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**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

North American Electric Reliability )  
Corporation )

Docket No. \_\_\_\_\_

**JOINT PETITION OF THE  
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION AND  
WESTERN ELECTRICITY COORDINATING COUNCIL FOR APPROVAL OF  
PROPOSED REGIONAL RELIABILITY STANDARD VAR-501-WECC-3**

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Pursuant to Section 215(d)(1) of the Federal Power Act (“FPA”)<sup>1</sup> and Section 39.5<sup>2</sup> of the Federal Energy Regulatory Commission’s (“FERC” or “Commission”) regulations, the North American Electric Reliability Corporation (“NERC”)<sup>3</sup> and the Western Electricity Coordinating Council (“WECC”) hereby submit proposed Regional Reliability Standard VAR-501-WECC-3 – Power System Stabilizers for Commission approval. Regional Reliability Standard VAR-501-WECC-3 establishes the performance criteria for power system stabilizers to help ensure the Western Interconnection is operated in a coordinated manner under normal and abnormal conditions.

NERC requests that the Commission approve proposed Regional Reliability Standard VAR-501-WECC-3 (**Exhibit A**) and find that the proposed Regional Reliability Standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest.<sup>4</sup> NERC also requests approval of: (i) the associated Implementation Plan (**Exhibit B**) for the proposed Regional

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<sup>1</sup> 16 U.S.C. § 824o (2012).

<sup>2</sup> 18 C.F.R. § 39.5 (2016).

<sup>3</sup> The Commission certified NERC as the electric reliability organization (“ERO”) in accordance with Section 215 of the FPA on July 20, 2006. *N. Am. Elec. Reliability Corp.*, 116 FERC ¶ 61,062 (2006) (“ERO Certification Order”).

<sup>4</sup> Unless otherwise designated, all capitalized terms shall have the meaning set forth in the *Glossary of Terms Used in NERC Reliability Standards*, available at [http://www.nerc.com/files/Glossary\\_of\\_Terms.pdf](http://www.nerc.com/files/Glossary_of_Terms.pdf).

Reliability Standard; (ii) the associated Violation Risk Factors (“VRFs”) and Violation Severity Levels (“VSLs”) (**Exhibits A and E**); and (iii) the retirement of Regional Reliability Standard VAR-501-WECC-2. The NERC Board of Trustees adopted proposed Regional Reliability Standard VAR-501-WECC-3 on February 9, 2017.

As required by Section 39.5(a)<sup>5</sup> of the Commission’s regulations, this petition presents the technical basis and purpose of proposed Regional Reliability Standard VAR-501-WECC-3, including supporting technical documentation (**Exhibits G and H**); a demonstration that the proposed Regional Reliability Standard meets the criteria identified by the Commission in Order No. 672<sup>6</sup> (**Exhibit C**); a mapping document illustrating how requirements from VAR-501-WECC-2 map to the proposed requirements from VAR-501-WECC-2 (**Exhibit D**); and a summary of the development history (**Exhibit F**).

## **I. EXECUTIVE SUMMARY**

Power System Stabilizers damp oscillations that can occur between geographic areas within the Western Interconnection and have played an important role in the stability of the Western Interconnection. Over the past several decades, WECC and related working groups have developed policies and guidelines, conducted studies, and approved a Regional Reliability Standard to help manage power system stabilizer use in the Western Interconnection. With the development of proposed Regional Reliability Standard VAR-501-WECC-3, WECC seeks to

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<sup>5</sup> 18 C.F.R. § 39.5(a) (2016).

<sup>6</sup> The Commission specified in Order No. 672 certain general factors it would consider when assessing whether a particular Reliability Standard is just and reasonable. *See Rules Concerning Certification of the Electric Reliability Organization; and Procedures for the Establishment, Approval, and Enforcement of Electric Reliability Standards*, Order No. 672, FERC Stats. & Regs. ¶ 31,204, at P 262, 321-37, *order on reh’g*, Order No. 672-A, FERC Stats. & Regs. ¶ 31,212 (2006) (“Order No. 672”).

incorporate elements from its policies, guidelines, and lessons learned from studies into clarified, mandatory requirements.

The purpose of proposed Regional Reliability Standard VAR-501-WECC-3 is to ensure the Western Interconnection is operated in a coordinated manner under normal and abnormal conditions by establishing the performance criteria for power system stabilizers. Proposed Regional Reliability Standard VAR-501-WECC-3 includes requirements that address the following: (1) providing Transmission Operators with procedures or other documents that inform the Transmission Operator of when a power system stabilizer will be out of service; (2) having the power system stabilizer in service at all times except during specific circumstances; (3) tuning power system stabilizers to stated criteria; (4) installing and completing start-up testing of a power system stabilizer; and (5) repairing or replacing a power system stabilizer within a specified time period.

