in real time.
Response: In R1, sub-bullet 1.3 allows for system operating orders that provide minimum and maximum bus voltage levels as an acceptable schedule.			
Robert Jenkins - First Solar			Requirement 1.1 identifies the voltage tolerance band as being part of the voltage schedule. However the ability to achieve a specific tolerance band will be a function of the initial design of the voltage control system. Therefore either the tolerance should be specified up-front in the design phase or should be limited to be within the project capabilities. I note that the second option was in the initial language but has been struck.  General I question why the Generator Operator is tasked with converting the TO's desire for a VAR or power factor output into a voltage set point. If the WECC requirement is that generators must have their AVRs on voltage control, then the requirement from the TO must be in the same terms. The GO should not be at risk of a standards violation due to the TO's desire for a control mode that is potentially inconsistent with the WECC directive. However if, for example, the TOs voltage set point is at the POI, the GO may need to provide its set point conversion methodology if it is monitoring the voltage at a different point, say the generator

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			terminals or the GSU high side.
<p>Response: The voltage tolerance provided by the TOP is generally broader than the performance tolerance of the generator AVR in accordance with NERC definition for a voltage schedule (see NERC VAR-001-1).</p>			
<p>The intent of VAR-001-WECC-1 is to require the generators to operate to a voltage set point through the conversion of the schedule, if necessary, and to allow flexibility that the conversion does not create an unnecessary burden on any entity.</p>			
<p>Shannon Black, WECC sblack@wecc.biz</p>			<p>These comments are my own observations and have not been vetted with WECC staff. Thanks you for the opportunity to comment.</p> <p>R1. Sub-requirements 1.1-1.3 are not cumulative sub-requirements of R1. Rather, they are a “listing” of potential options. The listing should be bulleted as opposed to creating additional sub-requirements. This would appear to be the intent of M1 as drafted.</p> <p>Should the word “any” be changed to “one”?</p> <p>R2. Add the word “Each” at the beginning of the sentence.</p> <p>Both R2.1. and R2.2</p> <p>These are free standing Requirements/ tasks to be performed separate from “converting” the schedule as required in the primary R2. R2.1 requires “provision of the methodology” and R2.2 requires “provision of data”; whereas, R2 requires “conversion.”</p> <p>Please consider making R2.1 and R2.2 free standing Requirements using the following language or a derivative thereof. I would suggest the following sequence as obtaining the data would seem to precede applying the methodology.</p> <p>Please consider:</p> <p>RX. Each Transmission Operator shall provide to the Generator Operator receiving the voltage schedule in R1, data deemed necessary by the Generator Operator to develop a set point conversion methodology, within 30 days of receiving a request from that Generator Operator.</p> <p>RX. Each Generator Operator shall provide to the Transmission Operator issuing the voltage schedule in R1, its voltage set point conversion methodology as applied from the point designated in R3 to the generator terminals, within 30 days of receiving a request from that Transmission Operator.</p> <p>R3. Sub-requirements 3.1-3.4 are not cumulative sub-requirements of R3. Rather, they are a “listing” of potential options. The listing should be bulleted as opposed to creating additional sub-requirements. This would appear to be the intent of M3 as drafted.</p> <p>R4. Consider the following for structural standardization:</p> <p>R4. Each Generator Operator using outside control loops to manage MVar production shall incorporate into its outside control loop design each of the following features:</p> <p>R4.1. The Automatic Voltage Regulator’s (AVR) automatic voltage controlled response to voltage deviations during System Disturbances.</p> <p>R4.2. An outside control loop shall only be used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.</p> <p>To the extent Requirements are changed, Measures would be adjusted accordingly.</p>



**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			Thank you for your consideration. W. Shannon Black
<p>Response:</p> <p>R1 The drafting team made the requested refinements to R1.</p> <p>R2 The drafting team made refinements to R2 to address this concern.</p> <p>R3 The drafting team made requested refinements to R3.</p> <p>R4 The drafting team made refinements to R4 (new R6) to address this concern.</p>			
Thompson, Mark, Alberta Electric System Operator mark.thompson@aeso.ca mark.thompson@aeso.ca			<p>The AESO would like to thank the drafting team for their efforts and we appreciate the opportunity to comment on one item in the standard.</p> <p>R1.1 states: A voltage set point with a voltage tolerance band and a specified period.</p> <p>The AESO directs Generator Operators to a voltage set point and the GO is told to remain there until further notice. So the "specified period" is until the GO is directed to change by the AESO. Can the requirement be reworded to allow for this scenario?</p> <p>Mark Thompson AESO</p>
<p>Response: The drafting team believes use of the term "until further notice" is specifying a period as required by R1.1.</p>			
Franklin, Will Xcel Energy/PSCo william.l.franklin@xcelenergy.com			<p>Xcel Energy (PSCo) comments:</p> <p>It is unclear as to the need for this standard. If there is a perceived deficiency in the current NERC standard then the NERC standards development process should be followed to improve the NERC standard.</p> <p>The description of the current draft section indicates that the concern is that some TOPs issue reactive power schedules. The proposed standard, if pursued, should address only that and not expand into other aspects that appear to duplicate the NERC standards.</p> <p>If the TOP needs to issue a reactive power schedule that requires the GO/GOP to maintain a constant VAR, then there should either be the creation of a definition of a reactive power schedule within the NERC standard or within this proposed standard and that should be the extent of the effort. Or if it is desired to not allow reactive power schedules within WECC then the standard should simply state that and no more.</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			<p>We appreciate the opportunity to comment.</p> <p>Will Franklin Xcel Energy</p>
<p>Response: The drafting team believes that VAR-002-WECC-1 provides additional requirements in the Western Interconnection that create problems with GOPs complying with NERC VAR-001-1. The purpose of VAR-001-WECC-1 is to resolve these problems.</p>			
			<p>Tacoma Power subject matter experts agree with the red-lined draft standard, VAR-001-WECC-1 Voltage and Reactive Control.</p>
<p>Response: Thank you.</p>			
<p>Northwestern</p>			<p>NorthWestern Energy thanks the WECC-0046 Drafting Team for the opportunity to provide Comments. NorthWestern has concerns about the premise on which this draft standard was based.</p> <p>The third paragraph of the Description of Current Draft states, Providing reactive power or power factor schedules forces Generation Operators to manually adjust their AVR voltage setting by trial and error to find a voltage setting that will provide the exact amount of reactive power directed by the Transmission Operator. Since the voltage on the transmission grid varies throughout the day, the Generation Operator is forced to continuously reset the voltage on the AVR.</p> <p>While the statements may be true of some generators in some power plants, it is not true of all generators or all situations.</p> <p>The terminal voltage of an islanded generator can be controlled by increasing or decreasing excitation. Manual control will require readjustment if the load changes, or AVR control can maintain constant voltage under changing load conditions. An islanded generator cannot control power factor or VARs – they are determined by the load.</p> <p>When paralleled to a grid, the same generator cannot control the grid voltage unless it is large enough to dominate the voltage response in the local area. Instead, all generators control their VAR output by increasing or decreasing excitation, and the net effect of the cumulative VAR production is an increase or decrease of grid voltage. An appropriately designed AVR can control to a power factor or VAR set point as easily and as automatically as it can control to voltage. The automatic voltage regulator design on many modern generators includes the capability to automatically regulate generator excitation based upon a set point for terminal voltage, power factor, or VARs.</p> <p>Because the underlying premise is false, the standard itself is flawed, and probably unnecessary. The following specific objections are noted:</p> <p>R1 Each Transmission Operator shall issue to Generator Operators any of the following acceptable types of voltage schedules.</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			<p>Comment: NERC VAR-001-1, R4, permits voltage or Reactive Power schedules. The WECC draft standard confuses a reactive power schedule with a voltage schedule. The requirement should be deleted. Delete R1 and all sub requirements</p> <p>R1.2 An initial volt-ampere reactive (Var) output or initial power factor output with a voltage tolerance band . . . Comment: A voltage tolerance band is not applicable to a VAR or power factor set point. The WECC draft standard confuses a reactive power schedule with a voltage schedule. Delete R1 and all sub requirements</p> <p>R1.3 A voltage band for a specified period Comment: The WECC draft standard quotes a portion of the NERC explanation of a voltage schedule without appropriate context. Delete R1 and all sub requirements</p> <p>R2 Generator Operator shall convert any voltage schedule in R1 into the voltage set point for the Automatic Voltage Regulators (AVR). Comment: It is not necessary for generator operators to convert a power factor schedule or VAR schedule into a voltage set point for the AVR. NERC VAR-001-1 addresses the subject in sufficient detail to ensure reliability. Recommended change: Each Generator Operator shall perform any calculations necessary to establish a generator (AVR) voltage set point and range that correspond with the voltage schedule received for the point of interconnection with the Transmission Operator’s facilities. (R2.1 and R2.2 are not necessary and should be deleted.)</p> <p>R3 The Transmission Operator shall designate the schedule in R1 at any of the following points: 3.1. The generator terminals. 3.2. The high side of the generator step-up transformer. 3.3. The point of interconnection. 3.4. A location designated by mutual agreement between the Transmission Operator and Generator Operator.</p> <p>Comment: NERC VAR-001-1, R4, requires the voltage schedule “at the interconnection between the generator facility and the Transmission Owner’s facilities.” It may be appropriate for the GOP and the TOP to agree on calculations that will meet the NERC requirement based upon a more convenient location to measure the voltage, but it does not seem that a WECC standard is required to clarify this. NERC VAR-001-1, R4, addresses the subject in sufficient detail to ensure reliability. Delete R3 and all sub requirements.</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			<p>R4 If the Generator Operator uses outside control loops to manage MVar production, the Generator Operator shall be subject to the following:</p> <p>4.1. Each control loop’s design incorporates the Automatic Voltage Regulator’s (AVR) automatic voltage controlled response to voltage deviations during System Disturbances.</p> <p>4.2. Utilizes control loops only by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.</p> <p>Comment: NERC VAR-002-1.1b requires the Generator Operator to maintain the generator voltage or Reactive Power output as directed by the Transmission Operator. There is no need to dictate specific control technology as long as the AVR is in service and controlling voltage. There is no need for the Transmission Operator to exercise veto authority over control technology that complies with NERC reliability requirements.</p> <p>Delete R4 and all sub requirements.</p> <p>NERC VAR-001-1, R3, specifies criteria for exempting a generator operator from the requirements of R4 and R6.1. The draft WECC standard does not contain any provision for exemption. This will result in an unnecessary burden on TOPs and GOPs if all generators of all sizes, vintages, and designs are required to comply with the entire standard. TOPs use planning studies to determine the reliability impacts of generator interconnections. These studies should be the basis for application of NERC or WECC standards to specific generators.</p>
<p><b>Response:</b></p> <p>The drafting team is making refinements to the introduction to clarify the intent of the standard. In the standard, reactive power schedules are not permitted in WECC. However, the Drafting Team’s (DT) investigation revealed that some TOPs still provide direction to GOPs using reactive power terminology i.e., parallel and bring the unit to unity power factor. Therefore, when a TOP gives a reactive power value with a voltage tolerance band to the GOP, it is converted to a voltage schedule. That voltage is maintained as the voltage schedule until a new schedule is given to the GOP or the specified period ends. The intent of the standard is that all schedules are converted to voltage schedules.</p> <p>An outside control loop is any control system external to the AVR that automatically adjusts the AVR set point of plants. In R4 (new R6), the drafting team replaced the term “outside control loop with “control loop external to the AVR” to clarify the requirement.</p> <p>The drafting team believes that machines subject to the registration criteria are required to comply with the standard. The drafting team clarified this point in R1. The standard does not provide any provisions for exemptions for providing schedules to small generators, but typically these smaller generators are not connected to the BES. The drafting team does not feel that TOPs will be required to provide voltage schedules to generators that are not part of the BES.</p>			
Adamski, Gerard NERC			Generally, I think the standard is in pretty good shape. Here are some thoughts or comments – they look like a lot but many of minor improvements or suggestions:

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			<ul style="list-style-type: none"> <li>• One overarching question – it seems like the standard is more a “how” standard versus a “what” standard. Is this appropriate as a standard or should this be a guide to GOPs as to how to comply with the VAR-002 standard.</li> <li>• I think the third paragraph of the introduction page (Description of Current Draft) provides a very good basis for the standard.</li> <li>• On the second page of the introduction (Description of Current Draft) that begins “even more disturbing...”, I find the description to be too literal and hope the GOP will act in the interest of reliability and not averse to that objective.”</li> <li>• Last paragraph of introduction (Description of Current Draft) – third line – change the word “rational” to “rationale”.</li> <li>• Purpose – please add “Western” before “Interconnection”.</li> <li>• Effective Date – please change the language to state: “On the first day of the second quarter following the date of the order providing regulatory approval.”</li> <li>• R1 – Eliminate the use of the word “acceptable”.</li> <li>• R1 – the sub-parts should be bulleted and not listed as 1.1 or 1.2 as these are options. This is consistent with the NERC approach to standards format.</li> <li>• 1.3 – would it be more appropriate to use the word “range” instead of “band”?</li> <li>• 1.3 – is the acronym VAr or Var? I thought it was VAr.</li> <li>• The objective of R1 is for the TOP to issue voltage schedules to the GOP to maintain reliable operation of the Western Interconnection. It would seem that the impact of not delivering on the R1 objective would be the potential for evil consequences that might include cascading (voltage collapse). I would argue the VRF should be High instead of Medium.</li> <li>• Perhaps due to my lack of detailed knowledge, I am not sure I understand what 1.2 is providing. I understand providing a VAr or pf output target but am not clear on the relation to the voltage tolerance band. Again maybe nothing to change for those who understand better than me. But I also look at this from the view of the reader at FERC or elsewhere and it may not be apparent to them either.</li> <li>• R2 – Slightly reword the requirement to the following “A Generator Operator shall convert any voltage schedule <b>required</b> in R1 into <b>a</b> voltage set point for use by the Automatic Voltage Regulator. (AVR).</li> <li>• R3 – I would suggest making this R2.</li> <li>• R3 – Add “to the Generator Operator” following “shall designate the schedule in R1”</li> <li>• R4 – Similar to the previous comment, I am not clear about the requirement as an “outsider”. What is an “outside control loop”? Is it a control loop external to the AVR? Similarly in 4.1, is the expectation that external control loops simulate expected AVR response? I would suggest additional words are needed to make the expectation clear. Perhaps the following should be considered:</li> </ul>

Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control

Commenter	Yes	No	Comment
			<p>If the GOP uses control loops external to the AVR to manage MVar production, the GOP shall ensure:</p> <p>4.1 Each control loop’s design replicates the AVR automatic voltage controlled response to voltage deviations during System Disturbances.</p> <p>4.2 Control loops are used only by mutual agreement between the GOP and the TOP affected by the control loop.</p> <ul style="list-style-type: none"> <li>• Measure M1 – change “provides” to “provided”</li> <li>• Measure M1 – modify Requirement 1 to Requirement R1.</li> <li>• Measure M2 – change the “voltage schedule in R1 into <b>the</b> voltage set point for the AVR” to “voltage schedule in R1 into <b>a</b> voltage set point for the AVR”</li> <li>• Measure M3 seems to be a different font than the rest.</li> <li>• VSLs – I think in general the VSLs suffer from not using the specific wording in the requirements.</li> <li>•             <ul style="list-style-type: none"> <li>○ For example, R1 VSL should read: “The TOP failed to issue to each GOP one of the types of voltage schedules specified in R1 for 5% or less of the operating hours for each generating unit.”</li> <li>○ R3 should read: “The TOP failed to designate the schedule in R1 to the GOP for 5% or less of the operating hours to each generating unit as required in R3.</li> </ul> </li> <li>• Several of the VSLs refer to measurements in a quarter. There is no identified basis for using a quarterly measure either in the requirements or the measures. It should be removed.</li> <li>• Several of the VSLs refer to percentages of operating hours. 5% of the operating hours seems like an awful large amount of time. 5% in a year represents 438 hours a year or nearly 2.5 weeks in a year. And this is the lower VSL. 15% represents a month and a half.</li> <li>• VSLs – R2 – is R2 expected to be assessed at the individual generating unit level? If so, this needs to be incorporated; further, it is not clear what the parenthesized statement intends.</li> <li>• VSLs – R4 – The Severe VSL should be formatted to be clearer that it is an “OR” statement:</li> </ul> <p style="margin-left: 40px;">GOP failed to ensure that the design for each outside control loop incorporated the AVR’s automatic voltage controlled response to voltage deviations</p> <p style="margin-left: 40px;">OR</p> <p style="margin-left: 40px;">The GOP failed to establish mutual agreement with the TOP to utilize the outside control loop.</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Committer	Yes	No	Comment
			<p>Response: Thank you for your clear and specific comments. The DT will carefully review each for incorporation into the standard.</p> <p>The standard is more stringent than NERC VAR-001. The drafting team believes a voltage schedule in the Western Interconnection is necessary because of VAR-002-WECC-1. The conversion of reactive power loading in R1 does to some degree get into the how to convert, but the DT believes this is necessary to make it clear and to accommodate existing practices.</p> <p>NERC used band in footnote 1 of VAR-001-1 rather than range. The drafting team uses the NERC language and considers band and range to be the same.</p> <p>In R1, all schedules are voltage schedules; therefore, a voltage band is needed in the second bullet. The description has been revised to clarify the concept.</p> <p>Adding “to the generator operator” is redundant since R1 states the voltage schedule must be given to the generator operator.</p>

**2. Do the refinements to the conversion of all reactive schedules into a voltage schedule address system operational needs? If your answer is no to any of the above elements, please specify which of the elements should be changed and suggest remedial language.**

**Summary Consideration:**

Committer	Yes	No	Comment
Koehn, Denise, BPA dekoehn@bpa.gov			<p>BPA appreciates the opportunity to comment. SMEs: Franky Puyleart, Steve Hitchens, Rebecca Berdahl</p> <p>As a TOP, BPA does not issue anything other than Voltage Schedules. If the intent of R1.2 is to identify that or how all reactive schedules are converted into voltage schedules, then BPA requests some clarification be made to R1.2.</p>
			<p>Response: Thank you for your comments. It is the intention of 1.2 to identify that, while WECC will continue to allow voltage support direction in terms other than voltage, such direction will be converted into a voltage set point that can be maintained by the AVR. The drafting team believes the standard will require all reactive power directions to be converted to a voltage schedule.</p>
Franklin, Will Xcel Energy/PSCo			<p>Xcel Energy (PSCo) comments:</p> <p>We still believe that R1.1 &amp; 1.3 are redundant to the existing NERC standard and provide no additional clarity. In fact, R1.2 may actually violate the existing standard.</p> <p>R1.2, if used, should be rephrased to state “a voltage target, within a specified band, that provides</p>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			<p>the VARs desired by the Transmission Operator.”</p> <p>R2 has become altogether confusing. What conversion is necessary? Surely we can't be asking a generator to make adjustments to the voltage setting to effect something they can't see. The requirement should require an incremental adjustment by the GO or a continuous communication while making adjustments if the goal is a target that only the TOP can see.</p> <p>R3 appears to be relaxing requirements already specified by the NERC standard. Suggest that the team submit a SAR to NERC to modify the standard to specify “a location designated by mutual agreement by the TOP and GOP” and eliminate R3.</p> <p>R4 – it's still unclear as to what outside control loops may be used. Is there an example?</p> <p>We appreciate the opportunity to comment.</p> <p>Will Franklin Xcel Energy</p>
<p>Response: The drafting team does not believe that 1.2 violates the existing standard. This proposed standard does provide additional restrictions that are not in the NERC standard. This standard protects both the TOP and GOP from unrealistic demands in a schedule that is specified at point other than where their equipment controls can realistically maintain, or have visibility to maintain. It eliminates the NERC-allowed ability to require a GOP to maintain a reactive power schedule by defining a requirement to convert the data provided into a voltage set point, at the machine terminals, that can be maintained for compliance. Some GOP's have multiple generating units that must share reactive power output which cannot be solved with traditional droop characteristics. They employ control loops external to the AVR that force the units to share reactive power demand by modifying the set points. This standard sets requirements to manage their use such that voltage response is maintained and proper coordination with the TOP occurs.</p> <p>Use of the term voltage set point is very descriptive for generator operators and is well understood. The drafting team prefers its use to voltage target.</p> <p>The conversion in R2 is necessary when voltage schedules are given at any point other than the generator terminal. R3 and R4 help the TOP understand the conversion. R5 helps the conversion to be done correctly.</p>			
<p>Seitz, Jay, US Department of the Interior jseitz@do.usbr.gov</p>			<p>We believe the Standard should only allow voltage schedules and remove the feature allowing a VAR or Power Factor schedule to be provided by the Transmission Operator and requiring the Generator Operator to convert it to a voltage set point for the Automatic Voltage Regulator. WECC Standard VAR-002-WECC-1 requires the Generator Operator to have the AVR in automatic voltage control mode, not VAR control or Power factor control. Likewise, the Transmission Operator should be required to provide a voltage schedule, not</p>