Proposed Regional Reliability Standard VAR-501-WECC-3 improves upon the existing standard by (1) focusing the in-service requirement on performance of the power system stabilizers rather than counting the hours they are online, (2) incorporating the power system stabilizer policies and guidelines into a mandatory standard, and (3) reducing administrative requirements with little benefit to reliability. Development of the proposed standard followed Commission-approved standards development processes and included subject matter experts with experience in power system stabilizers in the Western Interconnection. As a result, WECC draws upon its long history with power system stabilizers in the Western Interconnection to present an improved standard.

In this joint petition, NERC and WECC respectfully request the Commission approve proposed Regional Reliability Standard VAR-501-WECC-3, the associated VRFs and VSLs, the associated Implementation Plan, and the retirement of the existing Regional Reliability Standard

VAR-501-WECC-2. The following petition presents the justification for approval and supporting documentation.

## **II. NOTICES AND COMMUNICATIONS**

Notices and communications with respect to this filing may be addressed to the following:<sup>7</sup>

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## **III. BACKGROUND**

The following background information is provided below: (a) an explanation of the regulatory framework for NERC and Regional Reliability Standards; (b) an explanation of the WECC Regional Reliability Standards development process; (c) a discussion of the need for power system stabilizers in the Western Interconnection; and (d) the history of Project WECC-0107 Power System Stabilizer Design and Performance.

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<sup>7</sup> Persons to be included on the Commission's service list are identified by an asterisk. NERC respectfully requests a waiver of Rule 203 of the Commission's regulations, 18 C.F.R. § 385.203 (2014), to allow the inclusion of more than two persons on the service list in this proceeding.

## A. Regulatory Framework

By enacting the Energy Policy Act of 2005,<sup>8</sup> Congress entrusted the Commission with the duties of approving and enforcing rules to ensure the reliability of the Nation's Bulk-Power System, and with the duties of certifying an ERO that would be charged with developing and enforcing mandatory Reliability Standards, subject to Commission approval. Section 215(b)(1)<sup>9</sup> of the FPA states that all users, owners, and operators of the Bulk-Power System in the United States will be subject to Commission-approved Reliability Standards. Section 215(d)(5)<sup>10</sup> of the FPA authorizes the Commission to order the ERO to submit a new or modified Reliability Standard. Section 39.5(a)<sup>11</sup> of the Commission's regulations requires the ERO to file with the Commission for its approval each Reliability Standard that the ERO proposes should become mandatory and enforceable in the United States, and each modification to a Reliability Standard that the ERO proposes should be made effective.

The Commission has the regulatory responsibility to approve Reliability Standards that protect the reliability of the Bulk-Power System and to ensure that such Reliability Standards are just, reasonable, not unduly discriminatory or preferential, and in the public interest. Pursuant to Section 215(d)(2) of the FPA<sup>12</sup> and Section 39.5(c)<sup>13</sup> of the Commission's regulations, the Commission will give due weight to the technical expertise of the ERO with respect to the content of a Reliability Standard.

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<sup>8</sup> 16 U.S.C. § 824o (2012).

<sup>9</sup> *Id.* § 824o(b)(1).

<sup>10</sup> *Id.* § 824o(d)(5).

<sup>11</sup> 18 C.F.R. § 39.5(a) (2014).

<sup>12</sup> 16 U.S.C. § 824o(d)(2).

<sup>13</sup> 18 C.F.R. § 39.5(c)(1).



Similarly, the Commission approves Regional Reliability Standards proposed by Regional Entities if the Regional Reliability Standard is just, reasonable, not unduly discriminatory or preferential, and in the public interest.<sup>14</sup> In addition, Order No. 672 requires further criteria for Regional Reliability Standards. A regional difference from a continent-wide Reliability Standard must either be: (1) more stringent than the continent-wide Reliability Standard, or (2) necessitated by a physical difference in the Bulk-Power System.<sup>15</sup> The Commission must give due weight to the technical expertise of a Regional Entity, like WECC, that is organized on an Interconnection-wide basis with respect to a Regional Reliability Standard to be applicable within that Interconnection.<sup>16</sup>

### **B. WECC Regional Reliability Standards Development Process**

The proposed Regional Reliability Standard was developed in an open and fair manner and in accordance with the Commission-approved WECC Reliability Standards Development Procedures.<sup>17</sup> In accepting NERC's delegation agreements with the Regional Entities, the Commission found that NERC's proposed common attributes for Regional Reliability Standard development and WECC's Reliability Standards Development process provide for reasonable notice and opportunity for public comment, due process, openness, and a balance of interests in developing Reliability Standards and thus addresses certain of the criteria for approving Reliability Standards.<sup>18</sup> The development process is open to any person or entity that is an interested

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<sup>14</sup> Section 215(d)(2) of the FPA and 18 C.F.R. §39.5(a).

<sup>15</sup> *Rules Concerning Certification of the Electric Reliability Organization; and Procedures for the Establishment, Approval, and Enforcement of Electric Reliability Standards*, Order No. 672, FERC Stats. & Regs. ¶ 31,204, at P 291, *order on reh'g*, Order No. 672-A, FERC Stats. & Regs. ¶ 31,212 (2006).

<sup>16</sup> Order No. 672 at P 344.

<sup>17</sup> *Revisions to Delegation Agreement with Western Electricity Coordinating Council*, Letter Order, Docket No. RR14-8-000 (Dec. 23, 2014) (approving revised WECC Reliability Standards Development Procedures), available at <http://www.nerc.com/FilingsOrders/us/FERCOrdersRules/WECC%20Delegation%20Agreement.pdf>; The WECC Reliability Standards Development Procedures are available at <https://www.wecc.biz/Reliability/Reliability%20Standards%20Development%20Procedures%20-%20FERC%20Approved%20Dec%2023%202014.pdf>.

<sup>18</sup> *Order Accepting ERO Compliance Filing, Accepting ERO/Regional Entity Delegation Agreements, and Accepting Regional Entity 2007 Business Plans*, 119 FERC ¶ 61,060 at P 17 (2007).

stakeholder. WECC considers the comments of all stakeholders, and a vote of stakeholders and the WECC Board of Directors is required to approve a Regional Reliability Standard. Once the standard is approved by the WECC Board of Directors, NERC posts the approved Regional Reliability Standard for an additional comment period. Then the NERC Board of Trustees must adopt the Regional Reliability Standard before the Regional Reliability Standard is submitted to the Commission for approval.

### **C. Need for Power System Stabilizers in the Western Interconnection**

Power system stabilizers play an important role in the stability of the Western Interconnection. Power system stabilizers are part of the automatic voltage regulation system of a generator and are designed to add or subtract torque to a generator with the goal of damping oscillations on the Western Interconnection's Bulk Electric System ("BES") that otherwise would be amplified if the automatic voltage regulator is operated alone. Power system stabilizers within WECC were developed in the 1960s in response to power system oscillations on the Pacific Intertie within the Western Interconnection. These oscillations occur at very low frequencies (<1 Hertz), are very lightly dampened, and became known as "inter-area modes" of oscillation because they occur when real power is transferred from one Western Interconnection geographic region to another (such as between the Pacific Northwest and the Southwest). These modal oscillations are the result of a combination of many machines on one part of the Western Interconnection BES whose voltage support response to system fluctuations is not in phase with the response of machines on another part of the Western Interconnection BES.

Moreover, as the Commission recognized, the Western Interconnection possesses particular physical characteristics that justify interconnection-specific requirements.<sup>19</sup> In Order No. 740, the Commission stated:

[I]n the Western Interconnection a significant number of transmission paths are voltage or frequency stability-limited, in contrast to other regions of the [BES] where transmission paths more often are thermally-limited. Disturbances resulting in a stability-limited transmission path overload, generally, must be responded to in a shorter time frame than a disturbance that results in a thermally-limited transmission path overload. [FERC has also noted] its understanding that this physical difference is one of the reasons for the need for certain provisions of regional Reliability Standards in the Western Interconnection.<sup>20</sup>

As a result of the Western Interconnection physical characteristics, WECC developed a Regional Reliability Standard, policies, and guidelines that address power system stabilizers. With the development of proposed Regional Reliability Standard VAR-501-WECC-3, WECC provided additional clarity and incorporated the power system stabilizer policies and guidelines into one Regional Reliability Standard. Proposed Regional Reliability Standard VAR-501-WECC-3 addresses the unique characteristics of the Western Interconnection in one set of requirements that incorporate WECC's long history with power system stabilizers.