**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
			<p>a VAR schedule or a Power Factor schedule.</p> <p>The standard would be much easier to understand, apply, and enforce if Requirements R1 (including R1.1, R1.2, and R1.3) and R2 (including R2.1 and R2.2) and R3 (including R3.1, R3.2, R3.3, and R3.4) were consolidated into one Requirement with language such as:</p> <p>R1. The Transmission Operator shall provide to the Generator Operator a voltage schedule at a point agreed to by both the TOP and GOP. The voltage schedule may include appropriate characteristics such as a +/- tolerance or a voltage band.</p> <p>If the Transmission Operator were to provide a voltage schedule at a location as agreed by both the Generator Operator and the Transmission Operator the need for this “Conversion to a voltage set point” R2 Requirement is eliminated.</p> <p>In addition, this streamlined Requirement proposed above meets all four of the set point location options contained in Requirement R3 (R3.1, generator terminals; R3.2, transformer high side; R3.3 point of interconnection; or R3.4, location as agreed by the Transmission Operator and Generator Operator).</p>
<p>Response: Thank you for your comments. The drafting team determined that requiring a TOP to solely provide voltage direction (a schedule) in voltage terms at the generator terminals would be overly burdensome for the TOP; especially if it has hundreds of machines connected into its system. It is also unrealistic to provide real-time direction in terms of generator voltage, especially if the TOP does not have visibility of the generator terminal voltage. Direction in reactive power terms is easily understood by the GOP, so long as it has the freedom to convert the direction to a voltage setpoint. As simple as the act is, compliance complicates the process to demand a formal set of requirements.</p> <p>An example for writing the requirements as proposed is that, during an emergency condition, directing a generator to full buck or full boost allows the TOP to quickly respond to the need and permits the GOP to quickly comply with VAR-002-WECC-1 requirements.</p>			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

**3. Are the measures, risk factors, and Violation Severity Levels of the proposed VAR-001-WECC-1 standard appropriate? If your answer is no to any of the above elements, please specify which of the elements should be changed and suggest remedial language.**

**Summary Consideration:**

Commenter	Yes	No	Comment
Koehn, Denise, BPA dekoehn@bpa.gov		X	BPA appreciates the opportunity to comment. SMEs: Franky Puyleart, Steve Hitchens, Rebecca Berdahl  BPA sees no issues with the measures and risk factors in the proposed standard, VAR-001-WECC-1. BPA feels that the Violation Severity levels for R1, R2 and R4 are too harsh and request that they be modified accordingly or request that further explanation be given for how these VSL's were established.
Response: Thank you for your comment, the DT will re-evaluate the VSLs and provide explanations as needed. The drafting team followed the guidelines in the NERC "Violation Severity Levels Development Guidelines Criteria".			

**4. Are there issues with obtaining mutual agreements between the Generator Operator and Transmission Operator as specified in R4? If yes, please specify the issues you have identified and suggest remedial action.**

**Summary Consideration:**

Commenter	Yes	No	Comment
Koehn, Denise, BPA dekoehn@bpa.gov		X	BPA appreciates the opportunity to comment. SMEs: Franky Puyleart, Steve Hitchens, Rebecca Berdahl  BPA does not see any conflicts with this currently, but we feel that this needs to be analyzed on a case by case basis moving forward. If at all possible, these agreements should be included in the LGIA. If revision to an existing LGIA isn't an option then a separate agreement should be developed.
Response: Thank you for your comment.			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

**5. Are there any conflicts with the proposed VAR-001-WECC-1 standard and any NERC reliability standard? If yes, please specify the NERC Standard and the specific language within the Requirement that raises the conflict.**

**Summary Consideration:**

Commenter	Yes	No	Comment
Koehn, Denise, BPA dekoehn@bpa.gov	X		<p>BPA appreciates the opportunity to comment. SMEs: Franky Puyleart, Steve Hitchens, Rebecca Berdahl</p> <p>BPA sees a potential conflict between NERC Standard VAR-001 and the VAR-001- WECC-1 in that the points identified in R3 of the proposed VAR-001-WECC-1 and the NERC Standard VAR-001 R4 may not always align with each other.</p>
<p>Response: The drafting team felt that, the since “the point of interconnection” is an undefined term, it can be interpreted many ways. The DT identified what that means to the WECC in the new R2. The DT felt there is a conflict between the voltage locations described in NERC VAR-001-1 R4 and VAR-002-1 R2. The drafting team tried to resolve this conflict in new requirement R2.</p>			
Seitz, Jay, US Department of the Interior			<p>As stated in the response to Question 2, WECC Standard VAR-002-WECC-1 requires the Generator Operator to have the AVR in automatic voltage control mode, not VAR control or Power Factor control. Therefore the Transmission Operator should be required to provide a voltage schedule, a VAR schedule or a Power Factor schedule should not be allowed.</p> <p>Although we strongly believe Requirement R2 should be deleted, we point out it seems to run contrary to existing NERC Standard VAR-002-1. The proposed WECC Standard places the responsibility on the Generator Operator to convert the voltage or VAR or PF to a voltage set point at a useful location. However, the NERC Standard implies this is the responsibility of the Transmission Operator. NERC VAR-002-1 Requirement R4 requires the Generator Operator to provide step up transformer impedance and tap data; the Transmission Operator is then required to analyze the data and determine if tap changes should be made. The proposed WECC Standard appears to remove this voltage analysis responsibility from the Transmission Operator and place it instead on the Generator Operator. This is confusing and leads to a conflict.</p> <p>Requirement R4 deals with outside control loops. We believe this standard is not the appropriate place to address this issue and would suggest it be taken up in a future revision of a Planning (TPL) Standard. A TPL Standard should address what impact outer control loops may have on the system and measures to be taken to address any ensuing issues.</p>
<p>Response: While it is true that one could interpret the NERC VAR-002 standard to place the responsibility to perform this conversion on the TOP, it is at most implied. It could also be interpreted that the requirement to provide such data is only to allow the TOP to determine the appropriate transformer tap setting for interconnection to the BES. The drafting team chose to allow a conversion by the GOP since generally the TOP does not have visibility of the generator bus. This lack of visibility requires as a minimum a conversion from the high side voltage to the generator bus voltage. R5 then gives the GOP actual data to aid development of conversion algorithms.</p>			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Power Control**

Commenter	Yes	No	Comment
The DT felt that this standard is the appropriate place to address the use of control loops external to the AVR. Their use impacts how schedules are developed. The DT felt that any inclusion in a TPL standard would be to address the effects of their use to guide the TOP on negotiating with the GOP.			

**6. Does the proposed VAR-001-WECC-1 standard address all the issues previously raised regarding VAR-002-WECC-1? If no, please specify any outstanding issues and suggest remedial language or action.**

**Summary Consideration:**

Commenter	Yes	No	Comment
Koehn, Denise, BPA dekoehn@bpa.gov SMEs: Franky Puyleart, Steve Hitchens, Rebecca Berdahl		X	BPA appreciates the opportunity to comment. SMEs: Franky Puyleart, Steve Hitchens, Rebecca Berdahl  BPA sees no conflicts with the current VAR-002-WECC-1 and the proposed VAR-001-WECC-1.
<a href="#">Response: Thank you.</a>			
Black, Shannon, WECC			Response: See comments to questions above.
<a href="#">Response: See above response.</a>			

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### Standard Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 6, 2010
5. Second draft comment period ended	July 12, 2010
6. Drafting Team to review and respond to industry comments	August 11, 2010
7. Post third draft standard for industry comments	September 24, 2010

#### Description of Current Draft:

The purpose of this standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the system voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-1a requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation of generator operators that the allowed reactive schedule by NERC VAR-001-1a requires generator operators to maintain the reactive output defined in the schedule at all times. This will require the generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This standard restricts the Transmission Operator to providing only a Voltage Schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that Automatic Voltage Regulators (AVR) are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

The Compliance Monitoring Enforcement Program allows that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002 requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service and operate AVRs in automatic voltage control mode with some defined exceptions. VAR-001-WECC-1 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the NERC requirement. If the Transmission Operator provides the voltage schedule information in another format, such as in reactive power terms, compliance with the NERC requirement requires conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the Automatic Voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. This is especially true if the reactive change is due to a system problem.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued use of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

This posting is the third 30-day comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing them so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by October 27, 2010.

WECC Standard VAR-001-WECC-1 is more stringent than a continent-wide standard.

### **Future Development Plan:**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
1. Industry comments for third draft standard are due	October 25, 2010
2. Drafting Team to review and respond to industry comments	November 24, 2010
3. Post draft standard for Operating Committee approval	January 18, 2011
4. Operating Committee approves proposed standard	March 2011
5. Post draft standard for WECC Board approval	March 2011
6. Post draft standard for NERC comment period	April 2011
7. NERC comment period ends	April 2011
8. Drafting Team completes review and consideration of industry comments to NERC posting	May 2011
9. WECC Board approves proposed standard	June 2011
10. Submit NERC Board approval request	July 2011
11. Receive NERC Board approval	August 2011
12. Request FERC approval	September 2011

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

### **Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*



## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-WECC-1
3. **Purpose:** To ensure that voltage levels are within limits in real time to protect equipment and to help ensure the reliable operation of the Western Interconnection.
4. **Applicability**
  - 4.1. **Functional Entities**
    - 4.1.1. Generator Operators within the Western Interconnection.
    - 4.1.2. Transmission Operators within the Western Interconnection.
  - 4.2. **Facilities**
    - 4.2.1. On-line generation resources that are part of the Bulk Electric System.
5. **Effective Date:** On the first day of the second quarter following the date of the order providing regulatory approval.

### B. Requirements

- R1. Each Transmission Operator shall issue any of the following types of voltage schedules for each generation resource that is on-line and part of the Bulk Electric System to all Generator Operators within the Transmission Operating Area: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
  - A voltage set point with a voltage tolerance band and a specified period.
  - An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.
  - A voltage band for a specified period.
- R2. Each Transmission Operator shall issue a voltage schedule specified in Requirement R1 at any of the following points *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*:
  - The generator terminals.
  - The high side of the generator step-up transformer.
  - The point of interconnection.
  - A location designated by mutual agreement between the Transmission Operator and Generator Operator.

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

- R3.** Each Generator Operator shall convert the voltage schedule specified in Requirement R1 into the voltage set point for the generator excitation system. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
- R4.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement R2 to the generator terminals within 30 days of request by the Transmission Operator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- R5.** Each Transmission Operator shall provide all equipment and operating data to support development of the voltage set point conversion methodology within 30 days of request by the Generator Operator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- R6.** Each Generator Operator shall ensure that it meets the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- 6.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.
- 6.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### **C. Measures**

- M1.** Each Transmission Operator shall have evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement R1 are acceptable as evidence.
- M2.** The Transmission Operator shall have evidence that it defined its schedules at one of the designated points in Requirement R2. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M3.** Each Generator Operator shall have evidence that it converted a voltage schedule in Requirement R1 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

- M4.** The Generator Operator shall have evidence that within 30 days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement R3 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M5.** The Transmission Operator shall have evidence that within 30 days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M6.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have evidence that it met the control loop specifications in sub-parts 6.1 through 6.2. Design specifications with identified agreed-upon control loops; system reports, or other dated documentation are acceptable as evidence.

### **D. Compliance**

#### **1. Compliance Monitoring Process**

##### **1.1 Compliance Monitoring Responsibility**

Regional Entity

##### **1.2 Compliance Monitoring Period and Reset Time Frame**

Not applicable.

##### **1.3 Data Retention**

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 through M6 for one year plus the current year.

##### **1.4 Compliance Monitoring and Assessment Processes**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

##### **1.5 Additional Compliance Information**

None

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### 2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>R1</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to at least one but less than or equal to 5% of the generation resources that are on line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<b>R2</b>	The Transmission Operator did not specify one of the points when it issued a voltage schedule to at least one Generator Operator but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<b>R3</b>	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for less than 25% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 25% or more but less than 50% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 50% or more but less than 75% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 75% or more of its generators.
<b>R4</b>	N/A	N/A	N/A	The Generator Operator did not provide its voltage set point conversion methodology within 30 days of a request by the Transmission Operator.

**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R5	N/A	N/A	N/A	The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 30 days of a request by the Generator Operator.
R6	N/A	N/A	N/A	The Generator Operator did not show that its design for each control loop external to the AVR provides automatic voltage-controlled response to voltage deviations during System Disturbances, or the Generator Operator did not show that it received Transmission Operator agreement to use the control loop.

**E. Regional Differences**

None.

**F. Associated Documents**

**Version History**

Version	Date	Action	Change Tracking
1			

# WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

## Standard Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 7 <del>6</del> , 2010
<u>5. Second draft comment period ended</u>	<u>July 12, 2010</u>
<u>6. Drafting Team to review and respond to industry comments</u>	<u>August 11, 2010</u>
<u>7. Post third draft standard for industry comments</u>	<u>September 24, 2010</u>

### Description of Current Draft:

The purpose of this standard is to ensure that voltage levels, ~~reactive flows, and reactive resources are monitored, controlled, and maintained are~~ within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the system voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-1a requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation of generator operators that the allowed reactive schedule by NERC VAR-001-1a requires generator operators to maintain the reactive output defined in the schedule at all times. This will require the generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This standard restricts the Transmission Operator to providing only a Voltage Schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that Automatic Voltage Regulators (AVR) are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that ~~the generator provides AVRs are in service and controlling voltage so that generators provide~~ the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008. -

The Compliance Monitoring Enforcement Program allows that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002 requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service and operate AVRs in automatic voltage control mode with some defined exceptions. VAR-001-WECC-1 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the NERC requirement. If the Transmission Operator provides the voltage schedule information in another format, such as in reactive power terms, compliance with the NERC requirement requires conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the Automatic Voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their ~~Generation~~Generator Operators. ~~The practice is allowed to do this because the NERC VAR-001-1a requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules. Providing reactive power or power factor schedules (instead of specific voltage levels) forces Generation~~Generator Operators to manually adjust their AVR voltage setting ~~by trial and error to find a voltage to a~~ setting that will provide the exact amount of reactive power ~~directed by the Transmission Operator. Since the voltage on the transmission grid varies throughout the day, the Generation Operator is forced to continuously reset the voltage on the AVR. This is an unnecessary and distracting manual control burden on the Generation Operator. in the schedule.~~

~~NERC VAR-002 requires the Generation Operator to comply exactly with the voltage schedule or reactive power schedule directed by the Transmission Operator. If the Transmission Operator provides a voltage schedule, the AVR can automatically maintain compliance with the NERC requirement. If the Transmission Operator does not provide a voltage schedule, and instead provides a reactive power schedule, compliance can no longer depend on the automatic operation of the AVR. The proposed WECC VAR-002-WECC-1 standard prohibits the AVR from being switched~~

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

~~to a constant reactive power mode of operation. Instead compliance becomes totally dependent on constant attention and readjustment by the Generation Operator. This significantly increases the risk of reliability standard non-compliance for the generator.~~

~~Even more disturbing that this situation (the Transmission Operator specifying a constant reactive power output rather than a constant voltage level) defeats the intended purpose of the WECC VAR-002-WECC-1 standard, to prevent a voltage collapse. If the voltage does begin to collapse, the generator AVR — operating in constant voltage mode — will increase the reactive power output from the unit. That increase in reactive output means~~It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. ~~Once this occurs, If the Generation Generator Operator must immediately reduce alters~~ the amount of reactive power provided by the generator ~~or to return it to the schedule, there is higher risk noncompliance with NERC standard VAR-002, R2. That that such action~~ will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. ~~- This is especially true if the reactive change is due to a system problem.~~

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a ~~rational for rationale that will accommodate the~~ continued use of ~~schedules~~ ~~either providing direction in reactive power terms rather~~ than ~~a simple requiring all~~ Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

This posting is the ~~second~~third 30-day comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by ~~Generation Generator~~ Owners for implementing them so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by ~~June 7~~October 27, 2010.

WECC Standard VAR-001-WECC-1 is more stringent than a continent-wide standard.

### **Future Development Plan:**

<b>Anticipated Actions</b>	<b>Anticipated Date</b>
<del>1. Industry comments for second draft standard are due</del>	<del>June 8, 2010</del>
<del>2. Drafting Team to review and respond to industry comments</del>	<del>June 30, 2010</del>
<del>3. Post third draft standard for industry comments</del>	<del>July 16, 2010</del>
<u>4.1. Industry comments for third draft standard are due</u>	<u>August 16</u> <u>October 25</u> , 2010
<u>5.2. Drafting Team to review and respond to industry comments</u>	<u>September 15</u> <u>November 24</u> , 2010



**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Anticipated Actions	Anticipated Date
<del>6.3.</del> Post draft standard for Operating Committee approval	<del>September 17, 2010</del> <u>January 18, 2011</u>
<del>7.4.</del> Operating Committee approves proposed standard	<del>October 20, 2010</del> <u>March 2011</u>
<del>8.5.</del> Post draft standard for WECC Board approval	<del>October 29, 2010</del> <u>March 2011</u>
<del>9. WECC Board approves proposed standard</del>	<del>December 8, 2010</del>
<del>10.6.</del> Post draft standard for NERC comment period	<del>December 2010</del> <u>April 2011</u>
<del>11.7.</del> NERC comment period ends	<del>February</del> <u>April</u> 2011
<del>12.8.</del> Drafting Team completes review and consideration of industry comments to NERC posting	<del>March</del> <u>May</u> 2011
<del>9. WECC Board approves proposed standard</del>	<del>June 2011</del>
<del>13.10.</del> Submit NERC Board approval request	<del>May</del> <u>July</u> 2011
<del>11. Receive NERC Board approval</del>	<del>August 2011</del>
<del>14.12.</del> Request FERC approval	<del>August</del> <u>September</u> 2011

## **WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

### **Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. -Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. -New or revised definitions listed below become approved when the proposed standard is approved.- When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-WECC-1
3. **Purpose:** To ensure that voltage levels, ~~reactive flows, and reactive resources are monitored, controlled, and maintained are~~ within limits in real time to protect equipment and to help ensure the reliable operation of the Western Interconnection.-
4. **Applicability**
  - 4.1. **Functional Entities**
    - 4.1.4.1.1. Generator Operators within the Western Interconnection.
    - 4.2.4.1.2. Transmission Operators within the Western Interconnection.
  - 4.2. **Facilities**
    - 4.2.1. On-line generation resources that are part of the Bulk Electric System.
5. **Effective Date:** On the first day of the second quarter, ~~after applicable~~ following the date of the order providing regulatory approval.-

### B. Requirements

- R1. Each Transmission Operator shall issue ~~to Generator Operators~~ any of the following ~~acceptable~~ types of voltage schedules: for each generation resource that is on-line and part of the Bulk Electric System to all Generator Operators within the Transmission Operating Area: [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]
- 1.1. • A voltage set point with a voltage tolerance band and a specified period. -
  - 1.2. • An initial volt-ampere reactive (~~Var~~) output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.
  - 1.3. • A voltage band for a specified period.
- R2. ~~Generator~~ Each Transmission Operator shall ~~convert any issue a~~ voltage schedule specified in R1 into the voltage set point for the Automatic Voltage Regulators (AVR). Requirement R1 at any of the following points [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

*Same-day Operations*];

~~R2.1. When the Transmission Operator requests, the Generator Operator shall provide within 30 days its voltage set point conversion methodology from the point in R3 to the generator terminals. [Violation Risk Factor: Low] [Time Horizon: Operations Planning]~~

~~R2.2. When the Generator Operator requests, Transmission Operator shall provide within 30 days data to support development of the voltage set point conversion methodology. [Violation Risk Factor: Low] [Time Horizon: Operations Planning]~~

~~R3. The Transmission Operator shall designate the schedule in R1 at any of the following points:~~

~~3.1. • \_\_\_ The generator terminals.~~

~~3.2. • \_\_\_ The high side of the generator step-up transformer.~~

~~3.3. • \_\_\_ The point of interconnection.~~

~~3.4. • \_\_\_ A location designated by mutual agreement between the Transmission Operator and Generator Operator.~~

R3. Each Generator Operator shall convert the voltage schedule specified in Requirement R1 into the voltage set point for the generator excitation system. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

R4. #Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement R2 to the generator terminals within 30 days of request by the Transmission Operator. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

R5. Each Transmission Operator shall provide all equipment and operating data to support development of the voltage set point conversion methodology within 30 days of request by the Generator Operator. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

R4.R6. Each Generator Operator shall ensure that it meets the following control loop specifications if the Generator Operator uses ~~outside~~ control loops external to the Automatic Voltage Regulators (AVR) to manage MVar production, the Generator Operator shall be subject to the following: loading: [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

~~4.1.6.1.~~ Each control loop's design incorporates the ~~Automatic Voltage Regulator's (AVR)~~ AVR's automatic voltage controlled response to voltage deviations during System Disturbances.