#### **D. Development of Proposed Regional Reliability Standard**

As further described in Exhibit F hereto, proposed Regional Reliability Standard VAR-501-WECC-3 was developed as part of Project WECC-0107 Power System Stabilizer Design and Performance to improve upon Regional Reliability Standard VAR-501-WECC-2. On May 2, 2016, the ninth draft of proposed Regional Reliability Standard VAR-501-WECC-3 received the requisite approval from the registered ballot body, with a weighted approval of 66.0 percent. The WECC Board of Directors approved the standard on June 14, 2016 and subsequently approved the

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<sup>19</sup> *Version One Regional Reliability Standard for Resource and Demand Balancing*, Order No. 740, 133 FERC ¶ 61,063 (2010) at P 23.

<sup>20</sup> *Id.*

standard to be submitted to the NERC Board of Trustees for adoption on September 21, 2016. NERC posted the standard for a 45-day comment period concluding on January 25, 2017. There were no additional changes after this comment period. The NERC Board of Trustees adopted the standard on February 9, 2017.

#### **IV. JUSTIFICATION FOR APPROVAL**

As discussed in detail in Exhibit C, proposed Regional Reliability Standard VAR-501-WECC-3 – Power System Stabilizers is just, reasonable, not unduly discriminatory or preferential, and in the public interest. As described more fully herein and in Exhibit C, the proposed Regional Reliability Standard provides reliability benefits for the Bulk-Power System in the WECC region.

The purpose of proposed Regional Reliability Standard VAR-501-WECC-3 is to ensure the Western Interconnection is operated in a coordinated manner under normal and abnormal conditions by establishing the performance criteria for power system stabilizers. The provisions of the proposed standard provide mandatory performance requirements for power system stabilizers in the Western Interconnection based on long-held policy in the WECC region. The codification of this policy increases reliability by providing certainty around operating practices for power system stabilizers.

The proposed standard includes requirements for providing power system stabilizer operating specifications to Transmission Operators (Requirement R1), having power system stabilizers in service during all hours unless specifically exempted (Requirement R2), tuning power system stabilizers to meet certain inter-area mode criteria (Requirement R3), installing power system stabilizers under specified circumstances occurring after the effective date of the

standard (Requirement R4), and repairing or replacing an existing power system stabilizer within 24 months of the power system stabilizer becoming non-operational (Requirement R5).

This section of the petition addresses: (i) the justification of the need for the Proposed Regional Reliability Standard; (ii) the existing WECC policies and guidelines on power system stabilizers on which the revised VAR-501-WECC-3 is based; (iii) the applicability of proposed Regional Reliability Standard VAR-501-WECC-3; (iv) the description and technical basis of the proposed requirements; and (v) the enforceability of the proposed standard.

**A. Justification for the Need for the Proposed Regional Reliability Standard**

In addition to the physical characteristics of the Western Interconnection that necessitate a Regional Reliability Standard addressing power system stabilizers, discussed above, proposed Regional Reliability Standard VAR-501-WECC-3 meets the criteria to justify the need for a Regional Reliability Standard as it is more stringent than the related continent-wide NERC Reliability Standard VAR-002-4. Whereas NERC Reliability Standard VAR-002-4 only requires that a Generator Operator notify its Transmission Operator when it removes a power system stabilizer from service and does not limit the amount of time for operating generators without a power system stabilizer in service, proposed Regional Reliability Standard VAR-501-WECC-3 requires power system stabilizers to be in service except for specific circumstances and for a limited time. In addition, the proposed standard requires applicable entities to install power system stabilizers on generators following certain triggering events, which is not required by any continent-wide NERC Reliability Standard. As power system stabilizers provide an additional stability support beyond that of an automatic voltage regulator alone, the proposed Regional Reliability Standard VAR-501-WECC-3 is more stringent than continent-wide standards by requiring the extra level of support. Therefore, the proposed Regional Reliability Standard VAR-501-WECC-3 is justified because it meets the criteria in Order No. 672 to be more stringent than

continent-wide Reliability Standards. Entities that perform the functions to which the continent-wide standards and the proposed Regional Reliability Standard apply need to comply with all applicable standards, so the proposed Regional Reliability Standard provides a level of support to the Western Interconnection in addition to the continent-wide standards.