~~4.2.6.2.~~ Utilizes ~~Each~~ control ~~loops~~ ~~loop is~~ only ~~used~~ by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

~~[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]~~

### C. Measures

~~M1.~~ Each Transmission Operator shall have evidence that it ~~provides~~ provided the voltage schedules ~~with to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including~~ set points, tolerance bands, and specified periods as required in Requirement ~~1 to each Generator Operator~~ R1 are acceptable as evidence.

~~M2.~~ The Transmission Operator shall have evidence that it defined its schedules at one of the designated points in Requirement R2. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

~~M2.M3.~~ Each Generator Operator shall have evidence that it converted ~~anya~~ voltage schedule in Requirement R1 into ~~thea~~ voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.

~~M2.1.M4.~~ ~~When the Transmission Operator requests, the~~ The Generator Operator shall have evidence that ~~it provided~~ within 30 days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement R3 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

~~M2.2.M5.~~ ~~When the Generator Operator requests, The~~ Transmission Operator shall have evidence that ~~it provided~~ within 30 days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

~~M3.~~ ~~Each Transmission Operator shall have evidence that it provided its schedules at one of the designated points in R3.~~

~~M4.~~ ~~If the Generator Operator uses outside control loops to manage MVar~~

## WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

~~production, each loading, the~~ Generator Operator shall have evidence that:

~~4.1. Each Generator Operator's it met the control loop design incorporates the AVR's automatic voltage response to voltage deviations during System Disturbances.~~

~~4.2.M6. The Generator Operator obtained mutual agreement with the Transmission Operator affected by each specifications in sub-parts 6.1 through 6.2. Design specifications with identified agreed-upon control loops; system reports, or other dated documentation are acceptable as evidence.~~

### **D. Compliance**

#### **1. Compliance Monitoring Process**

##### **1.1 Compliance Monitoring Responsibility**

Regional Entity

##### **1.2 Compliance Monitoring Period and Reset Time Frame**

Not applicable.

##### **1.3 Data Retention**

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 through ~~M4~~M6 for one year plus the current year.

##### **1.4 Compliance Monitoring and Assessment Processes**

Compliance Audits  
Self-Certifications  
Spot Checking  
Compliance Violation Investigations  
Self-Reporting  
Complaints

##### **1.5 Additional Compliance Information**

None

**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

**2. Violation Severity Levels**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	<del>The</del> For the specified period, the Transmission Operator failed to provide <del>did not issue</del> one of the <del>types of</del> voltage schedules <del>specified</del> listed in R1 for 5% or to at least one but less than or equal to 5% of the generation resources that are on line and part of the operating-hours BES in a quarter for each generating unit the Transmission Operator Area.	<del>The</del> For the specified period, the Transmission Operator failed to provide <del>did not issue</del> one of the <del>types of</del> voltage schedules <del>specified</del> listed in R1 for to more than 5% up but less than or equal to (and including) 10% of the operating-hours generation resources that are on-line and part of the BES in a quarter for each generating unit the Transmission Operator Area.	<del>The</del> For the specified period, the Transmission Operator failed to provide <del>did not issue</del> one of the <del>types of</del> voltage schedules <del>specified</del> listed in R1 for to more than 10% up but less than or equal to (and including) 15% of the operating-hours generation resources that are on-line and part of the BES in a quarter for each generating unit the Transmission Operator Area.	<del>The</del> For the specified period, the Transmission Operator failed to provide <del>did not issue</del> one of the <del>types of</del> voltage schedules <del>specified</del> listed in R1 for to more than 15% of the operating-hours generation resources that are on-line and part of the BES in a quarter for each generating unit the Transmission Operator Area.
R2	The Generator Operator failed to convert any voltage schedule in R1 into the voltage set point for the AVR for 5% or less of the operating hours in a quarter. (No single generating unit should be higher than low VSL.) The Transmission Operator did not specify one of the points when it issued a voltage schedule to at least one Generator Operator but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission	N/A  The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	N/A  The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Generator Transmission Operator failed to convert any <del>did not specify</del> one of the points when it issued a voltage schedule in R1 into the voltage set point for to more than 5 15% of the operating hours in a quarter generation resources that are on-line and part of the BES in the Transmission Operator Area.

**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<u>Operator Area.</u>			
<b>R2.1R3</b>	<del>The Generator Operator failed to provide within 30 days its convert the voltage schedules in Requirement R1 into the voltage set point conversion methodology for the AVR for less than 25% of its generators.</del>	N/A <u>The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 25% or more but less than 50% of its generators.</u>	N/A <u>The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 50% or more but less than 75% of its generators.</u>	N/A <u>The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 75% or more of its generators.</u>
<b>R2.2R4</b>	<del>The Transmission Operator failed to provide within 30 days its data to support development of the voltage set point conversion methodology. N/A</del>	N/A	N/A	N/A <u>The Generator Operator did not provide its voltage set point conversion methodology within 30 days of a request by the Transmission Operator.</u>
<b>R3R5</b>	<del>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for 5% or less of the operating hours in a quarter to each generating unit as required in R3. N/A</del>	<del>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for more than 5% up to (and including) 10% of the operating hours in a quarter to each generating unit as required in R3. N/A</del>	<del>The Transmission Operator failed to direct the Generator Operator to comply with the voltage schedules at the points designated for more than 10% up to (and including) 15% of the operating hours in a quarter to each generating unit as required R3. N/A</del>	<del>The Transmission Operator failed to provide its data to support development of the voltage set point conversion methodology within 30 days of a request by the Generator Operator to comply with the voltage schedules at the points designated for more than 15% of the operating hours in a quarter to each generating unit as required in R3.</del>
<b>R4R6</b>	N/A	N/A	N/A	<u>The Generator Operator failed to provide evidence did not show that the its design for each outside control loop incorporates external to the AVR's AVR.</u>



**WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
				<del>provides</del> automatic voltage-controlled response to voltage deviations <del>or failed to receive</del> during System Disturbances, or the Generator Operator did not show that it <del>received</del> Transmission Operator agreement to <del>utilize</del> use the <del>outside</del> -control loop.

**E. Regional Differences**

None.

**F. Associated Documents**

**Version History**

Version	Date	Action	Change Tracking
1			



## **Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

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The WECC-0046 (VAR-001-WECC-1 Voltage and Reactive Control) Standard Drafting Team thanks everyone who submitted comments on the VAR-001-WECC-1 Voltage and Reactive Control Standard. This standard was posted for a 30-day public comment period from September 24, 2010 through October 25, 2010. WECC distributed the notice for these postings on September 24, 2010. The Standard Drafting Team asked stakeholders to provide feedback on the standard through a special Standard Comment Form. WECC received comments from five companies representing two of the 10 Industry Segments, as shown in the table on the following page.

In this 'Consideration of Comments' document, stakeholder comments have been organized so that it is easier to see the responses associated with each stakeholder. All comments received on the standard can be viewed in their original format at:

<http://www.wecc.biz/Standards/Development/WECC0046/Lists/WECC0046%20VAR001WECC1%20Voltage%20and%20Reactive%20Control/AllItems.aspx>

If you feel that your comment has been overlooked, please let WECC know immediately. WECC's goal is to give every comment serious consideration in this process. If you feel there has been an error or omission, please contact the Director of Standards, Steve Rueckert, at [steve@wecc.biz](mailto:steve@wecc.biz). In addition, there is a WECC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is described in the Process for Developing and Approving WECC Standards: <http://www.wecc.biz/Standards/Documents/WECC%20Standards%20Development%20Process.pdf>

## Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control

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The Industry Segments are:

- 1 — Transmission Owners
- 2 — RTOs, ISOs
- 3 — Load-serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 – Regional Reliability Organizations, Regional Entities

	Commenter	Organization	Industry Segment										
			1	2	3	4	5	6	7	8	9	10	
1.	Bajarang Agrawal	Arizona Public Service Company	✓		✓		✓						
2.	Franklin, William L. ,	Excel Energy/PSCO	✓										
3.	John Cummings and Gus Wilkins	PPL Energy Plus and PPL Montana					✓						
4.	Koehn, Denise	Bonneville Power Administration	✓										
5.	Matt Brewer	San Diego Gas & Electric	✓		✓		✓						

## **Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

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### **Index to Questions, Comments, and Responses**

<b>Question</b>	<b>Page</b>
<b>1. Has the WECC-0046 VAR-001-WECC-1 Voltage and Reactive Control Drafting Team completed its task? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.</b>	<b>4</b>

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

1. Has the WECC-0046 VAR-001-WECC-1 Voltage and Reactive Control Drafting Team completed its task? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Committer	Yes	No	Comment
Bजारंग Agrawal		X	<p><b>B. Requirements</b></p> <p><b>R1.</b> Each Transmission Operator shall issue <b>any only one</b> of the following types of voltage schedules for each generation resource that is on-line and part of the Bulk Electric System to all Generator Operators within the Transmission Operating Area: <i>[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]</i></p> <ul style="list-style-type: none"> <li>· A voltage set point with a voltage tolerance band and a specified period.</li> <li>· An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band <b>for a specified period</b> that the Generator Operator uses to establish a generator bus voltage set point.</li> <li>· A voltage band <b>for a specified period</b>.</li> </ul> <p><b>R2.</b> Each Transmission Operator shall issue a voltage schedule specified in Requirement R1 at <b>any only one</b> of the following points <i>[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]</i>:</p> <ul style="list-style-type: none"> <li>· The generator terminals.</li> <li>· The high side of the generator step-up transformer.</li> <li>· The point of interconnection.</li> <li>· A location designated by mutual agreement between the Transmission Operator and Generator Operator.</li> </ul> <p><b>R3.</b> Each Generator Operator shall convert the voltage schedule specified in Requirement R1 into the voltage set point for the generator <b>excitation system terminal</b>. <i>[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]</i></p>

**Response:**

R1 and R2: The drafting team modified “any” to “any one” to clarify the intent to address the comment.

R2: The drafting team believes there needs to be a specified period for every schedule.

R3: Regarding the replacement of “excitation system” with “terminal,” there are instances where the reference for the generator excitation system may be at a different location than the generator terminal. The drafting team believes “excitation system” is more inclusive.

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
Franklin, Will Xcel Energy/PSCo william.l.franklin@xcelenergy.com		X	<p>Xcel Energy (PSCo) Comments:</p> <p>We continue to believe that R1 is a duplication of the existing NERC Standard VAR-001 R4.</p> <p>We also question how R2 will be compliant with the NERC Standard VAR-001 R4 since R4 requires the schedule to be specified at the "interconnection"</p> <p>NERC Standard VAR-001 R4:</p> <p style="padding-left: 40px;">Each Transmission Operator shall specify a voltage or Reactive Power schedule 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...</p> <p>In general, we believe that the requirements provided in this draft WECC standard are applicable to concerns that exist continent wide and should be addressed in NERC standard VAR-001 rather than as a regional standard if there is a belief this needs to be a reliability standard. Additionally, if WECC feels it is necessary to have guidance, we would rather see it in criteria than a standard.</p> <p>Thanks for the opportunity to comment.  <b>Will Franklin</b>                      Xcel Energy</p>
<p>Response: The drafting team changed the filing from a regional standard to a regional variance for NERC VAR-001-1 requirements R3 and R4, so that transmission operators will not be subject to double jeopardy. The drafting team believes that this regional variance needs to be implemented because VAR-STD-002a-1 and VAR-002-WECC-1 standards have been approved. We are working with the NERC Project 2008-1 drafting team to make similar continent-wide requirements.</p>			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
<p>John Cummings and Gus Wilkins PPL Energy Plus and PPL Montana</p>		<p>X</p>	<p>PPL Energy Plus and PPL Montana (PPL Companies) commend the standard drafting team on a generally well written and thought-out standard. The Requirements, Measures, VRFs and VSLs all appear to be correct and appropriate.</p> <p>However, we have a few comments that we would like the Standard Drafting Team to address as part of the written record in case questions come up in the future during an audit regarding the meaning or intent of the proposal. The PPL Companies do not necessarily believe the VAR-001-WECC-1 standard should be changed to address the following items and leaves this decision to the SDT.</p> <ol style="list-style-type: none"> <li>1. The generating plant operator controls the machine terminal voltage by setting the AVR as instructed by the TOP and/or converted by the GOP. The plant operator cannot and should not over-ride plant controls that might change the AVR setpoint to protect the machine nor should the plant operator manually over-ride or ignore an alarm to keep the AVR at the setpoint issued by the TOP; to do either might trip the plant just when it is needed most by the grid. There may need to be recognition in VAR-001-WECC-1 that some flexibility may be in order because the GOP must keep the plant within limits (i.e. within Facility Ratings per VAR-002-1.1a).             <ol style="list-style-type: none"> <li>a. For example, if the AVR is set to the voltage specified by the TOP and the machine goes into stator current alarm and the PCS automatically lowers the AVR setpoint to come out of alarm, the SDT should indicate on the record or in the standard that the GOP has NOT violated the standard because the plant operator has set the AVR where it was supposed to be set.</li> <li>b. Further, the SDT should state on the record or in the standard that the plant operator will not be in violation of the standard by changing the AVR setpoint manually to come out of alarm on the plant. Moving the AVR setpoint manually might happen if the plant goes into alarm when the AVR is set at the setpoint called for by the TOP.</li> </ol> </li> <li>2. The SDT should state on the record or in the standard that this standard is not intended to cover VAR control between two generating plants if the two generating plants are on either side of a tie line and thus in two separate BAAs and controlled by two separate TOP's. The coordination of the operation of these neighboring plants is covered in the VAR-001-1 R1 standard involving voltage schedule and MVAR coordination at interface points.</li> </ol>
<p>Response: The drafting team believes that VAR-002-1 requirement R2.2 allows the generator operator to notify the Transmission Operators that the schedule cannot be met, provide a reason why it cannot be met, and request a new schedule so that the generator can operate in a condition that does not result in operating near an alarm point. The drafting team modified R1 to require schedules to be within equipment ratings.</p> <p>The drafting team believes that NERC VAR-001-1 R1 covers coordination of voltages with other Transmission Operators.</p>			

**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
<p>Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a>.</p> <p>Submitted on behalf of the following SMEs: Frank Puyleart, Steve Hitchens, Rebecca Berdahl, Fran Halpin.</p>	X		<p>Additional Suggestions:</p> <p>Please ensure clarity for the activities times in the "Description of Current Draft" section of the standard such that transmission operator activities pre-contingency and automatic planned performance of the system post-contingency are not mixed.</p> <p>Measurement 4 (M4) references the ".... from the point in Requirement R3 to ....", but this should read ".... from the point in Requirement R2 to ...."</p>
<p>Response: Transmission Operators are responsible for automatic planned generator performance for the pre- and post-system conditions. If there is a system condition where the prearranged generator performance should be different than the planned performance, it is the transmission operator's responsibility to direct the generator operator to respond differently. This standard does not address planned performance communication. Requirements in NERC VAR-002-1 address the required generator response to the transmission operator's voltage schedule.</p> <p>The drafting team made the correction in M4.</p>			



**Comment Report Form for WECC Standard VAR-001-WECC-1 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
<p>Matt Brewer San Diego Gas &amp; Electric <a href="mailto:mbrewer@semprautilities.com">mbrewer@semprautilities.com</a></p>		X	<p>Comment on R1: This requirement results in double jeopardy for an entity. If an entity doesn't provide a voltage schedule, it would be in violation of VAR-001-1 R4 and this requirement. This requirement, and perhaps this regional standard, should be handled as a regional variance to VAR-001-1 rather than in a separate standard. If the drafting team elects not pursue the above suggestion, then SDG&amp;E proposes the following changes to R1 and R5:</p> <p>Suggested wording changes for R1:</p> <p><b>R1.</b> Each Transmission Operator shall issue <b>one</b> of the following types of voltage schedules for each generation resource that is on-line and part of the Bulk Electric System <b>to the associated</b> Generator Operators within the Transmission <b>Operator's operating area</b></p> <ul style="list-style-type: none"> <li>· A voltage set point with a voltage tolerance band and a specified period.</li> <li>· An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.</li> <li>· A voltage band for a specified period. <b>Comment: This is missing the set point as required by VAR-001 (e.g. set point, tolerance band, specific time period).</b></li> </ul> <p>Proposed changes to R5:</p> <p><b>R5.</b> Each Transmission Operator shall provide <b>its transmission equipment</b> and operating data that the <b>Generator Operator needs</b> to support the <b>Generator Operator's</b> development of the voltage set point conversion methodology within 30 days of request by the Generator Operator.</p>
<p>Response:</p> <p>R1: The drafting team will change the filing from a standard to a regional variance for NERC VAR-001-1 requirements R3 and R4, so that transmission operators will not be subject to double jeopardy. The drafting team replaced "any" with "any one" and reworded the rest of the sentence to clarify R1. The drafting team does not see an issue with allowing a voltage band as a violation of VAR-001-1 R4 since the standard would be a regional variance to NERC VAR-001-1 R3 and R4.</p> <p>R5: the drafting team made similar refinements to R5 to incorporate the request.</p>			

## Standard VAR-001-2 — Voltage and Reactive Control

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### Regional Variance Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 6, 2010
5. Second draft comment period ended	July 12, 2010
6. Drafting Team to review and respond to industry comments	August 11, 2010
7. Post third draft standard for industry comments	September 24, 2010
8. Industry comments for third draft standard are due	October 25, 2010
9. Drafting Team to review and respond to industry comments	November 24, 2010
10. Post fourth draft as a regional variance to NERC VAR-001-2 requirements R3 and R4	December 7, 2010

#### Description of Current Draft:

The current draft has been converted from a Standard into a Regional Variance. The format incorporates the NERC Standard into the document with minor additions to address the scope of the variance. The regional variance specifics are included as section E and in this case are intended to replace NERC VAR-001-2 requirements R3 and R4 as noted at the beginning of section E. For clarity, existing text of NERC VAR-001-2 is not redlined even though it was not included in the last posting. The redline version of section E identifies what was changed from the last posting.