## **B. WECC Policy Statement on Power System Stabilizers**

The standard drafting team based the requirements in proposed Regional Reliability Standard VAR-501-WECC-3 on long-held policy in the Western Interconnection. This includes the WECC Policy Statement on Power System Stabilizers, the WECC Power System Stabilizer Tuning Guidelines, and the Criteria to Determine Excitation System Suitability for Power System Stabilizers in the Western Systems Coordinating Council (“WSCC”) System (**Exhibit H**).<sup>21</sup>

Approved by the WECC Board of Directors on April 18, 2002, the WECC Policy Statement on Power System Stabilizers provides guidance on the types of generators that should have power system stabilizers, citing the December 1992 Criteria to Determine Excitation System Suitability for Power System Stabilizers in the WSCC System. In addition, the WECC Policy Statement on Power System Stabilizers includes a reference to the WECC Power System Stabilizer Tuning Guidelines, which suggests minimum criteria needed to tune a power system stabilizer. Although not mandatory, the policy and referenced guidelines provided some direction to applicable entities in the Western Interconnection as to who should install power system stabilizers, how they should be tuned, and under what circumstances power system stabilizers could be out of operation. In developing proposed Regional Reliability Standard VAR-501-WECC-3, WECC expanded on the current Regional Reliability Standard VAR-501-WECC-2 to incorporate concepts from the WECC policies and guidelines, including applicability, installation,

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<sup>21</sup> WSCC became WECC in 2002 after merging with other regional transmission associations.

and tuning. By incorporating the policies and guidelines into a mandatory standard, WECC will help to ensure that the concepts from the policies and guidelines are consistently implemented. In doing so, the Western Interconnection can derive the benefits of more broadly-installed power system stabilizers and bolster the reliability of the system.

**C. Applicability of Proposed Regional Reliability Standard VAR-501-WECC-3 – Power System Stabilizers**

Proposed Regional Reliability Standard VAR-501-WECC-3 is applicable to: (1) Generator Operators in the Western Interconnection that operate synchronous generators, connected to the BES, that meet the definition of Commercial Operation; and (2) Generator Owners in the Western Interconnection that own synchronous generators, connected to the BES, that meet the definition of Commercial Operation.<sup>22</sup> In determining which generators should be subject to the proposed standard, the standard drafting team considered the WECC Policy Statement on Power System Stabilizers, included in Exhibit H hereto, and studies performed in the Western Interconnection on the applicability of power system stabilizers (“Applicability Study”), included in Exhibit G hereto.

The WECC Policy Statement on Power System Stabilizers recommended that power system stabilizers be applied to units greater than 30 Mega Volt Amps (“MVAs”). This threshold was based on a 1992 study, Criteria to Determine Excitation System Suitability for Power System Stabilizers in WSCC System, included in Exhibit H hereto. The results of the Applicability Study indicated, however, that generating unit MVA rating is not directly proportional to its impact on damping of particular modes of oscillation and, as a result, did not specify a MVA rating that could be used in the proposed standard. As discussed below, the standards drafting team ultimately decided to rely on a generator’s connection to the BES to determine applicability.

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<sup>22</sup> “Commercial Operation” is a WECC Regional Term and is defined as “[a]chievement of this designation indicates that the Generator Operator or Transmission Operator of the synchronous generator or synchronous condenser has received all approvals necessary for operation after completion of initial start-up testing.”

More specifically, the Applicability Study found that several factors influence the effectiveness of power system stabilizers at any single point in time, and it is nearly impossible to determine the impact of a single unit. As noted in the Applicability Study, the nature of system-wide modes of oscillation and the effectiveness of individual generating units on these modes varies with the system topology and the instantaneous operating point conditions. In some cases, the response of a particular unit may be of great importance to the overall system behavior, but in another case, have no impact. As a result, entities in the Western Interconnection have installed power system stabilizers on synchronous generators across the system to provide sufficient stability support at any one time.

Recognizing that broad use of power system stabilizers across the system provide stability support, the Applicability Study further looked into whether there was a MVA rating at which the damping effects of the power system stabilizer no longer benefited the system (**Exhibit G**). The study concluded, as noted above, that generating unit MVA rating is not directly proportional to its impact on damping of particular modes of oscillation. Stated simply, the Applicability Study concluded that there is no clear MVA rating threshold below which a power system stabilizer does not provide a benefit based on the data available. However, the Applicability Study did note that a majority of power system stabilizers in the Western Interconnection are on synchronous generators greater than 75 MVA.

Based on this study and the WECC policy, the standard drafting team determined that the standard should apply to any synchronous generator that connects to the BES and meets the definition of Commercial Operation. Under the BES definition, a generating resource is considered part of the BES if it is connected at a voltage of 100 kilovolts or above with: (1) gross individual nameplate rating greater than 20 MVA; or (2) gross plant/facility aggregate nameplate



rating greater than 75 MVA, unless excluded or exempted.<sup>23</sup> In the absence of a clear MVA rating threshold for the benefits of power system stabilizers, using the BES definition as a bright line of applicability would help to ensure an appropriate number of synchronous generators would have power system stabilizers installed. In fact, by using the BES definition as a threshold, the standard drafting team recognized that some generators previously excluded under the existing standard would be brought into scope because some generators that fell under the existing five percent operating hours exclusion would come in under the BES definition. In addition, the BES definition is a natural cut off for applicability of NERC Reliability Standards as it represents the threshold for determining whether a facility could impact the reliable operation of the Bulk-Power System. Therefore, the applicability of the proposed Regional Reliability Standard supports reliability by providing a clear applicability threshold for generators, which helps to ensure that there is sufficient stability support in the Western Interconnection.

#### **D. Description and Technical Basis of Proposed Requirements**

Proposed Regional Reliability Standard VAR-501-WECC-3 revises the existing requirements in Regional Reliability Standard VAR-501-WECC-2 to incorporate existing WECC policies and guidelines on power system stabilizers, provide improved clarity on installation and tuning of power system stabilizers, and reduce administrative burdens that have little benefit to reliability. The existing Regional Reliability Standard VAR-501-WECC-2 requires applicable entities to run power system stabilizers for 98 percent of operating hours, except under 12 specified conditions, obligating entities to log the number of operating hours of the synchronous generator. In contrast, the proposed Regional Reliability Standard VAR-501-WECC-3 requires applicable entities to have the power system stabilizer in service during all hours, unless specifically

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<sup>23</sup> The entire Bulk Electric Definition is in the *Glossary of Terms Used in NERC Reliability Standards*, available at [http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary\\_of\\_Terms.pdf](http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf).

exempted under Requirement R2, without the burdensome expectation that all operating hours must be logged. In addition, Regional Reliability Standard VAR-501-WECC-3 added requirements to (1) notify Transmission Operators as to known circumstances when a power system stabilizer will be out of service; (2) tune the power system stabilizer to stated specifications; and (3) install and service power system stabilizers.

The following sections discuss the proposed Requirements R1, R2, R3, R4, and R5.

### **1. Requirement R1**

Proposed Requirement R1 requires a Generator Owner to provide to its Transmission Operator the Generator Owner's written Operating Procedure or other document(s) describing those known circumstances during which the Generator Owner's power system stabilizer will not be providing an active signal to the automatic voltage regulator. Such procedures or documents must be provided within 180 days of any of the following events: (1) the effective date of VAR-501-WECC-3; (2) the power system stabilizer's Commercial Operation date; or (3) any changes to the power system stabilizer operating specifications. The intent of Requirement R1 is to provide the Transmission Operator awareness of the varying states of the power system stabilizer in a planning horizon, particularly to help ensure the Transmission Operator knows when the power system stabilizer is active and providing damping to the system.

The standard drafting team selected 180 days to give time to develop the appropriate documents, if necessary, after the triggering factors. For instance, if an entity just installed a power system stabilizer on a generator, the 180 days gives the Generator Owner time to complete start-up testing and incorporate any operating specifications into the document that resulted from start-up testing. In addition, the Generator Operator must already provide more real-time status updates of the power system stabilizer to the Transmission Operator under Reliability Standard VAR-002-4, Requirement R3, so the Transmission Operator would receive any status change notifications

while waiting to receive any operating documents required under proposed Requirement R1. For purposes of notifying the Transmission Operator, the various states of the power system stabilizer, such as on, off, active, and non-active, would not constitute changes to the operating specifications as long as the power system stabilizer is operating according to the documentation provided to the Transmission Operator. Proposed Requirement R1 provides a reliability benefit by incorporating a requirement in the planning horizon into the power system stabilizer standard. By providing operating procedures or documents, proposed Requirement R1 improves reliability by supplementing the real-time reporting obligations of Reliability Standard VAR-002-4, Requirement R3 with planning horizon documents.

## **2. Requirement R2**

Whereas proposed Requirement R1 addresses normal operating conditions, proposed Requirement R2 addresses exceptions to normal operation of power system stabilizers. Proposed Requirement R2 requires Generator Operators to have their power system stabilizers in service while synchronized, except during any of the following: (1) component failure; (2) testing of a BES Element affecting or affected by the power system stabilizer; (3) maintenance, or (4) as agreed upon by the Generator Operator and the Transmission Operator. This requirement only applies when the power system stabilizer has been out of service for a period greater than 30 minutes as such short-term incidents are unlikely to have any negative impact on the reliability of the BES. For instance, there is no reliability concern if there is a lag in the power system stabilizer becoming active the instant the generator is synchronized. With the 30-minute allowance, there is time for synchronization and subsequent activation of the power system stabilizer. To that end, a power system stabilizer may be out of service for 30 minutes or less, regardless of cause, without risking noncompliance with Requirement R2.