The purpose of this regional variance to a NERC reliability standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator's Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the Bulk Electric System's voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-2 Requirement R3 allows Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC standard VAR-001-2 Requirement 4 and Requirement 6.1. The drafting team believes that permitting such

## Standard VAR-001-2 — Voltage and Reactive Control

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exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

The NERC VAR-001-2 Requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation that generator operators given reactive schedules under NERC VAR-001-2 are required to maintain the reactive output defined in the schedule at all times. This will require generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to a NERC standard restricts the Transmission Operator to providing only a Voltage Schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR's automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that the AVRs are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

The Compliance Monitoring Enforcement Program allows that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002 requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service operating in automatic voltage control mode with some defined exceptions. This proposed variance to VAR-001-2 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the requirement. If the Transmission Operator provides voltage schedule information in another format, such as in reactive power terms, compliance with the proposed requirements require conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the automatic voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such

## Standard VAR-001-2 — Voltage and Reactive Control

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action will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. This is especially true if the reactive change is due to a system problem.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued use of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

This posting is the fourth comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing the schedules so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by January 6, 2011.

The WECC variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 reliability standard. The proposed regional variance in section E contains requirements that are more stringent than the continent-wide requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

### Future Development Plan:

Anticipated Actions	Anticipated Date
1. Comments from fourth posting are due	January 6, 2011
2. Post draft standard for Operating Committee approval	January 26, 2011
3. Operating Committee approves proposed standard	March 2, 2011
4. Post draft standard for WECC Board approval	March 2011
5. WECC Board approves proposed standard	June 2011
6. Post draft standard for NERC comment period	July 2011
7. NERC comment period ends	August 2011
8. Drafting Team completes review and consideration of industry comments to NERC posting	September 2011
9. Submit NERC Board approval request	September 2011
10. Receive NERC Board approval	October 2011
11. Request FERC approval	November 2011

**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**None**

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-2
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4. Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5. Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
  - R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to support its voltage under first Contingency conditions.
  - R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### **C. Measures**

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### **D. Compliance**

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority

Regional Entity.

#### 1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

#### 1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

#### 1.4. Data Retention

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

#### 1.5. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

### 2. Violation Severity Levels (no changes)

## E. Regional Variances

### E.A. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

#### Requirements

**E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.



- A voltage band for a specified period.
- E.A.14.** Each Transmission Operator shall issue a voltage schedule specified in Requirement E.A.13 at any one of the following points [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning and Same-day Operations*]:
- The generator terminals.
  - The high side of the generator step-up transformer.
  - The point of interconnection.
  - A location designated by mutual agreement between the Transmission Operator and Generator Operator.
- E.A.15.** Each Generator Operator shall convert the voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning and Same-day Operations*]
- E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 days of request by the Transmission Operator. [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]
- E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]
- E.A.18.** Each Generator Operator shall ensure that it meets the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: [*Violation Risk Factor: Medium*] [*Time Horizon: Real-time Operations*]
- E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.
  - E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures

- M.E.A.13.** Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.
- M.E.A.14.** The Transmission Operator shall have and provide upon request, evidence that it

## Standard VAR-001-2 — Voltage and Reactive Control

defined its schedules at one of the points designated in Requirement E.A.14. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

- M.E.A.15.** Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.
- M.E.A.16.** The Generator Operator shall have and provide upon request, evidence that within 30 days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.17.** The Transmission Operator shall have and provide upon request, evidence that within 30 days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.18.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

### Violation Severity Levels

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.13</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.

## Standard VAR-001-2 — Voltage and Reactive Control

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.14</b>	The Transmission Operator did not specify one of the points when it issued a voltage schedule to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued voltage schedules to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued voltage schedules to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued voltage schedules to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<b>E.A.15</b>	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of its generators.
<b>E.A.16</b>	N/A	N/A	N/A	The Generator Operator did not provide its voltage set point conversion methodology within 30 days of a request by the Transmission Operator.
<b>E.A.17</b>	N/A	N/A	N/A	The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 30 days of a request by the Generator Operator.

## Standard VAR-001-2 — Voltage and Reactive Control

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.18</b>	N/A	N/A	N/A	The Generator Operator did not show that its design for each control loop external to the AVR provides automatic voltage-controlled response to voltage deviations during System Disturbances, or the Generator Operator did not show that it received Transmission Operator agreement to use the control loop.

### Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
2	TBD	Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
2		Modified to add a WECC region variance	

## Standard VAR-001-2 — Voltage and Reactive Control

### ~~Standard~~Regional Variance Development Roadmap

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Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
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The purpose of this regional variance to a NERC reliability standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the ~~generator~~generator's Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the ~~system~~Bulk Electric System's voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-1a requirement~~The NERC VAR-001-2 Requirement R3 allows Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC standard VAR-001-2 Requirement 4 and Requirement 6.1. The~~

## Standard VAR-001-2 — Voltage and Reactive Control

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drafting team believes that permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

The NERC VAR-001-2 Requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation ~~of that~~ generator operators ~~that the allowed given~~ reactive ~~schedule by~~ schedules under NERC VAR-001-~~1a requires generator operators~~ 2 are required to maintain the reactive output defined in the schedule at all times. This will require ~~the~~ generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to a NERC standard restricts the Transmission Operator to providing only a Voltage Schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the ~~AVR~~ AVR's automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that ~~Automatic Voltage Regulators (AVR)~~ the AVRs are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

The Compliance Monitoring Enforcement Program allows that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002 requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service ~~and operate AVRs~~ operating in automatic voltage control mode with some defined exceptions. This proposed variance to VAR-001-~~WECC-1~~ 2 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the ~~NERC~~ requirement. If the Transmission Operator provides ~~the~~ voltage schedule information in another format, such as in reactive power terms, compliance with the proposed NERC ~~requirements~~ s ~~requires~~ conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the ~~Automatic Voltage~~ automatic voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the

## Standard VAR-001-2 — Voltage and Reactive Control

Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. This is especially true if the reactive change is due to a system problem.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued use of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

This posting is the ~~third 30-day~~fourth comment period of a draft standard that requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing ~~them~~the schedules so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the standard and submit comments by ~~October 27, 2010~~January 6, 2011.

~~WECC Standard VAR-001-WECC-1 is more stringent than a continent-wide standard.~~

The WECC variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 reliability standard. The proposed regional variance in section E contains requirements that are more stringent than the continent-wide requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

### Future Development Plan:

Anticipated Actions	Anticipated Date
1. <del>Industry comments for third draft standard</del> <u>Comments from fourth posting</u> are due	<del>October 25, 2010</del> <u>January 6, 2011</u>
<del>2. Drafting Team to review and respond to industry comments</del>	<del>November 24, 2010</del>
<del>3.2.</del> Post draft standard for Operating Committee approval	January <del>18</del> <u>26</u> , 2011
<del>4.3.</del> Operating Committee approves proposed standard	March <u>2</u> , 2011
<del>5.4.</del> Post draft standard for WECC Board approval	March 2011
<del>6. Post draft standard for NERC comment period</del>	<del>April 2011</del>
<del>7. NERC comment period ends</del>	<del>April 2011</del>
<del>8. Drafting Team completes review and consideration of industry comments to NERC posting</del>	<del>May 2011</del>
<del>9.5.</del> WECC Board approves proposed standard	June 2011
<del>6. Post draft standard for NERC comment period</del>	<u>July 2011</u>

## Standard VAR-001-2 — Voltage and Reactive Control

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Anticipated Actions	Anticipated Date
<u>7. NERC comment period ends</u>	<u>August 2011</u>
<u>8. Drafting Team completes review and consideration of industry comments to NERC posting</u>	<u>September 2011</u>
<del>10.9.</del> Submit NERC Board approval request	<del>July</del> <u>September</u> 2011
<del>11.10.</del> Receive NERC Board approval	<del>August</del> <u>October</u> 2011
<del>12.11.</del> Request FERC approval	<del>September</del> <u>November</u> 2011



**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

Standard VAR-001-2 — Voltage and Reactive Control

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~~A.~~ None

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-2
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.

~~1.1.1.4.4. Generator Operators within the Western Interconnection.~~

#### ~~1.2. Facilities~~

~~1.2.1. On-line generation resources that are part of the Bulk Electric System.~~

~~2.5. (Proposed) Effective Date: On \_\_\_\_\_ The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the ~~second~~first calendar quarter following the ~~date~~six months after Board of ~~the order providing regulatory approval~~Trustees' adoption.~~

### B. Requirements

- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4. Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

Operator to comply with the schedule in automatic voltage control mode (AVR in service and controlling voltage).

- R5.** Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.
- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
  - R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to support its voltage under first Contingency conditions.
  - R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

**C. Measures**

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.

- M4. 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 Requirement 11.

## D. Compliance

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority

Regional Entity.

#### 1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

#### 1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

#### 1.4. Data Retention

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

#### 1.5. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

### 2. Violation Severity Levels (no changes)

## E. Regional Variances

### E.A. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

#### Requirements

**R4-E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation ~~resource~~resources that ~~is~~are on-line and part of the Bulk Electric System ~~to all Generator Operators~~ within the Transmission ~~Operating Operator~~ Area: [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.
- A voltage band for a specified period.

**R2.E.A.14.** Each Transmission Operator shall issue a voltage schedule specified in Requirement **R4E.A.13** at any one of the following points [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning and Same-day Operations*]:

- The generator terminals.
- The high side of the generator step-up transformer.
- The point of interconnection.
- A location designated by mutual agreement between the Transmission Operator and Generator Operator.

**R3.E.A.15.** Each Generator Operator shall convert the voltage schedule specified in Requirement **R4E.A.13** into the voltage set point for the generator excitation system. [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning and Same-day Operations*]

**R4.E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement **R2E.A.14** to the generator terminals within 30 days of request by the Transmission Operator. [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]

**R5.E.A.17.** Each Transmission Operator shall provide ~~at~~ to the Generator Operator, within 30 days of a request for data by the Generator Operator, its transmission equipment data and operating data to support that supports development of the voltage set point conversion methodology ~~within 30 days of request by the Generator Operator~~. [*Violation Risk Factor: Lower*] [*Time Horizon: Operations Planning*]

**R6.E.A.18.** Each Generator Operator shall ensure that it meets the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: [*Violation Risk Factor: Medium*] [*Time Horizon: Real-time Operations*]

**6.1.E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.

**6.2.E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### **C. Measures**

~~M1-M.E.A.13.~~ Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement ~~R1E.A.13~~ are acceptable as evidence.

~~M2-M.E.A.14.~~ The Transmission Operator shall have and provide upon request, evidence that it defined its schedules at one of the points designated ~~points~~ in Requirement ~~R2E.A.14~~. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

~~M3-M.E.A.15.~~ Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement ~~R1E.A.13~~ into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.

~~M4-M.E.A.16.~~ The Generator Operator shall have and provide upon request, evidence that within 30 days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement ~~R3E.A.14~~ to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

~~M5-M.E.A.17.~~ The Transmission Operator shall have and provide upon request, evidence that within 30 days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

~~M6-M.E.A.18.~~ If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts ~~6E.A.18.1~~ through ~~6E.A.18.2~~. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

## ~~D. Compliance~~

### ~~1. Compliance Monitoring Process~~

#### ~~1.1 Compliance Monitoring Responsibility~~

~~Regional Entity~~

#### ~~1.2 Compliance Monitoring Period and Reset Time Frame~~

~~Not applicable.~~

#### ~~1.3 Data Retention~~

The Generator Operators and Transmission Operators shall keep evidence for Measures M1 through M6 for one year plus the current year.

**1.4—Compliance Monitoring and Assessment Processes**

**1.5—Additional Compliance Information**

None

**2. Violation Severity Levels**

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>R1</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to at least one but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in R1 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<b>R2</b>	The Transmission Operator did not specify one of the points when it issued a voltage schedule to at least one Generator Operator but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued a voltage schedule to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<b>R3</b>	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for less than 25% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 25% or more but less than 50% of its	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 50% or more but less than 75% of its	The Generator Operator failed to convert the voltage schedules in Requirement R1 into the voltage set point for the AVR for 75% or more of its generators.



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R-#	Lower-VSL	Moderate-VSL	High-VSL	Severe-VSL
		<del>generators.</del>	<del>generators.</del>	
<b>R4</b>	N/A	N/A	N/A	<del>The Generator Operator did not provide its voltage set point conversion methodology within 30 days of a request by the Transmission Operator.</del>
<b>R5</b>	N/A	N/A	N/A	<del>The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 30 days of a request by the Generator Operator.</del>
<b>R6</b>	N/A	N/A	N/A	<del>The Generator Operator did not show that its design for each control loop external to the AVR provides automatic voltage-controlled response to voltage deviations during System Disturbances, or the Generator Operator did not show that it received Transmission Operator agreement to use the control loop.</del>
E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b><u>E.A.13</u></b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules	For the specified period, the Transmission Operator did not issue one of the voltage schedules	For the specified period, the Transmission Operator did not issue one of the voltage schedules	For the specified period, the Transmission Operator did not issue one of the voltage schedules

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<b>R-#</b>	<b>Lower-VSL</b>	<b>Moderate-VSL</b>	<b>High-VSL</b>	<b>Severe-VSL</b>
	listed in <a href="#">E.A.13</a> to at least one <a href="#">generation resource</a> but less than or equal to 5% of the generation resources that are <a href="#">on-line</a> and part of the BES in the Transmission Operator Area.	listed in <a href="#">E.A.13</a> to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	listed in <a href="#">E.A.13</a> to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	listed in <a href="#">E.A.13</a> to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<a href="#">E.A.14</a>	The Transmission Operator did not specify one of the points when it issued a voltage schedule to at least one <a href="#">generation resource</a> but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued <a href="#">voltage schedules</a> to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued <a href="#">voltage schedules</a> to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	The Transmission Operator did not specify one of the points when it issued <a href="#">voltage schedules</a> to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.
<a href="#">E.A.15</a>	The Generator Operator failed to convert the voltage schedules in Requirement <a href="#">E.A.13</a> into the voltage set point for the AVR for less than 25% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement <a href="#">E.A.13</a> into the voltage set point for the AVR for 25% or more but less than 50% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement <a href="#">E.A.13</a> into the voltage set point for the AVR for 50% or more but less than 75% of its generators.	The Generator Operator failed to convert the voltage schedules in Requirement <a href="#">E.A.13</a> into the voltage set point for the AVR for 75% or more of its generators.
<a href="#">E.A.16</a>	N/A	N/A	N/A	The Generator Operator did not provide its voltage set point conversion methodology within 30 days of a request by the Transmission Operator.
<a href="#">E.A.17</a>	N/A	N/A	N/A	The Transmission Operator did not provide its data to support

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<b>R-#</b>	<b>Lower-VSL</b>	<b>Moderate-VSL</b>	<b>High-VSL</b>	<b>Severe-VSL</b>
				development of the voltage set point conversion methodology within 30 days of a request by the Generator Operator.
<b><u>E.A.18</u></b>	N/A	N/A	N/A	The Generator Operator did not show that its design for each control loop external to the AVR provides automatic voltage-controlled response to voltage deviations during System Disturbances, or the Generator Operator did not show that it received Transmission Operator agreement to use the control loop.

**Version History**

<b>Version</b>	<b>Date</b>	<b>Action</b>	<b>Change Tracking</b>
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
2	TBD	Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
<u>2</u>		<u>Modified to add a WECC region variance</u>	



**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control  
Version 4**

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The WECC-0046 (Regional Variance to VAR-001-2 Voltage and Reactive Control) Drafting Team thanks everyone who submitted comments on the WECC Regional Variance to the NERC VAR-001-2 Voltage and Reactive Control Standard. This standard was posted for a 30-day public comment period from December 8, 2010 through January 7, 2011. WECC distributed the notice for these postings on December 8, 2010. The Standard Drafting Team asked stakeholders to provide feedback on the variance to a NERC reliability standard through a special Standard Comment Form. WECC received comments from three companies representing three of the 10 Industry Segments, as shown in the table on the following page.

In this 'Consideration of Comments' document, stakeholder comments have been organized so that it is easier to see the responses associated with each stakeholder. All comments received on the standard can be viewed in their original format at:

<http://www.wecc.biz/Standards/Development/WECC0046/Lists/WECC0046%20VAR001WEC C1%20Voltage%20and%20Reactive%20Contr1/AllItems.aspx>

If you feel that your comment has been overlooked, please let WECC know immediately. WECC's goal is to give every comment serious consideration in this process. If you feel there has been an error or omission, please contact the Director of Standards, Steve Rueckert, at [steve@wecc.biz](mailto:steve@wecc.biz). In addition, there is a WECC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is described in the Process for Developing and Approving WECC Standards: <http://www.wecc.biz/Standards/Documents/WECC%20Standards%20Development%20Process.pdf>

## Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control

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The Industry Segments are:

- 1 — Transmission Owners
- 2 — RTOs, ISOs
- 3 — Load-serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 — Regional Reliability Organizations, Regional Entities

Commenter		Organization	Industry Segment										
			1	2	3	4	5	6	7	8	9	10	
1.	Bajarang Agrawal	Arizona Public Service Company	✓		✓		✓						
2.	Amir Hammad	Constellation Power Generation					✓						
3.	Koehn, Denise	Bonneville Power Administration	✓										
4.													
5.													

## Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control

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### Index to Questions, Comments, and Responses

Question	Page
1. Do you agree with changing Project WECC-0046/VAR-001-WECC-1 Voltage and Reactive Control to a WECC regional variance to the NERC Reliability Standard VAR-001-2 to prevent a duplication of NERC requirements and prevent the potential for double jeopardy? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.	4
2. Did the drafting implement the regional variance to the NERC reliability standard VAR-001-2 correctly by replacing requirements R3 and R4 of VAR-001-2 with the proposed requirements in Section E? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.	5
3. Does the proposed WECC regional variance to VAR-001-2 create a serious and substantial burden on competitive markets within the interconnection that is not necessary for reliability? If you answered "yes", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.	6
4. Does the proposed regional variance to VAR-001-2 provide an adequate level of reliability to the bulk electric system such that the variance is not likely to cause a serious and substantial threat to public health, safety, welfare, or national security? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.	7
5. Does the proposed regional variance to VAR-001-2 pose a significant adverse impact on reliability or commerce of the interconnection? If you answered "yes", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.	8
6. Has the WECC-0046/VAR-001-WECC-1 Voltage and Reactive Control Drafting Team completed its task? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.	9

**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

1. Do you agree with changing Project WECC-0046/VAR-001-WECC-1 Voltage and Reactive Control to a WECC regional variance to the NERC Reliability Standard VAR-001-2 to prevent a duplication of NERC requirements and prevent the potential for double jeopardy? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Commenter	Yes	No	Comment
Baj Agrawal, Engineering Manager Arizona Public Service Company <a href="mailto:bajarang.agrawal@aps.com">bajarang.agrawal@aps.com</a>	X		
<b>Response:</b>			
Amir Hammad - Manager, Regulatory Affairs Constellation Power Generation (443) 677-9762 cell <a href="mailto:amir.hammad@constellation.com">amir.hammad@constellation.com</a>		X	<p>Constellation believes that the mission of the drafting team is a good one in that a TO can allow a GOP to operate in a mode other than automatic as long as the TO is confident that the voltage set point is being met. However, Constellation objects to creating a variance to VAR-001-2.</p> <p>Adding the proposed variance to VAR-001-2 ignores VAR-002, which specifically states that a GOP must operate in automatic voltage control mode. If a GOP was allowed to operate in another mode, such as power factor mode, under a regional variance of VAR-001-2, the GOP could be non compliant with VAR-002 R1. Furthermore, some of the language in the proposed variance mimics the language in VAR-002-1.1b R2, which creates the potential for double jeopardy. E.A.18 is redundant to E.A.15.</p> <p>A more clear and effective approach is to revise VAR-002 to remove the restriction that a GOP must operate in automatic voltage control mode instead of pursuing a WECC variance for VAR-001-2.</p>
<p><b>Response:</b> In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that the AVRs are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008. The drafting team views its mission in WECC Project-0046 as providing guidance on voltage schedules as a result of the WECC regional VAR-002-WECC-1 standard, which requires the operation of generators' AVRs to be in service and controlling voltage. The Project WECC-0046 drafting team recognizes that NERC VAR-002-1 standard allows for generators to operate in modes other than voltage control mode. The NERC standards do not address the need in the Western Interconnection to provide voltage support during outage conditions. The WECC regional VAR-002-WECC-1 standard, the NERC VAR-001-2 and VAR-002-1 standards, and the WECC regional variance to VAR-001-2 are designed to assure reliability in the Western Interconnection by maintaining AVRs in automatic control mode while minimizing the burden on Transmission</p>			

**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
<p>Operators and Generator Operators.</p> <p>The drafting team cannot find a situation that would cause double jeopardy between NERC VAR-002-1.1b R2 and the WECC regional variance to VAR-001-2. The commenter did not provide an example where double jeopardy might occur. We do not believe there is a double jeopardy issue the VAR-002-1.1b R2 and the proposed WECC regional variance. The WECC regional variance clarifies and works together with the NERC standards.</p> <p>Requirement E.A.15 addresses the conversion of TO's schedule to an AVR set point and requirement E.A.18 addresses the use of a control loop that is external to an AVR. The drafting team does not believe that these requirements are redundant.</p>			
<p>Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a>.</p> <p>Submitted on behalf of the following SMEs:</p> <p>Frank Puyleart, Steve Hitchens, Rebecca Berdahl</p>	X		
<p>Response:</p>			
<p>Response:</p>			

2. Did the drafting implement the regional variance to the NERC reliability standard VAR-001-2 correctly by replacing requirements R3 and R4 of VAR-001-2 with the proposed requirements in Section E? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Commenter	Yes	No	Comment
<p>Baj Agrawal, Engineering Manager Arizona Public Service Company <a href="mailto:bajarang.agrawal@aps.com">bajarang.agrawal@aps.com</a></p>	X		
<p>Response:</p>			
<p>Amir Hammad - Manager, Regulatory Affairs Constellation Power Generation</p>		X	<p>Constellation believes that the drafting team should submit proposed revisions to VAR-002 in order to achieve their stated goal of allowing the GOPs the flexibility of operating in a mode other than</p>



**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
(443) 677-9762 cell <a href="mailto:amir.hammad@constellation.com">amir.hammad@constellation.com</a>			automatic, should the TOP approve that mode of operation.
Response: It is not in the Project WECC-0046 scope to allow flexibility in operating an AVR in a mode other than controlling voltage. Revising VAR-002 as requested is not an option for the reasons stated in the response to Constellation’s comments to question 1.			
Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a> .  Submitted on behalf of the following SMEs:  Frank Puyleart, Steve Hitchens, Rebecca Berdahl			BPA feels that this needs to be addressed during the NERC/FERC review as to whether this variance can actually replace these requirements.
Response: The “Rules of Procedure of the North American Electric Reliability Corporation” (Appendix 3A page 31) permits the development of Regional Variance to a NERC reliability standard on an Interconnection-wide Basis when the Regional Reliability Organization has valid justification and when the variance is not inconsistent with or less stringent than the NERC reliability standard. The variance may be an alternative method for obtaining the same reliability objective as the continent standard and is typically necessitated by a physical difference. A variance is embodied within a reliability standard and as such, if adopted by NERC and approved by the ERO governmental authority, shall be enforce within the applicable regional entity or regional entities pursuant to delegated authority.			
Response:			

3. Does the proposed WECC regional variance to VAR-001-2 create a serious and substantial burden on competitive markets within the interconnection that is not necessary for reliability? If you answered "yes", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Commenter	Yes	No	Comment
Baj Agrawal, Engineering Manager Arizona Public Service Company <a href="mailto:bajarang.agrawal@aps.com">bajarang.agrawal@aps.com</a>		X	
Response:			

**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
Amir Hammad - Manager, Regulatory Affairs Constellation Power Generation (443) 677-9762 cell <a href="mailto:amir.hammad@constellation.com">amir.hammad@constellation.com</a>			
<b>Response:</b>			
Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a> .  Submitted on behalf of the following SMEs:  Frank Puyleart, Steve Hitchens, Rebecca Berdahl		X	BPA will not be changing its operations due to this variance; therefore, do not expect impacts on competitive markets within the interconnection that is not necessary for reliability.
<b>Response:</b> Thank you for your response.			
<b>Response:</b>			

4. Does the proposed regional variance to VAR-001-2 provide an adequate level of reliability to the bulk electric system such that the variance is not likely to cause a serious and substantial threat to public health, safety, welfare, or national security? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Commenter	Yes	No	Comment
Baj Agrawal, Engineering Manager Arizona Public Service Company <a href="mailto:bajarang.agrawal@aps.com">bajarang.agrawal@aps.com</a>	X		
<b>Response:</b>			
Amir Hammad - Manager, Regulatory Affairs			

**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
Constellation Power Generation (443) 677-9762 cell <a href="mailto:amir.hammad@constellation.com">amir.hammad@constellation.com</a>			
Response:			
Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a> .  Submitted on behalf of the following SMEs:  Frank Puyleart, Steve Hitchens, Rebecca Berdahl			BPA will not be changing its operations due to this variance; therefore, do not expect impacts to public health, safety, welfare or national security.
Response: Thank you for your response.			
Response:			

5. Does the proposed regional variance to VAR-001-2 pose a significant adverse impact on reliability or commerce of the interconnection? If you answered "yes", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Commenter	Yes	No	Comment
Baj Agrawal, Engineering Manager Arizona Public Service Company <a href="mailto:bajarang.agrawal@aps.com">bajarang.agrawal@aps.com</a>		X	
Response:			
Amir Hammad - Manager, Regulatory Affairs Constellation Power Generation (443) 677-9762 cell <a href="mailto:amir.hammad@constellation.com">amir.hammad@constellation.com</a>			

**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
<a href="#">Response:</a>			
Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a> .  Submitted on behalf of the following SMEs:  Frank Puyleart, Steve Hitchens, Rebecca Berdahl		X	BPA will not be changing its operations due to this variance; therefore, do not expect impacts on reliability or commerce of the interconnection.
<a href="#">Response: Thank you for your response.</a>			
<a href="#">Response:</a>			

6. Has the WECC-0046/VAR-001-WECC-1 Voltage and Reactive Control Drafting Team completed its task? If you answered "no", please suggest wording changes, or indicate any additional substantive items that the drafting team should address.

**Summary Consideration:**

Commenter	Yes	No	Comment
Baj Agrawal, Engineering Manager Arizona Public Service Company <a href="mailto:bajarang.agrawal@aps.com">bajarang.agrawal@aps.com</a>		X	<p>E.A.15 to E.A.17 are unnecessary requirements and do not improve reliability in any way. Typically in our system a TO will ask a GO to simply increase or decrease a VAR output of a generator and then leave the generator at that voltage set point till further notified. Thus, there are no set point calculations to be made and a GO will not know how to make those calculations since the system changes are occurring all the time. Also, such calculations are unnecessary and do not improve the reliability of the system in anyway and unnecessarily add burden and to GO.</p> <p>E.A.15 requires the conversion of voltage schedules to set point for generator excitation system which is typically voltage regulator set point. Voltage regulator set points are not necessarily same as the terminal voltage set points depending upon the excitation system type. If the drafting team wants to retain E.A.15, there should be an option to convert the voltage schedules to the terminal voltage also. The following wording is suggested:</p> <p>E.A.15 Each Generator Operator shall convert the voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system or generator terminal voltage.</p>

**Comment Report Form for WECC Regional Variance VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
			Alternatively, if the TO specifies a generator terminal voltage set point, no calculations are required.
<p>Response: The APS voltage scheduling methodology fits into requirement E.A.13. The drafting team believes the APS Transmission Operator’s current voltage scheduling methodology and process is a conversion of a voltage schedule into an AVR set point. Not all Transmission Operators are providing a schedule that translates directly into an AVR voltage set point. Often Transmission Operators and Generators Operators have an undocumented methodology for converting a schedule into an AVR set point. The drafting team believes there is a need for documenting and writing these methodologies in order to demonstrate compliance with existing NERC requirements. These requirements clarify the NERC requirements and system operation.</p> <p>The drafting team believes the current wording in E.A.15 permits the conversion of a voltage schedule to the point that controls the generator’s automatic voltage regulator.</p>			
<p>Amir Hammad - Manager, Regulatory Affairs Constellation Power Generation (443) 677-9762 cell <a href="mailto:amir.hammad@constellation.com">amir.hammad@constellation.com</a></p>		X	No, the intention of the drafting team was to allow a GOP to operate in a mode other than automatic as long as the TO approves. Revising VAR-002 to remove the restriction that a GOP must operate in automatic voltage control mode is a more clear and effective approach than creating a regional variance in VAR-001.
<p>Response: It is not in the Project WECC-0046 scope to allow flexibility in operating an AVR in a mode other than controlling voltage. Revising VAR-002 as requested is not an option for the reasons stated in the response to Constellation’s comments to question 1.</p>			
<p>Denise Koehn, Bonneville Power Administration, <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a>.  Submitted on behalf of the following SMEs:  Frank Puyleart, Steve Hitchens, Rebecca Berdahl</p>	X		
<p>Response:</p>			
<p>Response:</p>			

## Standard VAR-001-2 — Voltage and Reactive Control

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### Regional Variance Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 6, 2010
5. Second draft comment period ended	July 12, 2010
6. Drafting Team to review and respond to industry comments	August 11, 2010
7. Post third draft standard for industry comments	September 24, 2010
8. Industry comments for third draft standard are due	October 25, 2010
9. Drafting Team to review and respond to industry comments	November 24, 2010
10. Post fourth draft as a regional variance to NERC VAR-001-2 requirements R3 and R4	December 7, 2010
11. Comments from fourth posting are due	January 7, 2011
12. Post draft standard for Operating Committee approval	January 26, 2011

#### Description of Current Draft:

The current draft has been converted from a Standard into a Regional Variance to the NERC VAR-001-2 standard. The format incorporates the NERC Standard into the document with minor additions to address the scope of the variance. The regional variance specifics are included as section E and in this case are intended to replace NERC VAR-001-2 requirements R3 and R4 as noted at the beginning of section E. The redline version of section E identifies what was changed from the last posting.

The purpose of this regional variance to a NERC reliability standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection. The “Rules of Procedure of the North American Electric Reliability Corporation” (Appendix 3A page 31) permits the development of regional variance to a NERC reliability standard on an Interconnection-wide basis when the Regional Reliability Organization has valid justification and when the variance is not inconsistent with or less stringent than the NERC reliability standard. The variance is an alternative method for obtaining the same reliability objective as the continent standard and is typically necessitated by a physical difference. A variance is embodied within a reliability standard and as such, if adopted by NERC and approved by the ERO governmental authority, shall be enforce within the applicable regional entity or regional entities pursuant to delegated authority.

## Standard VAR-001-2 — Voltage and Reactive Control

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Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator's Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the Bulk Electric System's voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-2 Requirement R3 allows Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC standard VAR-001-2 Requirement 4 and Requirement 6.1. The drafting team believes that permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

The NERC VAR-001-2 Requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation that generator operators given reactive schedules under NERC VAR-001-2 are required to maintain the reactive output defined in the schedule at all times. This will require generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to a NERC standard restricts the Transmission Operator to providing only a voltage schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR's automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that the AVRs are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

The Compliance Monitoring Enforcement Program allows that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002 requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service operating in automatic voltage control mode with some defined exceptions. This proposed variance to VAR-001-2 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the requirement. If the Transmission Operator provides voltage schedule information in another format, such as in reactive power terms, compliance with the proposed requirements require conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the automatic voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

## Standard VAR-001-2 — Voltage and Reactive Control

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During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. This is especially true if the reactive change is due to a system problem.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued use of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

With this posting the standard drafting team is requesting Operating Committee approval of the draft regional variance to the NERC VAR-001-2 standard. The WECC regional variance requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing the schedules so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the regional variance to a NERC reliability standard and submit comments by February 28, 2011.

The WECC variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 reliability standard. The proposed regional variance in section E contains requirements that are more stringent than the continent-wide requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

### Future Development Plan:

Anticipated Actions	Anticipated Date
1. Operating Committee approves proposed standard	March 2, 2011
2. Post draft standard for WECC Board approval	March 2011
3. Post draft standard for 45 day NERC comment period	April 2011
4. NERC comment period ends	May 2011
5. WECC Board approves proposed standard	June 2011
6. Post draft standard for 15 day NERC comment period	July 2011
7. NERC comment period ends	August 2011



## Standard VAR-001-2 — Voltage and Reactive Control

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Anticipated Actions	Anticipated Date
8. Drafting Team completes review and consideration of industry comments to NERC posting	September 2011
9. Submit NERC Board approval request	September 2011
10. Receive NERC Board approval	October 2011
11. Request FERC approval	November 2011

**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**None**

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-2
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1.** Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2.** Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3.** The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1.** Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2.** For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4.** Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5.** Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

## Standard VAR-001-2 — Voltage and Reactive Control

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scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
  - R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to support its voltage under first Contingency conditions.
  - R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### D. Compliance

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority

Regional Entity.

#### 1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

#### 1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

#### 1.4. Data Retention

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

#### 1.5. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

### 2. Violation Severity Levels (no changes)

## E. Regional Variances

### E.A. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

#### Requirements

**E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.

- A voltage band for a specified period.
- E.A.14.** Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:*
- The generator terminals.
  - The high side of the generator step-up transformer.
  - The point of interconnection.
  - A location designated by mutual agreement between the Transmission Operator and Generator Operator.
- E.A.15.** Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*
- E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*
- E.A.18.** Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*
- E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.
  - E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures

- M.E.A.13.** Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.

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- M.E.A.14.** The Transmission Operator shall have and provide upon request, evidence that it provided one of the voltage schedule reference points in Requirement E.A.14 for each generation resource in its Area to the Generator Operator. Dated letters, e-mail, or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.
- M.E.A.15.** Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.
- M.E.A.16.** The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.17.** The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.18.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

### Violation Severity Levels

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.13</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.

**Standard VAR-001-2 — Voltage and Reactive Control**

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.14</b>	The Transmission Operator did not provide a voltage schedule reference point for at least one but less than or equal to 5% of the generation resources in the Transmission Operator area.	The Transmission Operator did not provide a voltage schedule reference point for more than 5% but less than or equal to 10% of the generation resources in the Transmission Operator Area.	The Transmission Operator did not provide a voltage schedule reference point for more than 10% but less than or equal to 15% of the generation resources in the Transmission Operator Area.	The Transmission Operator did not provide a voltage schedule reference point for more than 15% of the generation resources in the Transmission Operator Area.
<b>E.A.15</b>	The Generator Operator failed to convert at least one voltage schedule in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of the voltage schedules.	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of the voltage schedules.
<b>E.A.16</b>	The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.	The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.	The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.	The Generator Operator did not provide its voltage set point conversion methodology within 120 days of a request by the Transmission Operator.
<b>E.A.17</b>	The Transmission Operator provided its data to support development of the voltage set point conversion methodology than 30 days but less than or equal to 60 days of a request by the Generator Operator.	The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Generator Operator.	The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Generator Operator.	The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 120 days of a request by the Generator Operator.



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E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.18</b>	N/A	The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.	The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.	The Generator Operator did not meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.

### Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
2	TBD	Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
2		Modified to add a WECC region variance	

## Standard VAR-001-2 — Voltage and Reactive Control

### Regional Variance Development Roadmap

*This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.*

#### Development Steps Completed:

Completed Actions	Completion Date
1. Post draft standard for initial industry comments	December 14, 2009
2. Receive Initial industry comments from First Posting	January 29, 2010
3. Drafting Team to review and respond to initial industry comments	March 4, 2010
4. Post second draft standard for industry comments	May 6, 2010
5. Second draft comment period ended	July 12, 2010
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8. Industry comments for third draft standard are due	October 25, 2010
9. Drafting Team to review and respond to industry comments	November 24, 2010
10. Post fourth draft as a regional variance to NERC VAR-001-2 requirements R3 and R4	December 7, 2010
<u>11. Comments from fourth posting are due</u>	<u>January 7, 2011</u>
<u>12. Post draft standard for Operating Committee approval</u>	<u>January 26, 2011</u>

#### Description of Current Draft:

The current draft has been converted from a Standard into a Regional Variance- to the NERC VAR-001-2 standard. The format incorporates the NERC Standard into the document with minor additions to address the scope of the variance. The regional variance specifics are included as section E and in this case are intended to replace NERC VAR-001-2 requirements R3 and R4 as noted at the beginning of section E. ~~For clarity, existing text of NERC VAR-001-2 is not redlined even though it was not included in the last posting.~~ The redline version of section E identifies what was changed from the last posting.

The purpose of this regional variance to a NERC reliability standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection. The “Rules of Procedure of the North American Electric Reliability Corporation” (Appendix 3A page 31) permits the development of regional variance to a NERC reliability standard on an Interconnection-wide basis when the Regional Reliability Organization has valid justification and when the variance is not inconsistent with or less stringent than the NERC reliability standard. The variance is an alternative method for obtaining the same reliability objective as the continent standard and is typically necessitated by a physical difference. A variance is embodied within a reliability standard and as such, if adopted by

## Standard VAR-001-2 — Voltage and Reactive Control

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NERC and approved by the ERO governmental authority, shall be enforce within the applicable regional entity or regional entities pursuant to delegated authority.

Analysis of disturbances in the Western Interconnection have demonstrated that during and immediately following a disturbance, the generator's Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the Bulk Electric System's voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators.

The NERC VAR-001-2 Requirement R3 allows Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC standard VAR-001-2 Requirement 4 and Requirement 6.1. The drafting team believes that permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

The NERC VAR-001-2 Requirement R4 allows Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation that generator operators given reactive schedules under NERC VAR-001-2 are required to maintain the reactive output defined in the schedule at all times. This will require generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to a NERC standard restricts the Transmission Operator to providing only a ~~Voltage Schedule~~voltage schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR's automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

In the Western Interconnection, System Operating Limits for transmission paths in the Bulk Electric System assume that the AVRs are in service to control voltage to support the transfer capability. On April 16, 2008, the WECC Board of Directors approved VAR-002-WECC-1 to ensure that the AVRs are in service and controlling voltage so that generators provide the proper voltage support when generation and transmission outages occur. Subsequently, the NERC Board of Trustees approved VAR-002-WECC-1 standard on October 29, 2008.

The Compliance Monitoring Enforcement Program allows that WECC standard requirements may be more, but not less, stringent than NERC requirements. NERC VAR-002 requires Generator Operators to maintain the voltage or Reactive Power output as directed by the Transmission Operators. VAR-002-WECC-1 requires that Generators Operators maintain the AVRs in service operating in automatic voltage control mode with some defined exceptions. This proposed variance to VAR-001-2 does not allow AVR operation to be defined by a reactive power schedule.

If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the requirement. If the Transmission Operator provides voltage schedule information in another format, such as in reactive power terms, compliance with the proposed requirements require conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the automatic voltage control. The resulting voltage needs to be monitored by the Transmission

## Standard VAR-001-2 — Voltage and Reactive Control

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Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. This is especially true if the reactive change is due to a system problem.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued use of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

~~This posting is the fourth comment period of a draft standard that~~ With this posting the standard drafting team is requesting Operating Committee approval of the draft regional variance to the NERC VAR-001-2 standard. The WECC regional variance requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing the schedules so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the regional variance to a NERC reliability standard and submit comments by ~~January 6~~ February 28, 2011.