The intent of proposed Requirement R2 is to shift the focus from counting operating hours to requiring performance of power system stabilizers. Under the existing standard, power system stabilizers can be out of service for two percent of the time for any reason. In addition, under the existing version of the standard, there are twelve instances in which certain hours may be excluded from the in-service requirement beyond the two percent downtime. The proposed Regional Reliability Standard narrows those exceptions. Under Requirement R2, power system stabilizers may be out of service for 30 minutes or longer only in the following circumstances: component failure, testing of certain Elements, maintenance, or when agreed upon by the Generator Operator and Transmission Operator.

Proposed Requirement R2 improves upon the existing Requirement R2 by requiring power system stabilizers to be in service for 100 percent of the time except for the circumstances stated in the standards, whereas the existing standard only requires power system stabilizers to be in service 98 percent of operating hours except for the circumstances stated in the standard and for two percent of operating hours for any reason. As a result, proposed Requirement R2 promotes reliability by allowing Generator Operators to focus on keeping the power system stabilizer in service, except for the stated reasons or by agreement, rather than counting the hours it is out of service and by increasing the amount of time required to be in service. In addition, proposed Requirement R2 decreases an administrative burden that does little to promote reliability through eliminating the expectation to log hours of synchronous generator operation.

### **3. Requirement R3**

Proposed Requirement R3 specifies inter-area mode criteria for tuning power system stabilizers. The proposed requirement reads as follows:

- R3.** Each Generator Owner shall tune its PSS to meet the following inter-area mode criteria, except as specified in Requirement R3, Part 3.5 below: [Violation Risk Factor: Medium] [Time Horizon: Operating Assessment]

- 3.1. PSS shall be set to provide the measured, simulated, or calculated compensated  $V_t/V_{ref}$  frequency response of the excitation system and synchronous machine such that the phase angle will not exceed  $\pm 30$  degrees through the frequency range from 0.2 Hertz to the lesser of 1.0 Hertz or the highest frequency at which the phase of the  $V_t/V_{ref}$  frequency response does not exceed 90 degrees.
- 3.2. PSS output limits shall be set to provide at least  $\pm 5\%$  of the synchronous machine's nominal terminal voltage.
- 3.3. PSS gain shall be set to between  $1/3$  and  $1/2$  of maximum practical gain.
- 3.4. PSS washout time constant shall be no greater than 30 seconds.
- 3.5. Units that have an excitation system or PSS that is incapable of meeting the tuning requirements of Requirement R3 are exempt from Requirement R3 until the voltage regulator is either replaced or retrofitted such that the PSS becomes capable of meeting the tuning requirements.

Proposed Requirement R3 drew from the WECC Power System Stabilizer Tuning Guidelines to determine tuning output criteria (**Exhibit H**). In addition, the standard drafting team took a practical approach to setting the parameters in proposed Requirement R3. Recognizing that proper tuning is important to power system stabilizer performance, the standard drafting team also considered how best to construct the criteria based on practical limitations and past experience. For instance, the standard drafting team noted in the Guideline and Technical Basis section that the proposed .2 Hertz to the lesser of 1 Hertz frequency range more closely aligns with observed oscillation frequencies in the Western Interconnection than the .1 Hertz included in the WECC Power System Stabilizer Tuning Guidelines. Additionally, the standard drafting team considered real operating conditions when determining that the power system stabilizer gain is to be  $1/3$  and  $1/2$  of the maximum practical gain that could be achieved during commissioning. As detailed more fully in Exhibit G hereto, by using maximum practical gain that was achieved during commissioning as a measure, the standard drafting team took limiting factors that could occur in actual operations, such as noise, into account that may not be represented in simulations.

Therefore, proposed Requirement R3 promotes reliability by requiring tuning parameters that take practical considerations and unit variations into account.

#### **4. Requirement R4**

Proposed Requirement R4 requires Generator Owners to install and complete start-up testing of a power system stabilizer on a generator within 180 days of either of the following: (1) the Generator Owner connects a generator to the BES, after achieving Commercial Operation, and after the effective date of VAR-501-WECC-3; or (2) the Generator Owner replaces the voltage regulator on its existing excitation system after achieving Commercial Operation for its generator that is connected to the BES and after the effective date of VAR-501-WECC-3.