The WECC variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 reliability standard. The proposed regional variance in section E contains requirements that are more stringent than the continent-wide requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

### Future Development Plan:

Anticipated Actions	Anticipated Date
<del>1. Comments from fourth posting are due</del>	<del>January 6, 2011</del>
<del>2. Post draft standard for Operating Committee approval</del>	<del>January 26, 2011</del>
<del>3.1. </del> Operating Committee approves proposed standard	March 2, 2011
<del>4.2. </del> Post draft standard for WECC Board approval	March 2011
<u>3. Post draft standard for 45 day NERC comment period</u>	<u>April 2011</u>

## Standard VAR-001-2 — Voltage and Reactive Control

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Anticipated Actions	Anticipated Date
4. <u>NERC comment period ends</u>	<u>May 2011</u>
5. WECC Board approves proposed standard	June 2011
6. Post draft standard for <u>15 day</u> NERC comment period	July 2011
7. NERC comment period ends	August 2011
8. Drafting Team completes review and consideration of industry comments to NERC posting	September 2011
9. Submit NERC Board approval request	September 2011
10. Receive NERC Board approval	October 2011
11. Request FERC approval	November 2011

### Definitions of Terms Used in Standard

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**None**

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-2
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1.** Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2.** Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3.** The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1.** Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2.** For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4.** Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5.** Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

## Standard VAR-001-2 — Voltage and Reactive Control

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scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
  - R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to support its voltage under first Contingency conditions.
  - R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### D. Compliance



**1. Compliance Monitoring Process**

**1.1. Compliance Enforcement Authority**

Regional Entity.

**1.2. Compliance Monitoring Period and Reset Time Frame**

One calendar year.

**1.3. Compliance Monitoring and Enforcement Processes:**

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

**1.4. Data Retention**

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

**1.5. Additional Compliance Information**

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

**2. Violation Severity Levels (no changes)**

**E. Regional Variances**

**E.A. Regional Variance for the Western Electricity Coordinating Council**

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

**Requirements**

**E.A.13.** Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.

- A voltage band for a specified period.

**E.A.14.** Each Transmission Operator shall ~~issue a voltage schedule specified in Requirement E.A.13 at any~~ provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:*

- The generator terminals.
- The high side of the generator step-up transformer.
- The point of interconnection.
- A location designated by mutual agreement between the Transmission Operator and Generator Operator.

**E.A.15.** Each Generator Operator shall convert ~~the each~~ voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]*

**E.A.16.** Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by ~~the its~~ Transmission Operator. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

**E.A.17.** Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. *[Violation Risk Factor: Lower] [Time Horizon: Operations Planning]*

**E.A.18.** Each Generator Operator shall ~~ensure that it meets~~ meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: *[Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]*

**E.A.18.1.** Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.

**E.A.18.2.** Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures

**M.E.A.13.** Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in Requirement E.A.13 are acceptable as evidence.

## Standard VAR-001-2 — Voltage and Reactive Control

- M.E.A.14.** The Transmission Operator shall have and provide upon request, evidence that it ~~defined its schedules at provided~~ one of the voltage schedule reference points designated in Requirement E.A.14- for each generation resource in its Area to the Generator Operator. Dated ~~reports, spreadsheets, letters, e-mail,~~ or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.
- M.E.A.15.** Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.
- M.E.A.16.** The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.17.** The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.
- M.E.A.18.** If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

### Violation Severity Levels

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.13</b>	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.	For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.

## Standard VAR-001-2 — Voltage and Reactive Control

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
<b>E.A.14</b>	The Transmission Operator did not <del>specify one of the points when it issued</del> <u>provide a</u> voltage schedule <del>reference point for</del> at least one <del>generation resource</del> but less than or equal to 5% of the generation resources <del>that are on-line and part of the BES</del> in the Transmission Operator <del>Area-area</del> .	The Transmission Operator did not <del>specify one of the points when it issued</del> <u>provide a</u> voltage <del>schedules</del> <u>reference point for</u> more than 5% but less than or equal to 10% of the generation resources <del>that are on-line and part of the BES</del> in the Transmission Operator Area.	The Transmission Operator did not <del>specify one of the points when it issued</del> <u>a</u> voltage <del>schedules</del> <u>reference point for</u> more than 10% but less than or equal to 15% of the generation resources <del>that are on-line and part of the BES</del> in the Transmission Operator Area.	The Transmission Operator did not <del>specify one of the points when it issued</del> <u>provide a</u> voltage <del>schedules</del> <u>reference point for</u> more than 15% of the generation resources <del>that are on-line and part of the BES</del> in the Transmission Operator Area.
<b>E.A.15</b>	The Generator Operator failed to convert <del>the at least one</del> <u>schedule</u> in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of <del>its generators</del> <u>the voltage schedules</u> .	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of <del>its generators</del> <u>the voltage schedules</u> .	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of <del>its generators</del> <u>the voltage schedules</u> .	The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of <del>its generators</del> <u>the voltage schedules</u> .
<b>E.A.16</b>	<del>N/A</del> <u>The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.</u>	<del>N/A</del> <u>The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.</u>	<del>N/A</del> <u>The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.</u>	The Generator Operator did not provide its voltage set point conversion methodology within <del>30</del> <u>120</u> days of a request by the Transmission Operator.
<b>E.A.17</b>	<del>N/A</del> <u>The Transmission Operator provided its data to support development of the voltage set</u>	<del>N/A</del> <u>The Transmission Operator provided its data to support development of the voltage set</u>	<del>N/A</del> <u>The Transmission Operator provided its data to support development of the voltage set</u>	The Transmission Operator did not provide its data to support development of the voltage set point conversion

## Standard VAR-001-2 — Voltage and Reactive Control

E #	Lower VSL	Moderate VSL	High VSL	Severe VSL
	<u>point conversion methodology than 30 days but less than or equal to 60 days of a request by the Generator Operator.</u>	<u>point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Generator Operator.</u>	<u>point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Generator Operator.</u>	methodology within <del>30</del> 120 days of a request by the Generator Operator.
E.A.18	N/A	N/A <u>The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	N/A <u>The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	The Generator Operator did not <del>show that its design for each</del> meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR provides automatic voltage-controlled response to voltage deviations during System Disturbances, or the Generator Operator did not show that it received Transmission Operator agreement to use the control loop manage Mvar loading.

### Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
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**Standard VAR-001-2 — Voltage and Reactive Control**

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2		Modified to add a WECC region variance	
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## Standard VAR-001-2 — Voltage and Reactive Control

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If the Transmission Operator provides a schedule of voltages to the Generator Operator, the Generator Operator can more easily maintain compliance with the requirement. If the Transmission Operator provides voltage schedule information in another format, such as in reactive power terms, compliance with the proposed requirements require conversion of the operating instruction to a voltage value by the Generator Operator. The Generator Operator uses the converted value to set the automatic voltage control. The resulting voltage needs to be monitored by the Transmission Operator to ensure the desired outcome is achieved or the Transmission Operator needs to issue additional schedules.



## Standard VAR-001-2 — Voltage and Reactive Control

During the VAR-002-WECC-1 standard development process, the industry comments noted that not all WECC Transmission Operators provide voltage schedules to their Generator Operators. Providing reactive power schedules (instead of specific voltage levels) forces Generator Operators to manually adjust their AVR voltage setting to a setting that will provide the exact amount of reactive power in the schedule.

It is recognized that during the course of a day, system dynamics may result in changes in reactive output such that the generator will no longer produce the amount of reactive power specified by the Transmission Operator's reactive power schedule. If the Generator Operator alters the amount of reactive power provided by the generator to return it to the schedule, there is higher risk that such action will result in the generator doing the exact opposite of what is needed to prevent a voltage collapse and will expose the Western Interconnection to a risk of blackout. This is especially true if the reactive change is due to a system problem.

The drafting team surveyed Transmission Operators and Generator Operators to identify scheduling practices that are causing confusion. The survey results identified a rationale that will accommodate the continued use of providing direction in reactive power terms rather than requiring all Transmission Operators to define the stable system voltage with the exclusive use of a voltage schedule.

With this posting the standard drafting team is requesting Operating Committee approval of the draft regional variance to the NERC VAR-001-2 standard. The WECC regional variance requires Transmission Operators to issue schedules but identifies the methodologies to be used by Generator Owners for implementing the schedules so as to maintain compliance without burdensome manual intervention by operating personnel. Please review the regional variance to a NERC reliability standard and submit comments by February 28, 2011.

The WECC variance to VAR-001-2 is an alternative approach to meeting the same reliability objective as the NERC VAR-001-2 reliability standard. The proposed regional variance in section E contains requirements that are more stringent than the continent-wide requirements R3 and R4 of VAR-001-2 or provides a specific alternative approach to meeting the same reliability objective.

### Future Development Plan:

<u>Anticipated Actions</u>	<u>Anticipated Date</u>
<u>1. Operating Committee approves proposed standard</u>	<u>March 2, 2011</u>
<u>2. Post draft standard for WECC Board approval</u>	<u>March 2011</u>
<u>3. Post draft standard for 45 day NERC comment period</u>	<u>April 2011</u>
<u>4. NERC comment period ends</u>	<u>May 2011</u>
<u>5. WECC Board approves proposed standard</u>	<u>June 2011</u>
<u>6. Post draft standard for 15 day NERC comment period</u>	<u>July 2011</u>
<u>7. NERC comment period ends</u>	<u>August 2011</u>

## Standard VAR-001-2 — Voltage and Reactive Control

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<u>Anticipated Actions</u>	<u>Anticipated Date</u>
<u>8. Drafting Team completes review and consideration of industry comments to NERC posting</u>	<u>September 2011</u>
<u>9. Submit NERC Board approval request</u>	<u>September 2011</u>
<u>10. Receive NERC Board approval</u>	<u>October 2011</u>
<u>11. Request FERC approval</u>	<u>November 2011</u>

**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these definitions will be removed from the standard and added to the Glossary.*

**None**

### A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-2
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
  - 4.1. Transmission Operators.
  - 4.2. Purchasing-Selling Entities.
  - 4.3. Load Serving Entities.
  - 4.4. Generator Operators within the Western Interconnection.
5. **(Proposed) Effective Date:** The first day of the first calendar quarter six months after applicable regulatory approval; or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter six months after Board of Trustees' adoption.

### B. Requirements

- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load – within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall specify criteria that exempts generators from compliance with the requirements defined in Requirement 4, and Requirement 6.1.
  - R3.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
  - R3.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- R4. Each Transmission Operator shall specify a voltage or Reactive Power schedule <sup>1</sup> 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).
- R5. Each Purchasing-Selling Entity and Load Serving Entity shall arrange for (self-provide or purchase) reactive resources – which may include, but is not limited to, reactive generation

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<sup>1</sup> The voltage schedule is a target voltage to be maintained within a tolerance band during a specified period.

## Standard VAR-001-2 — Voltage and Reactive Control

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scheduling; transmission line and reactive resource switching;, and controllable load– to satisfy its reactive requirements identified by its Transmission Service Provider.

- R6.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
  - R6.1.** 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.
- R7.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- 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 and Interconnection voltages within established limits.
- R9.** Each Transmission Operator shall maintain reactive resources – which may include, but is not limited to, reactive generation scheduling; transmission line and reactive resource switching;, and controllable load– to support its voltage under first Contingency conditions.
  - R9.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R10.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R11.** 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.
- R12.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

### C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule as specified in Requirement 4 to each Generator Operator it requires to follow such a schedule.
- M2.** 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 in accordance with Requirement 3.2.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in Requirement 6.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** 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 Requirement 11.

### D. Compliance

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority

Regional Entity.

#### 1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

#### 1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

#### 1.4. Data Retention

The Transmission Operator shall retain evidence for Measures 1 through 4 for 12 months.

The Compliance Monitor shall retain any audit data for three years.

#### 1.5. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

### 2. Violation Severity Levels (no changes)

## E. Regional ~~Differences~~Variances

~~None identified.~~

### E.A. Regional Variance for the Western Electricity Coordinating Council

The following Interconnection-wide variance shall be applicable in the Western Electricity Coordinating Council (WECC) and replaces, in their entirety, Requirements R3 and R4. Please note that Requirement R3 is deleted and R4 is replaced with the following requirements.

#### Requirements

E.A.13. Each Transmission Operator shall issue any one of the following types of voltage schedules to the Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area: [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

- A voltage set point with a voltage tolerance band and a specified period.
- An initial volt-ampere reactive output or initial power factor output with a

voltage tolerance band for a specified period that the Generator Operator uses to establish a generator bus voltage set point.

- A voltage band for a specified period.

E.A.14. Each Transmission Operator shall provide one of the following voltage schedule reference points for each generation resource in its Area to the Generator Operator. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]:

- The generator terminals.
- The high side of the generator step-up transformer.
- The point of interconnection.
- A location designated by mutual agreement between the Transmission Operator and Generator Operator.

E.A.15. Each Generator Operator shall convert each voltage schedule specified in Requirement E.A.13 into the voltage set point for the generator excitation system. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning and Same-day Operations]

E.A.16. Each Generator Operator shall provide its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals within 30 calendar days of request by its Transmission Operator. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

E.A.17. Each Transmission Operator shall provide to the Generator Operator, within 30 calendar days of a request for data by the Generator Operator, its transmission equipment data and operating data that supports development of the voltage set point conversion methodology. [Violation Risk Factor: Lower] [Time Horizon: Operations Planning]

E.A.18. Each Generator Operator shall meet the following control loop specifications if the Generator Operator uses control loops external to the Automatic Voltage Regulators (AVR) to manage MVar loading: [Violation Risk Factor: Medium] [Time Horizon: Real-time Operations]

E.A.18.1. Each control loop's design incorporates the AVR's automatic voltage controlled response to voltage deviations during System Disturbances.

E.A.18.2. Each control loop is only used by mutual agreement between the Generator Operator and the Transmission Operator affected by the control loop.

### Measures

M.E.A.13. Each Transmission Operator shall have and provide upon request, evidence that it provided the voltage schedules to the Generator Operator. Dated spreadsheets, reports, voice recordings, or other documentation containing the voltage schedule including set points, tolerance bands, and specified periods as required in

Requirement E.A.13 are acceptable as evidence.

M.E.A.14. The Transmission Operator shall have and provide upon request, evidence that it provided one of the voltage schedule reference points in Requirement E.A.14 for each generation resource in its Area to the Generator Operator. Dated letters, e-mail, or other documentation that contains notification to the Generator Operator of the voltage schedule reference point for each generation resource are acceptable as evidence.

M.E.A.15. Each Generator Operator shall have and provide upon request, evidence that it converted a voltage schedule as described in Requirement E.A.13 into a voltage set point for the AVR. Dated spreadsheets, logs, reports, or other documentation are acceptable as evidence.

M.E.A.16. The Generator Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Transmission Operator it provided its voltage set point conversion methodology from the point in Requirement E.A.14 to the generator terminals. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

M.E.A.17. The Transmission Operator shall have and provide upon request, evidence that within 30 calendar days of request by its Generator Operator it provided data to support development of the voltage set point conversion methodology. Dated reports, spreadsheets, or other documentation are acceptable as evidence.

M.E.A.18. If the Generator Operator uses outside control loops to manage MVar loading, the Generator Operator shall have and provide upon request, evidence that it met the control loop specifications in sub-parts E.A.18.1 through E.A.18.2. Design specifications with identified agreed-upon control loops, system reports, or other dated documentation are acceptable as evidence.

**Violation Severity Levels**

<u>E #</u>	<u>Lower VSL</u>	<u>Moderate VSL</u>	<u>High VSL</u>	<u>Severe VSL</u>
<u>E.A.13</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to at least one generation resource but less than or equal to 5% of the generation resources that are on-line and part of the BES in the Transmission</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 5% but less than or equal to 10% of the generation resources that are on-line and part of the BES in the Transmission</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 10% but less than or equal to 15% of the generation resources that are on-line and part of the BES in the Transmission</u>	<u>For the specified period, the Transmission Operator did not issue one of the voltage schedules listed in E.A.13 to more than 15% of the generation resources that are on-line and part of the BES in the Transmission Operator Area.</u>



**Standard VAR-001-2 — Voltage and Reactive Control**

<u>E #</u>	<u>Lower VSL</u>	<u>Moderate VSL</u>	<u>High VSL</u>	<u>Severe VSL</u>
	<u>Operator Area.</u>	<u>Operator Area.</u>	<u>Operator Area.</u>	
<u>E.A.14</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for at least one but less than or equal to 5% of the generation resources in the Transmission Operator area.</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for more than 5% but less than or equal to 10% of the generation resources in the Transmission Operator Area.</u>	<u>The Transmission Operator did not a voltage schedule reference point for more than 10% but less than or equal to 15% of the generation resources in the Transmission Operator Area.</u>	<u>The Transmission Operator did not provide a voltage schedule reference point for more than 15% of the generation resources in the Transmission Operator Area.</u>
<u>E.A.15</u>	<u>The Generator Operator failed to convert at least one voltage schedule in Requirement E.A.13 into the voltage set point for the AVR for less than 25% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 25% or more but less than 50% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 50% or more but less than 75% of the voltage schedules.</u>	<u>The Generator Operator failed to convert the voltage schedules in Requirement E.A.13 into the voltage set point for the AVR for 75% or more of the voltage schedules.</u>
<u>E.A.16</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 30 days but less than or equal to 60 days of a request by the Transmission Operator.</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Transmission Operator.</u>	<u>The Generator Operator provided its voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Transmission Operator.</u>	<u>The Generator Operator did not provide its voltage set point conversion methodology within 120 days of a request by the Transmission Operator.</u>
<u>E.A.17</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology than 30 days but less than or equal to 60 days of a request by the Generator Operator.</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 60 days but less than or equal to 90 days of a request by the Generator Operator.</u>	<u>The Transmission Operator provided its data to support development of the voltage set point conversion methodology greater than 90 days but less than or equal to 120 days of a request by the Generator Operator.</u>	<u>The Transmission Operator did not provide its data to support development of the voltage set point conversion methodology within 120 days of a request by the Generator Operator.</u>

## Standard VAR-001-2 — Voltage and Reactive Control

<u>E #</u>	<u>Lower VSL</u>	<u>Moderate VSL</u>	<u>High VSL</u>	<u>Severe VSL</u>
<u>E.A.18</u>	<u>N/A</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.1 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>	<u>The Generator Operator did not meet the control loop specifications in EA18.1 through EA18.2 when the Generator Operator uses control loop external to the AVR to manage Mvar loading.</u>

### Version History

<b>Version</b>	<b>Date</b>	<b>Action</b>	<b>Change Tracking</b>
0	April 1, 2005	Effective Date	New
1	August 2, 2006	BOT Adoption	Revised
1	July 3, 2007	Added “Generator Owners” and “Generator Operators” to Applicability section.	Errata
1	August 23, 2007	Removed “Generator Owners” and “Generator Operators” to Applicability section.	Errata
2	TBD	Modified to address Order No. 693 Directives contained in paragraphs 1858 and 1879.	Revised.
<u>2</u>		<u>Modified to add a WECC region variance</u>	



## **Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control**

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The WECC-0046 (Regional Variance to VAR-001-2 Voltage and Reactive Control) Drafting Team thanks everyone who submitted comments on the WECC Regional Variance to the NERC VAR-001-2 Voltage and Reactive Control Standard. This standard was posted for a 30-day public comment period from January 25, 2011 through February 25, 2011. WECC distributed the notice for the posting on January 25, 2011. The Standard Drafting Team asked stakeholders to provide feedback on the variance to the NERC Reliability Standard through a special Standard Comment Form. WECC received comments from three companies representing three of the 10 Industry Segments, as shown in the table on the following page.