The intent behind proposed Requirement R4 was to provide specificity as to when a power system stabilizer should be installed and to provide a reasonable amount of time for commissioning. As detailed in the mapping document in Exhibit D hereto, the standard drafting team concluded 180 days is a reasonable time for commissioning based on comments received and consultation with compliance staff. The 180 days allows the Generator Owner to address some unforeseen circumstances that may delay commissioning, although the drafting team recognized that there may be other circumstances out of the entity's control that may extend commissioning beyond 180 days. The standard drafting team determined that it could not accommodate all unforeseen circumstances in a requirement and that 180 days was an appropriate balance of allowing some time for unforeseen circumstances while providing a clear timeframe. All new synchronous generators connected to the BES are required to install power system stabilizers, but existing synchronous generators do not need to install a power system stabilizer until one of the triggering events listed in proposed Requirement R4. In addition, the first bullet of proposed Requirement R4 is intended to only apply to initial connection to the BES.

## **5. Requirement R5**

Proposed Requirement R5 requires each Generator Owner to repair or replace a power system stabilizer within 24 months of that power system stabilizer becoming incapable of meeting the tuning specifications in Requirement R3. The intent of proposed Requirement R5 is to address units that previously were working but no longer are capable. In addition, the standard drafting team streamlined the approach towards repairs or replacements. In the existing Regional Reliability Standard VAR-501-WECC-2, Requirement R1, Parts 1.8, 1.9, and 1.10 provide incremental repair timeframes, depending on the type of maintenance and documentation submitted, up to 24 months. The 24-month timeframe originally was intended to accommodate procurement periods for replacing a power system stabilizer, which was based on entity experiences in WECC, and the Commission recognized the need for this timeframe.<sup>24</sup> The proposed Requirement R5 simply allows 24 months for repair or replacement, regardless of cause or documentation. Therefore proposed Requirement R5 retains the maximum time period to accommodate procurement periods and eliminates the tiered approach from the current standard to streamline the requirement and reduce excess documentation needs.

### **E. Enforceability of Proposed Regional Reliability Standard VAR-501-WECC-3**

The proposed Regional Reliability Standard includes VRFs and VSLs. The VSLs provide guidance on the way that NERC will enforce the requirements of the proposed Regional Reliability Standard. The VRFs are one of several elements used to determine an appropriate sanction when the associated requirement is violated. The VRFs assess the impact to reliability of violating a specific requirement. The VRFs and VSLs for the proposed Regional Reliability Standard comport with NERC and Commission guidelines related to their assignment. For a detailed review

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<sup>24</sup> *Version One Regional Reliability Standards for Facilities Design, Connections, and Maintenance; Protection and Control; and Voltage and Reactive*, 135 FERC ¶ 61,061 (2011) at P 104.

of the VRFs, the VSLs, and the analysis of how the VRFs and VSLs were determined using these guidelines, please see Exhibit E.

The proposed Regional Reliability Standard also includes measures that support each requirement by clearly identifying what is required and how the requirement will be enforced. These measures help ensure that the requirements will be enforced in a clear, consistent, and non-preferential manner and without prejudice to any party.<sup>25</sup>

## **V. EFFECTIVE DATE**

NERC respectfully requests that the Commission approve the proposed Regional Reliability Standard VAR-501-WECC-3 and the retirement of VAR-501-WECC-2 to become effective as set forth in the proposed Implementation Plan, provided in Exhibit B hereto. The proposed effective date of the proposed Regional Reliability Standard is the first day of the first calendar quarter after the effective date of the applicable governmental authority's order approving the standard, or as otherwise provided for by the applicable governmental authority. The implementation plan provides, however, that for units placed in service prior to final regulatory or NERC Board of Trustees approval of the standard, Requirement R3 becomes effective five years after the effective date of the standard. The drafting team determined that the additional time for certain units to comply with Requirement R3 is necessary as changing the tuning parameters on power system stabilizers does not need to occur for currently-operating units and could place a moderate to severe burden on the entity depending on its practices. Units placed into service for

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<sup>25</sup> Order No. 672 at P 327 (“There should be a clear criterion or measure of whether an entity is in compliance with a proposed Reliability Standard. It should contain or be accompanied by an objective measure of compliance so that it can be enforced and so that enforcement can be applied in a consistent and non-preferential manner.”).



the first time after the effective date of the standard can tune the power system stabilizers to the parameters in proposed Requirement R3 during initial testing and start-up.

## VI. CONCLUSION

For the reasons set forth above, NERC respectfully requests that the Commission approve:

- the proposed Regional Reliability Standard VAR-501-WECC-3 in **Exhibit A**;
- the other associated elements in the Reliability Standard in **Exhibit A**, including the VRFs and VSLs (**Exhibits A and E**);
- the retirement of existing Regional Reliability Standard VAR-501-WECC-2; and
- the Implementation Plan, included in **Exhibit B**.

Respectfully submitted,

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