In this 'Consideration of Comments' document, stakeholder's comments have been organized so that it is easier to see the responses associated with each stakeholder. All comments received on the standard can be viewed in their original format at:

<http://www.wecc.biz/Standards/Development/WECC0046/Lists/WECC0046%20VAR001WECC1%20Voltage%20and%20Reactive%20Contr1/AllItems.aspx>

If you feel that your comment has been overlooked, please let WECC know immediately. WECC's goal is to give every comment serious consideration in this process. If you feel there has been an error or omission, please contact the Director of Standards, Steve Rueckert, at [steve@wecc.biz](mailto:steve@wecc.biz). In addition, there is a WECC Reliability Standards Appeals Process.<sup>1</sup>

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<sup>1</sup> The appeals process is described in the Process for Developing and Approving WECC Standards: <http://www.wecc.biz/Standards/Documents/WECC%20Standards%20Development%20Process.pdf>

## Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control

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The Industry Segments are:

- 1 — Transmission Owners
- 2 — RTOs, ISOs
- 3 — Load-serving Entities
- 4 — Transmission-dependent Utilities
- 5 — Electric Generators
- 6 — Electricity Brokers, Aggregators, and Marketers
- 7 — Large Electricity End Users
- 8 — Small Electricity End Users
- 9 — Federal, State, Provincial Regulatory or other Government Entities
- 10 – Regional Reliability Organizations, Regional Entities

Commenter		Organization	Industry Segment										
			1	2	3	4	5	6	7	8	9	10	
1.	Spencer Tacke	Modesto Irrigation District	✓		✓		✓						
2.	Denise Koehn	Bonneville Power Administration	✓										
3.	Darcy O'Connell	California ISO	✓										
4.													
5.													

## **Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control**

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### **Index to Questions, Comments, and Responses**

<b>Question</b>	<b>Page</b>
1. The WECC-0046 VAR-001-WEC-1 Voltage and Reactive Control Drafting Team welcomes comments on any and all aspects of the proposed document.	<b>4</b>

**Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control**

1. The WECC-0046 VAR-001-WEC-1 Voltage and Reactive Control Drafting Team welcomes comments on any and all aspects of the proposed document.

**Summary Consideration:**

Commenter	Yes	No	Comment
Spencer Tacke Modesto Irrigation District <a href="mailto:spencert@mid.org">spencert@mid.org</a>			In Requirement E.A.13, I don't believe that only generators deemed to be part of the Bulk Electric System (BES) should be required to have voltage schedules, but that all generators above a minimum size (i.e., similar to the requirement that all generators 10 MVA or larger have AVR), should. NERC VAR-001.2 does not require compliance only for generating resources that are part of the BES, so we should be consistent with that standard, and shouldn't make being part of the BES a requirement in this standard, either.  Thank you.
<p><b>Response:</b> The drafting team does not believe that a variance to a NERC Reliability Standard can be written to require compliance with requirements for facilities that are not part of the Bulk Electric System. Therefore, this comment is beyond the scope of the WECC-0046 project.</p>			
Denise Koehn Bonneville Power Administration <a href="mailto:dekoehn@bpa.gov">dekoehn@bpa.gov</a> Comments submitted on behalf of the following SMEs: Frank Puyleart, Steve Hitchens, Rebecca Berdahl			BPA is in support of final document.
<p><b>Response:</b> Thank you.</p>			
Darcy O'Connell California ISO <a href="mailto:doconnell@caiso.com">doconnell@caiso.com</a>			The California ISO (ISO) submits these comments to request clarification regarding the intended applicability of the regional variance to VAR-001-2 currently in development by WECC. Specifically, the ISO believes language should be added to the draft clarifying that the standard applies to all Generation Operators capable of following a voltage set-point schedule, regardless of the technology of their underlying generating unit, and whether or not that technology utilizes traditional "excitation" systems.  The purpose of the regional variance to NERC VAR-001-2 "is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection." To accomplish this, the variance proposes two changes to the NERC standards: (1) deletes NERC VAR-001-2 Requirement R3 that allows Transmission Operators the option of specifying criteria to exempt generators from complying with voltage schedules and (2) restricts the Transmission Operator to

**Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
			<p>providing a voltage schedule, but allows the schedule to be conveyed through a reactive power level under specified conditions. The draft justifies the elimination of the exemption on the basis that “permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.”</p> <p>Consistent with prohibiting generator exemptions, the regional variance at E.A.13 requires each Transmission Operator to provide a voltage schedule to “Generator Operators for each of their generation resources that are on-line and part of the Bulk Electric System within the Transmission Operator Area.” The unqualified language of the requirement suggests the all generating units, not otherwise subject to a forced or planned outage, and regardless of the technology employed, should be provided a voltage schedule. The ISO believes that this provision appropriately requires both synchronous and asynchronous generating units to receive and follow a voltage schedule. Such interpretation coincides with the drafting team’s conclusion that the absence of a uniform requirement for generators to support system voltage threatens the reliability of the Western Interconnection. is threatened by. This conclusion is reinforced when consideration is given to the significant displacement of energy and capacity from conventional synchronous generation, anticipated during many hours by the Western Interconnection’s increasing reliance on asynchronous variable energy resources, to satisfy state mandated renewable portfolio standards. Simply put, if a present concern exists regarding the adequacy of voltage support following contingencies from the current generation portfolio in the Western Interconnection, that concern will only be exacerbated in the future with greater penetration levels of variable energy resources.</p> <p>While the plain language and underlying purpose of the variance supports an interpretation that the variance applies to all Generating Operators regardless of the technology of the underlying generating unit, there are, nevertheless, other elements of the variance and related discussion that create ambiguity with respect to the intended reach of the variance. For example, Requirement E.A.15 requires each generator operator to convert the voltage schedule into a voltage set point for the “generation excitation system.” Most, if not all, asynchronous generation technologies do not have “excitation systems,” , creating the impression that the variance applies only to conventional synchronous generators. Similarly, the drafting team’s introduction to the variance emphasizes the critical role of automatic voltage regulators (AVR) operating in automatic voltage control mode. Indeed, VAR-002-WECC-1, which is the subject of the Notice of Proposed Rulemaking in FERC docket no. RM-09-9-000, explicitly restricts AVR availability standards to synchronous machines. On the one hand, this implies an intent to restrict the variance to VAR-001 to synchronous generators, but on the other hand, it also demonstrates that the standard drafters know how to qualify application of the requirement and here chose not to. Accordingly, the draft variance potentially creates confusion that should be addressed.</p>

**Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control**

Commenter	Yes	No	Comment
			<p>Finally, the ISO acknowledges that an interpretation of the variance to apply to all generation types will have the effect of altering the reactive power requirements that may be present in many interconnection tariffs approved by FERC. In Order No. 661a and in <i>California ISO</i>, 132 FERC ¶ 61,196 (Aug. 31, 2010), FERC concluded that asynchronous generators need not operate other than at unity power factor, unless the transmission operator demonstrates the reactive power need through interconnection studies.</p> <p>Because older asynchronous generators were designed and installed with the intent of maintaining a reactive schedule of unity power factor, supplying a voltage schedule to existing asynchronous generators may not be effective or practical. However, if the standard is intended to apply to all generators, then the effect is to require asynchronous generators to be able to follow a voltage schedule. The ISO supports such an interpretation, but, more importantly, believes that the intent of the variance must be clearly stated as based in the reliability requirements of generator voltage control and not left to future requests for interpretation.</p> <p>Movement away from a reactive schedule and toward a voltage set-point schedule, combined with the reliability impacts of voltage control, necessitate that all generation (including wind and solar) must be able, and must be required to, follow voltage schedules. Notwithstanding the foregoing, the uniform application of this requirement may require some transition or recognition of existing technical limitations. Thus, it may be appropriate to clarify that this requirement applies to all Generator Operators of all generating units that (1) are synchronous (2) are asynchronous and achieve commercial operation after the variance's effective date and (3) are asynchronous existing generating units which currently are capable of following a voltage schedule.</p>

Response: The drafting team discussed asynchronous generators and determined that there is ambiguity in the NERC Standards and that it is further exacerbated by interpretations from FERC, as the commenter has indicated. The drafting team concluded that this particular issue is, without question, a continent-wide issue. The team could not use this variance to immediately add clarity without a new standard request. The drafting team believes it would be more appropriate to address this comment in a continent-wide standard that would permit the addition of requirements to specifically address reactive capabilities of asynchronous generation. However, requirement E.A.13 of the WECC Regional Variance requires each Transmission Operator to issue voltage schedules to Generator Operators for their generation resources that are on-line and part of the Bulk Electric System. VAR-002-1.1b requirement R2 requires the Generator Operator to maintain the generator voltage output (within the facility ratings) as directed by the Transmission Operator. The drafting team agrees with the FERC recommendation in the Notice of Proposed Rulemaking – FERC docket no. RM-09-9-000 – and the 1996 outage recommendation; there is a reactive power need for generation resources to control voltage in the Western Interconnection.

There is nothing in VAR-001-2, the WECC Regional Variance to VAR-001-2, or VAR-002-1.1b that permits Generator Operators to fail to comply with those requirements because generation resources are not synchronous generators. VAR-002-1.1b requirement R2.2 requires the Generator Operator to provide an explanation of why the schedule cannot be met, but with the removal of VAR-001-2 requirement R3 in the WECC Regional Variance, the generator exemption provision is no longer permitted. Thus, asynchronous generation that has the capability to provide reactive support would be obligated to perform. It will be the responsibility of the Generator Operator in its conversion methodology to explain its method that develops a set point for controlling generator terminal voltage.



**Comment Report Form for WECC Regional Variance to VAR-001-2 – Voltage and Reactive Control**

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Commenter	Yes	No	Comment
			<p>The reference to the generator excitation system was used because it is easily understood to be the system for controlling reactive output. The drafting team tried other terms but found them to be confusing. The drafting team believes that the clarity provided for the translation to a set point controlling the generator bus voltage was more important than the potential confusion.</p>
<p>Response:</p>			



Richard Padilla  
Chair, VAR-001-WECC-1  
Voltage and Reactive Control Drafting Team  
Principle Electrical Engineer  
Pacific Gas and Electric Company  
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February 2, 2011

**Subject:** Notification of Completion  
WECC-0046 / VAR-001-WECC-1  
Voltage and Reactive Control  
Regional Variance to the NERC VAR-001-2 standard

**To:** WECC Operating Committee

In accordance with the Western Electricity Coordinating Council's (WECC) Process for Developing and Approving WECC Standards (Process), the Voltage and Reactive Control Drafting Team (Team) has concluded drafting WECC-0046, VAR-001-WECC-1: Voltage and Reactive Control.

### **Concurrent Posting**

On January 25, 2011, the WECC-0046, VAR-001-WECC-1, Voltage and Reactive Control Drafting Team (Team) concurrently posted its proposed regional variance to the NERC VAR-001-2 standard, for a 30-day comment period closing February 25, 2011 as well as for approval at the March 2, 2011 Operating Committee meeting in Scottsdale, AZ. The Team will review all comments received during the comment period. Upon completing that review, the Team will decide whether any additional substantive changes are necessary. If the Team concludes that no substantive changes are needed, the Team will recommend that the Operating Committee approve the proposed criterion. By contrast, if the Team concludes that additional substantive changes are needed based upon the comments received, the Team will request the proposed criterion be removed from the March 2011 Operating Committee agenda.

The document can be found at:

<http://www.wecc.biz/Standards/Development/WECC0046/Shared%20Documents/Final/WECC-0046%20VAR-001-WECC-1%20Voltage%20and%20Reactive%20Control%20Standard%20Final%20Clean%201-25-11.doc>

### **Overview**

The current draft has been converted from a Standard into a Regional Variance to the NERC VAR-001-2 Standard. The format incorporates the NERC Standard into the document with minor additions to address the scope of the variance. The regional variance



specifics are included as Section E of the proposed document (see hyperlink above), and in this case, are intended to replace NERC VAR-001-2 requirements R3 and R4 as noted at the beginning of Section E.

## **Variance**

The purpose of this regional variance to a NERC Reliability Standard is to ensure that voltage levels are within limits in real time to protect equipment and the reliable operation of the Western Interconnection. The “Rules of Procedure of the North American Electric Reliability Corporation” (Appendix 3A, page 31) permits the development of a regional variance to a NERC reliability standard on an Interconnection-wide basis when the Regional Reliability Organization has valid justification and when the variance is not inconsistent with or less stringent than the NERC Reliability Standard. The variance is an alternative method for obtaining the same reliability objective as the continent standard and is typically necessitated by a physical difference. A variance is embodied within a reliability standard and as such, if adopted by NERC and approved by the electric reliability organization governmental authority, shall be enforced within the applicable Regional Entity(ies) pursuant to delegated authority.

## **Drafting Team Voting Results**

In accordance with the Process, a majority vote of the drafting team present is required to approve submitting the recommended document to the Standing Committee. Of the 21 team members, seven members were present at the meeting and voted “yes” to submit the document to the Standing Committee for approval, subject to the results of the concurrent request for comments. No members who were present voted “no” or abstained. Fourteen members did not attend the meeting. Results of the vote are attached as Appendix A.

The final document was distributed to all the members of the drafting team so that members who were not able to attend the vote had an opportunity to comment on the document. Any drafting team members who disagreed with the language of the document were encouraged to provide a dissenting comment and, if possible, provide specific language that would make the document acceptable. No dissenting comments were received.

All comments received during the development process can be found on the WECC-0046 Team Site located at:

<http://www.wecc.biz/Standards/Development/WECC0046/default.aspx>

## Impact Statement

The Process requires the drafting team to prepare and post an impact assessment report regarding the estimated costs to implement the draft document. Analyses of disturbance events in the Western Interconnection have demonstrated that during and immediately following a disturbance, a generator's Automatic Voltage Regulator (AVR) — operating in automatic voltage control mode — is needed to stabilize the Bulk Electric System's voltage. Transmission Operators are responsible for determining the voltage levels required to maintain reliable operation of the Interconnection and convey the required voltage level information to Generator Operators. However, NERC VAR-001-2 allows the following:

Requirement R3 gives Transmission Operators the option of specifying criteria that exempt generators from compliance with the requirements defined in NERC Standard VAR-001-2, Requirement 4 and Requirement 6.1. The drafting team believes that permitting such exemptions reduces the proper voltage support when generation and transmission outages occur, adversely impacting the reliability of the Western Interconnection.

Requirement R4 gives Transmission Operators the option of providing reactive power schedules rather than voltage schedules; however, operating against a reactive power schedule will not ensure reliability in the Western Interconnection. This conclusion is based on the interpretation that generator operators given reactive schedules under NERC VAR-001-2 are required to maintain the reactive output defined in the schedule at all times. This will require generator operators to modify the AVR set point as system conditions change to maintain the specified reactive output of the schedule.

This variance to the NERC VAR-001 standard restricts the Transmission Operator to providing only a voltage schedule, but allows the schedule to be conveyed through a reactive power level, provided that the reactive power level is converted to a voltage level for the AVR's automatic voltage control mode setting. Once a reactive power level is converted to a voltage level, that voltage level defines the schedule until a new voltage schedule, which may be in reactive power terms, is provided by the Transmission Operator.

These modifications to creating and following voltage schedules are mainly administrative and are expected to have little to no cost in day-to-day operations. There is expected to be some minor cost associated with documenting the conversion methodology to translate the schedules, regardless of the form in which they are provided to the Generator Operator, into a voltage schedule based on the bus governed by the voltage regulator (typically the generator bus).



If you have questions, please feel free to contact me.

Sincerely,

Rick Padilla  
Drafting Team Chair

Cc: Steve Rueckert  
Ken Wilson  
W. Shannon Black



**Appendix A**  
**Voltage and Reactive Control Drafting Team**  
**Polling Results for Submittal of the Final Draft Document**  
**to the**  
**WECC Operating Committee for Approval**

Out of the 21 members of the drafting team, when asked whether the final draft of the criterion should be forwarded to the Operating Committee for approval, subject to comments received during the concurrent 30-day comment period, the results of that poll showed:

**Voting Team Members**

<b>Name</b>	<b>Organization</b>	<b>Present</b>
Anderson, Gregory	SCE	
Anderson, Phil	IPC	
Bowers, Waylon	US Army Corps of Engineers	
Casey, Chuck	RVCD	
Colpron, Guy M.	IPC	Yes
Cummings, John	PPLM MT	Yes
Girgis, George	USBR	
Jastram, Matt	PGE	
Kronebusch, Shane	BCHA	Yes
Manuguid, Robin	SDG&E	
Muller, Philip	SCD Energy	
Oñate, Pablo	EPE	
Padilla, Richard (Rick) (Committee Chair)	PG&E	Yes
Pulyeart, Frank	BPA	Yes
Roth, Alan	CALP	Yes
Ryan, Mike	PGE	
Aquino, Romel	SCE	
Simpson, John	REI	
Wenke, Steve	Avista	
Wilkins, A. Gus	PPL MT	
Yale, John	CHPD	Yes

## Ballot Pool Members and the Final Ballot Results<sup>1</sup>

### 1. WECC Board of Directors (June 22, 2011)

On June 22, 2011, the WECC Board of Directors unanimously voted in favor of a motion to approve the WECC Regional Variance to VAR-001-2 Voltage and Reactive Control Standard (Project WECC-0046).

Voting Results: Yes – 31, No – 0

No minority opinions were expressed against the Board motion.

### 2. Operating Committee (March 3, 2011)

**Motion:**

*To approve the Regional Variance to NERC VAR-001-2 Voltage and Reactive Control Standard*

VOTING CLASS	YES	NO	ABSTAIN
TRANSMISSION PROVIDERS	24	3	4
TRANSMISSION CUSTOMERS	11	1	3
STATE and PROVINCIAL	0	0	0
<b>TOTALS</b>	<b>35</b>	<b>4</b>	<b>7</b>

See the following table for more details on the Operating Committee ballot.

#### Operating Committee

Standard  
NERC VAR-001-2

SP - State and Provincial  
IS - Interested Stakeholder  
TP - Transmission Provider  
TC - Transmission Customer

Name of Organization	Name of Voting Member	Voting			
		Class	Yes	No	Abstain
Alberta Electric System Operator (AESO)	Doug Hincks	TP	X		
AltaLink L.P. (ALTA)	Rick Spyker	TP	X		

<sup>1</sup> Including a list of significant minority issues that were not resolved

Arizona Public Service (AZPS)	Bert Peters	TP	X		
Avista Corp (AVA)	Scott J. Kinney (alternate)	TP		X	
Black Hills Power Corporation (BHP)	Kelly Wolfe	TP	X		
Bonneville Power Administration-Power Bus Line (BPAP)	Fran Halpin	TC	X		
Bonneville Power Administration-TBL (BPAT)	Don Watkins	TP	X		
British Columbia Hydro and Power Authority (BCHA)	Clement Ma	TC	X		
British Columbia Transmission Corporation (BCTC)	Devinder Ghangass	TP	X		
California ISO (CISO)	Deb LeVine	TP	X		
Calpine Corporation (CALP)	Frank Obertance	TC	X		
City of Anaheim	Kelly Nguyen	TP	X		
City of Riverside	Daniel Garcia	TP			X
Colorado Springs Utilities (CSU)	Warren Rust	TP	X		
Comision Federal de Electricidad (CFE)	Jesus Aragon	TP			X
Dynegy, Inc. (DYN)	Brian Theaker	TC	X		
Gila River Power, L.P. (PGR)	Kenneth Parker	TC	X		
Idaho Power Company (IPC)	John Anderson	TC			X
Idaho Power Company (IPC)	Rich Bauer	TP		X	
Imperial Irrigation District (IID)	Joel Fugett	TP	X		
Los Angeles Department of Water and Power (LDWP)	Kenneth Silver	TP	X		
Mariner Consulting	John Stout	TC	X		
Modesto Irrigation District (MID)	Toxie Burriss	TP	X		
New Harquahala Generating Company	Nicholas Hayes	TP		X	
NV Energy	Gene Henneberg	TP	X		
Pacific Gas & Electric (PG&E)	Kris Bucholz	TP	X		
Pacific Gas & Electric (PG&E)	Joe Minkstein	TC	X		
PacifiCorp (PAC)	Brent Roholt	TP	X		
Platte River Power Authority (PRPA)	John R. Powell	TP	X		
Portland General Electric (PGE)	Mike Ryan	TP			X
Powerex (PWX)	Mike Goodenough	TC	X		
Public Utility District No. 1 of Chelan County (CHPD)	Hugh Owen	TC	X		
Public Utility District No. 2 of Grant County (GCPD)	Denise Hale	TC			X
Puget Sound Energy, Inc. (PSE)	Gary Nolan (alternate)	TP	X		
Sacramento Municipal Utility District (SMUD)	Mark Willis	TP	X		
Salt River Project (SRP)	Robert Kondziolka	TP	X		
San Diego Gas & Electric Company (SDGE)	Anita Hoyos	TP			X
Southwest Transmission Cooperative, Inc. (SWTC)	Shane Sanders	TP	X		
Tacoma Power (TPWR)	John Lawrence	TC	X		
Tacoma Power (TPWR)	Renee Knarreborg	TP	X		
Tri-State Generation & Transmission Association, Inc (TSGT)	Thomas A. Smith	TP	X		
U.S. Bureau of Reclamation (USBR)	Jay Seitz	TC		X	



Utility System Efficiencies, Inc. (USE)	Ron Calvert	TC			X
Western Area Power Administration (WAPA)	Pete Garris	TP	X		
Western Area Power Administration (WAPA)	Ken Otto	TC	X		
Xcel Energy (PSCO)	Bob Staton	TP	X		

		Yes	No	Abstain
Voting Summary	SP	0	0	0
	TC	11	1	3
	TP	24	3	4
Total		35	4	7

**Result: Passed**

Minority Opinions expressed with the ballot:

- Does not follow the original Standard Authorization Request provided. Does not provide a reason for why a voltage schedule could not be provided, and creates an additional level of documentation required for each reactive schedule change.
- VAR-001 is for Transmission Operators (TOP), not for Generator Operators (GOP). VAR-002-1.1b is for GOPs. Adding requirements for GOPs into VAR-001 has made additional requirements on generators that were not intended by the standard. The responsibility to make a voltage schedule lies with the TOP – not with the GOP doing a conversion to figure it out from the TOP’s VAR schedule.
- Does not see the value in being more restrictive than NERC Standard.
- The standard does not provide the flexibility. The standard should allow a set power factor within a voltage band.

**Exhibit G**

**Standard Drafting Team Roster**

## Standard VAR-001-WECC-1 – Voltage and Reactive Control

### Drafting Team WECC0046 for Regional Variance to VAR-001-2

Name and Title Affiliation Contact Info	Biographical Information
<p>Waylon Bowers, MSEE, PE Chief, Power Section</p> <p>Hydroelectric Design Center US Army Corps of Engineers 333 SW 1st Ave Portland, OR 97214 (503) 808-4287 Office (503) 830-0991 Mobile <a href="mailto:Waylon.T.Bowers@usace.army.mil">Waylon.T.Bowers@usace.army.mil</a></p>	<p>Waylon Bowers is the Chief of the Power Section within the US Army Corps of Engineers' Hydroelectric Design Center (HDC) in Portland, Oregon where he has worked since 2004. Waylon received his Bachelor of Science degree in Electrical Engineering and his Master of Science degree in Energy Systems from Oregon State University (OSU). Waylon is licensed as a Professional Engineer in the state of Oregon. He has worked for Intel and the former NEC Eluminant.</p>
<p>Shane Kronebusch, Eng.L., AScT Lead Engineer – Electrical L&amp;S Electric of Canada, Inc. - Engineering Division (Home Office) 21596-95A AVE Langley, BC V1M 2C6 (604) 230-8858 Mobile (715) 241-3472 Office (877) 258-5128 Toll Free <a href="mailto:skronebusch@lselectric.com">skronebusch@lselectric.com</a></p>	<p>Shane has 22 years of experience in excitation, governors, unit control and protection in the utility industry. Shane moved to L&amp;S Electric in 2010 as a Senior Control Engineer and has recently been promoted to Lead Engineer – Electrical. L&amp;S Electric is a leading supplier of integrated solutions for the hydroelectric industry with the best value in digital governors and automation and has successfully supplied integrated solutions worldwide for over 500 new and rehabilitated hydroelectric generating units, ranging in size from 250 KW to 500 MW.</p> <p>Prior to moving to L&amp;S Electric, Shane has 20 years of experience in Protection and Control for BC Hydro and Power Authority. Prior to leaving BC Hydro Shane was working as a Project Equipment Specialist in the Generation Engineering and Maintenance Service division. Responsibilities included writing of equipment specifications for exciters and governors, developing engineering and maintenance standards. Field work consisted of commissioning and testing of new equipment and units into service, performing generator testing and preparing model validation reports for WECC and providing support to field staff.</p>
<p>Pablo Oñate Compliance Engineer El Paso Electric Company (915) 543-4393 Office <a href="mailto:pablo.onate@epelectric.com">pablo.onate@epelectric.com</a></p>	<p>Drafting Team – Process Observer – No additional contact information available.</p>
<p>Gregory V. Anderson Senior Engineer - Excitation Engineering Group Southern California Edison Company 7455 Fenwick Lane Westminster, CA 92683 (714) 895-0561 Office</p>	<p>Mr. Anderson has 28 years experience in design application, installation, commissioning, and testing of excitation systems on hydro, fossil fuel, and nuclear power plants at SCE. He performs power system dynamic performance studies and modeling to meet the WECC generator modeling requirements. Besides the PROJECT WECC-0046 VOLTAGE AND REACTIVE CONTROL STANDARD DRAFTING TEAM, Mr. Anderson has the following Regional and industry experience:</p> <p>Member of WECC Controls Working Group, 2003-Present.</p>

<p>(714) 984-5499 Mobile  <a href="mailto:gregory.anderson@sce.com">gregory.anderson@sce.com</a></p>	<ul style="list-style-type: none"> <li>• Vice-Chairman of WECC-0049 Blackstart Regional Criteria Drafting Team, 2009-Present.</li> <li>• Member IEEE Excitation Systems and Controls Sub-committee, 2004-Present</li> <li>• Member IEEE Excitation Systems Working Group, 2004-Present.</li> <li>• Member IEEE Power System Stability Sub-committee, 2009-Present.</li> </ul> <p>Mr. Anderson has a Bachelor of Science degree in Electrical Engineering from California State University - Long Beach and is a licensed Professional Engineer in California</p>
<p>John B. Yale  Hydro Plant Engineering  Manager  Chelan County Public  Utilities District No. 1  PO Box 1231  Wenatchee, WA  98807-1231  (509)-661-4051 Office</p>	<p>John Yale has worked in the power generation industry for 30 years. He has earned a BSEE, Master of Management of Engineering and Technology, and completed extensive graduate coursework in electrical power engineering. He is a registered Professional Engineer in Alaska and Washington. John spent the first 24 years of his career with major engineering and construction firms specializing in generators, controls, and excitation. He has been in his present position responsible for engineering and reliability compliance for the District's hydroelectric plants on the Columbia River for six years. He is a past chair of the IEEE Hydroelectric Subcommittee, Chair of the working group for hydroelectric plant controls and a member of the IEEE Power Generation Subcommittee. He has authored several peer reviewed papers on subjects relating to control of hydroelectric units.</p>

<p>Francis Puyleart, PE  Electrical Engineer –  Technical Operations  Bonneville Power  Administration  ATTN: TOT-DITT2  PO Box 491  Vancouver, WA 98662  <a href="mailto:frpuyleart@bpa.gov">frpuyleart@bpa.gov</a>  (360) 418–2464 Office</p>	<p><u>Description of Qualifications:</u></p> <ul style="list-style-type: none"> <li>• Licensed Professional Engineer in Washington.</li> <li>• Masters of Science in Electrical Engineering concentrating in Power System Analysis, Power System Protection, Control Theory and Power Electronics.</li> <li>• Generator testing to improve AVR / PSS settings, create reactive capability curves and improve transient simulation models.</li> </ul> <p><u>Work Experience:</u></p> <ul style="list-style-type: none"> <li>• WECC Involvement <ul style="list-style-type: none"> <li>○ 3 ½ years of involvement in the Modeling &amp; Validation Work Group <ul style="list-style-type: none"> <li>▪ Load Modeling Task Force</li> <li>▪ Generator Testing Task Force</li> </ul> </li> <li>○ 2 years of involvement in the Westside Model Task Force</li> <li>○ 3 years of involvement in the WECC-0046/NERC VAR-001-2 Standard Drafting Team</li> </ul> </li> <li>• 3 ½ years of work for a Model Improvement / Basecase Development group <ul style="list-style-type: none"> <li>○ Generator testing to improve AVR / PSS settings, create reactive capability curves and improve transient simulation models.</li> <li>○ HVDC equipment modeling, validation and testing.</li> <li>○ Industrial / residential load modeling, validation and testing.</li> <li>○ Thermal Generation Interconnection Studies</li> </ul> </li> <li>• 5 ½ years of work for Technical Operations group at Bonneville Power Administration <ul style="list-style-type: none"> <li>○ Development of policies, procedures and tools for dealing with the intermittency of wind generation in real time.</li> <li>○ Wind generator model development and validation.</li> <li>○ Creating detailed and accurate estimates of the within hour balancing reserve requirements for the BPA balancing authority area.</li> <li>○ Interpreting / applying / maintaining dispatcher standing orders.</li> <li>○ Lead for setting OTC limits for the Northern Intertie and the I-5 Corridor.</li> <li>○ Outage coordination with dispatchers and foreign utilities.</li> <li>○ Design / implementation of study process improvement efforts</li> </ul> </li> </ul>
<p>Romel Aquino  Project Manager  Power Production  Department  Southern California Edison  300 N. Lone Hill Avenue,  San Dimas, CA 91773  (909) 394-8956 Office  <a href="mailto:Romel.C.Aquino@sce.com">Romel.C.Aquino@sce.com</a></p>	<p>BSEE, My background is in power engineering having more than twenty-three (23) years of diverse experience in system protection, electrical design, and project management. I have worked with different transmission, distribution substations and generation facilities for their maintenance, upgrade and turnkey projects. My current position with Southern California Edison Company requires me to make sure that all company-owned generating facilities under WECC/NERC follow all applicable reliability standards particularly in protection systems. I respond and provide support to technical inquiries and concerns from upper management, legal department officers, and field personnel. I review, audit evidentiary documentation for accuracy; perform field location workshops to assist understanding of WECC/NERC requirements</p>

<p>Phillip Muller President SCD Energy Solutions 436 Nova Albion Way, San Rafael, CA 94903, (415) 479-1710 Office <a href="mailto:philm@scdenergy.com">philm@scdenergy.com</a></p>	<p>Phillip. Muller has 30 years experience in the electric and gas utility industry including management consulting, regulatory strategy development, contract negotiations, and marketing strategy development. As founder of SCD Energy Solutions, he emphasizes understanding the regulatory changes facing the marketplace, supporting viable market solutions in regulatory and market design proceedings, and developing effective strategies for benefiting from changes in the energy marketplace. He has been active in electric industry restructuring in California and throughout the West, and continues to participate in the development and implementation of new market structures. Mr. Muller has a Bachelors of Arts degree in Environmental Studies from Sonoma State University and an MBA from John F. Kennedy University.</p>
<p>Richard (Rick) J. Padilla PE Principal Electrical Engineer Pacific Gas and Electric Co.  (530) 757-5216 Office <a href="mailto:Rjp5@pge.com">Rjp5@pge.com</a></p>	<p>Rick Padilla has a BSEE in Electrical Engineering and is a registered professional Engineer in California. He has over 32 years experience in nuclear, fossil, and hydro facilities. Rick has served in the WECC Control Work Group for approximately 10 years. Rick worked in plant design for 17 years working with generators, excitation systems, and balance of plant equipment. Rick has worked for the last 15 years in a specialist group supporting excitation systems and addressing a variety of operating concerns between generation and system operations groups. Rick is the generation compliance expert and is the Generation liaison with PG&amp;E's planning and system operations groups.</p>
<p>Augustus (Gus) J. Wilkins, Registered Professional Engineer - Montana Principal Engineer Company: PPL MT LLC. (406) 533-3457 Office 45 Basin Creek Road Butte, MT 59701  <a href="mailto:ajwilkins@pplweb.com">ajwilkins@pplweb.com</a></p>	<p>Education: BSEE and MS Industrial Engineering and Management Engineering  Experience: Forty-four years experience in the protection, automation and remote control of electrical systems – transmission, substations and generation.</p>
<p>Phillip M. Anderson, P.E. Idaho Power Engineering Project Leader Research, Development and Deployment 1221 W. Idaho St. Boise, Idaho 83702  (208) 388-2908 Office (208) 484-2024 Mobile <a href="mailto:philanderson@idahopower.com">philanderson@idahopower.com</a></p>	<p>Phil is an Engineering Project Leader in Research, Development and Deployment, for Idaho Power's Transmission and Distribution Planning Department. In Phil's 18 years with Idaho Power he has worked in a number of engineering capacities including Hydro automation engineer and EMS/SCADA engineer. Prior to working at Idaho Power, Phil worked for two other utilities in power generation engineering and has 27 years of engineering experience. Phil holds a Bachelor of Science and a Master of Engineering degree in Electrical Engineering and is a Licensed Professional Engineer in the states of Idaho and Oregon.</p>
<p>Chuck Casey City of Riverside (951) 710-5010 Office <a href="mailto:ccasey@riversideca.gov">ccasey@riversideca.gov</a></p>	<p>Drafting Team – No contact information available.</p>

<p>Guy Colpron Engineering Leader Idaho Power Company (208) 388-2784 Office <a href="mailto:gcolpron@idahopower.com">gcolpron@idahopower.com</a></p>	<p>Education: BSEE Washington State University</p> <p>Worked at Idaho Power Company as a Communications Engineer for two years and as a System Protection Engineer for 15 years. Currently working as an Engineering Leader in Power Production Group working on SCADA, Generator Protection &amp; Controls, Generator Modeling and other Generator protection related efforts.</p>
<p>Kurt Conger Director of Power Supply, Transmission &amp; Regulatory Policy Northern Wasco County, PUD The Dalles Oregon (425) 444 3149 Office <a href="mailto:kcong@nwasco.com">Kurt— conger@nwasco.com</a></p>	<p>Education: BS Engineering Science – Power Systems</p> <p>Worked for 29 years in Electric Power Utility Industry. Worked with FERC Regulations, power supply planning and acquisition, Transmission Planning and modeling and load forecasting, planning &amp; marketing.</p>
<p>George Girgis USBR <a href="mailto:ggirgis@do.usbr.gov">ggirgis@do.usbr.gov</a> (303) 445-2310 Office</p> <p>Martin Bauer P.E. Compliance Audit &amp; Incident Evaluation Program Manager Bureau of Reclamation Power Resources Office Denver Federal Center P.O. Box 25007 Denver, CO 80225 <a href="mailto:mbauer@usbr.gov">mbauer@usbr.gov</a> (303) 445-2901 Office</p>	<p>Drafting Team – Reassigned to other tasks. Martin Bauer replaced George Girgis.</p> <p>Martin Bauer is a licensed Professional Engineer working as Program Manager in Compliance Auditing and Incident Evaluation at the Bureau of Reclamation.</p>
<p>Matt Jastram Portland General Electric <a href="mailto:Jastram@pgn.com">Jastram@pgn.com</a></p>	<p>Drafting Team – No additional contact information available.</p>

<p>John M Cummings, P.E. Senior Transmission Engineer PPL Energy Plus 45 Basin Creek Road Butte, MT 59701 (406) 533-3568 Office <a href="mailto:JMCummings@pplweb.com">JMCummings@pplweb.com</a></p>	<p>John Cummings has a Bachelor of Science degree in Electrical Engineering from Montana State University (BSEE78). John worked for 35 years in the utility business, including 5 years in transmission planning and 5 years in the transmission control center operations as an operator training instructor and NERC-certified System Operator. John also has almost 5 years experience with PPL which owns and operates over 1,000 MW of hydro and thermal plants in Montana. John has been involved in many Operating Transfer Capacity (OTC) studies for paths that are thermally limited, angle stability limited or voltage stability limited. At the transmission control center, John instructed operators on all aspects of grid operations involving Balancing, Interchange and Transmission Operations. At PPL, John works as a liaison between the transmission service provider and the generator operators of the PPL facilities on all aspects of the GO/TO interface. John has commented on dozens of NERC and WECC standards, but this is the first start-to-finish Standard Drafting Team he has been on and he commends both Mr. Ken Wilson and Mr. Rick Padilla on their efforts to listen to all comments from all industry segments on the regional variance associated with VAR-001-WECC-1.</p>
<p>Robin Manuguid San Diego Gas &amp; Electric <a href="mailto:rmanugid@semprautilities.com">rmanugid@semprautilities.com</a> (619) 725-8628 Office</p>	<p>Robin has been employed by San Diego Gas &amp; Electric since 1992. Her experience includes six years in operation resource planning and 14 years in electric transmission planning and operations including providing voltage schedules to the generator operators in the SDG&amp;E footprint. She has conducted generator interconnection studies including providing testimonies before the California Energy Commission and the California Public Utilities Commission. She has been a member of the WECC Operation Practices Subcommittee or OPS (under the Operating Committee) and chairs the Operating Procedure Review Group (under OPS).</p> <p>Robin graduated from California Polytechnic State University at San Luis Obispo in 1992 (BSEE Power).</p>
<p>Mike Ryan Operations Management Portland General Electric (503) 464-8793 Office <a href="mailto:Mike.ryan@pgn.com">Mike.ryan@pgn.com</a></p>	<p>Education: BSEE, Masters Electrical Power Engineering Licensed Professional Engineer, Oregon</p> <p>35 yrs in Electrical Utility Business, work included Transmission Planning &amp; Operations, Operations Management, Operation of Balancing Authority.</p>
<p>Alan Roth Calpine <a href="mailto:alanr@calpine.com">alanr@calpine.com</a></p>	<p>BSEE from California Polytechnic State University, San Luis Obispo Registered Engineer - California</p> <p>25 years working in the petro-chemical industry. Responsibilities included engineering of industrial process plants and operation and maintenance of a power plant and medium voltage distribution system. 13 years with Calpine Corporation. Responsibilities include engineering and construction of large combined cycle power plants and operations support for operating plants. Also participate in WECC activities including standing committee membership and participation in various working groups and drafting teams.</p>
<p>Steve Wenke Avista <a href="mailto:Steve.wenke@avistacorp.com">Steve.wenke@avistacorp.com</a></p>	<p>Steve Wenke, PE – I have been with Avista since 1985 and have been Chief Generation Engineer since 1991. In that time I have worked in all facets of generator operations, maintenance, and development. Among my responsibilities is overseeing and coordinating Avista’s NERC compliance program for the generation assets.</p>



<p>John Simpson  John L. Simpson  Consultant  John L Simpson  Transmission Consulting  40318 Colfax Road,  Magnolia, TX 77354  (281) 954-1853 Office  <a href="mailto:John.L.Simpson@att.net">John.L.Simpson@att.net</a></p>	<p>John Simpson has a Bachelor of Science degree in Electrical Engineering from the University of Colorado and is a registered Professional Engineer in the states of Colorado and Florida. John has worked in the electric utility industry for over 40 years including 15 years in Power Plant Electrical Engineering with Public Service Company of Colorado, 15 years in Transmission Engineering and System Planning with Florida Power Corporation, and 10 years in Merchant Generating Plant Development and Transmission Interconnection with Reliant Energy and its successor companies. John has actively participated in several NERC and Regional Standard Development teams and is currently the Chair of the Standard Drafting Team for NERC Project 2008-01, Voltage and Reactive Planning and Control, and NERC Project 2011-INT-02, Interpretation of VAR-002 for Constellation.</p>
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