

February 25, 2015

**VIA ELECTRONIC FILING**

David Erickson  
President and Chief Executive Officer  
Alberta Electric System Operator  
2500, 330 - 5 Avenue SW  
Calgary, Alberta  
T2P 0L4

RE: *North American Electric Reliability Corporation*

Dear Mr. Erickson:

The North American Electric Reliability Corporation (“NERC”) hereby submits Notice of Filing of the North American Electric Reliability Corporation of Proposed Reliability Standards PRC-004-2.1(i)a, PRC-004-4, PRC-005-2(i), PRC-005-3(i), and VAR-002-4. NERC requests, to the extent necessary, a waiver of any applicable filing requirements with respect to this filing.

NERC understands the AESO may adopt the proposed reliability standards subject to Alberta legislation, principally as established in the *Transmission Regulation* (“the T Reg.”). Briefly, it is NERC’s understanding that the T Reg. requires the following with regard to the adoption in Alberta of a NERC Reliability Standard:

1. The AESO must consult with those market participants that it considers are likely to be directly affected.
2. The AESO must forward the proposed reliability standards to the Alberta Utilities Commission for review, along with the AESO’s recommendation that the Commission approve or reject them.
3. The Commission must follow the recommendation of the AESO that the Commission approve or reject the proposed reliability standards unless an interested person satisfies the Commission that the AESO’s recommendation is “technically deficient” or “not in the public interest.”

Further, NERC has been advised by the AESO that the AESO practice with respect to the adoption of a NERC Reliability Standard includes a review of the NERC Reliability Standard for applicability to Alberta legislation and electric industry practice. NERC has been advised that, while the objective is to adhere as closely as possible to the requirements of the NERC Reliability Standard, each NERC Reliability Standard

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approved in Alberta (called an “Alberta reliability standard”) generally varies from the similar and related NERC Reliability Standard.

NERC requests the AESO consider Proposed Reliability Standards PRC-004-2.1(i)a, PRC-004-4, PRC-005-2(i), PRC-005-3(i), and VAR-002-4 for adoption in Alberta as an “Alberta reliability standard(s),” subject to the required procedures and legislation of Alberta.

Please contact the undersigned if you have any questions.

Respectfully submitted,

/s/ Holly A. Hawkins

Holly A. Hawkins  
*Associate General Counsel for the North  
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Enclosure



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**Exhibit A** Proposed Reliability Standards

**Exhibit B** Implementation Plans

- Exhibit C** Draft Technical White Paper
- Exhibit D** Reliability Standards Criteria
- Exhibit E** Summary of Development History and Complete Record of Development of Proposed Reliability Standards
- Exhibit F** Standard Drafting Team Roster for NERC Standards Development Project 2014-01



NERC Board of Trustees.<sup>3</sup> The proposed changes do not affect the Violation Risk Factors (“VRFs”), Violation Severity Levels (“VSLs”), or the Measures associated with the proposed Reliability Standards subject to this filing. NERC also provides notice of the Implementation Plan for each proposed Reliability Standard (Exhibit B).

This filing presents the technical basis and purpose of the proposed Reliability Standards, a summary of the development history (Exhibit E), and a demonstration that the proposed Reliability Standards meet the Reliability Standards criteria (Exhibit D).

## **I. EXECUTIVE SUMMARY**

The proposed revisions clarify how the unique operating characteristics of dispersed power producing resources impact the applicability of NERC Reliability Standards. As NERC has previously asserted, in order to ensure that Reliability Standards are applied in a cost-effective manner and that the applicability of Reliability Standards is focused on entities having a material impact on reliability of the Bulk-Power System, it is necessary to provide greater specificity in the applicability section of the Reliability Standards. The Federal Energy Regulatory Commission (“FERC”) acknowledged the need for such clarity and prioritization in Order No. 693,<sup>4</sup> and has approved numerous Reliability Standards with applicability based on electric facility characteristics, including the Critical Infrastructure Protection Reliability Standards.<sup>5</sup>

Dispersed power producing resources, such as wind and solar, are generally considered to be variable energy resources. As explained in this filing, the design and operating characteristics

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<sup>3</sup> An explanation of the NERC numbering convention for Reliability Standards is available on the NERC web site at: [http://www.nerc.com/pa/Stand/Resources/Documents/NERC\\_standards\\_numbering\\_system\\_V2.pdf](http://www.nerc.com/pa/Stand/Resources/Documents/NERC_standards_numbering_system_V2.pdf).

<sup>4</sup> Order No. 693 at P 98.

<sup>5</sup> See also, EOP-010-1, FAC-003-3, PRC-005-2, and PRC-022-1.

of these resources are different than traditional generation and Reliability Standards should account for these differences.

The proposed Reliability Standards reflect in-depth technical analysis by the NERC Dispersed Generation Resources Standard Drafting Team, which considered the technical characteristics of dispersed generation and the risk to the Bulk-Power System associated with this type of generation facilities. The standard drafting team reviewed several groups of Reliability Standards applicable to dispersed generation prior to recommending the proposed changes to the three Reliability Standards listed above.

The standard drafting team determined that when evaluated individually, the components of dispersed power generation, such as individual wind or solar units, often do not pose a significant risk to the reliability of the Bulk-Power System. However, reliability could be improved by ensuring the equipment utilized to aggregate these individual units to a common point of interconnection with the Bulk-Power System is operated and maintained as required by the NERC Reliability Standards.

To tailor the body of NERC Reliability Standards to account for the reliable operations of these resources, NERC is proposing the changes to the three distinct Reliability Standards included in this filing.



## II. NOTICES AND COMMUNICATIONS

Notices and communications with respect to this filing may be addressed to the following:

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## III. BACKGROUND

### A. **NERC Reliability Standards Development Procedure**

The proposed Reliability Standards were developed in an open and fair manner and in accordance with the Reliability Standard development process. NERC develops Reliability Standards in accordance with Section 300 (Reliability Standards Development) of its Rules of Procedure and the NERC Standard Processes Manual.<sup>6</sup>

NERC's proposed rules provide for reasonable notice and opportunity for public comment, due process, openness, and a balance of interests in developing Reliability Standards and thus satisfies the Reliability Standards criteria. The development process is open to any person or entity with a legitimate interest in the reliability of the Bulk-Power System. NERC considers the comments of all stakeholders, and a vote of stakeholders and the NERC Board of

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<sup>6</sup> The NERC Rules of Procedure are available at <http://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx>. The NERC Standard Processes Manual is available at [http://www.nerc.com/comm/SC/Documents/Appendix\\_3A\\_StandardsProcessesManual.pdf](http://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf).

Trustees is required to approve a Reliability Standard before the Reliability Standard is submitted to the applicable governmental authorities.

**B. Definition of “Bulk Electric System”**

On April 4, 2006, NERC submitted a filing that included the NERC Glossary, which includes NERC’s definition of “Bulk Electric System.” On November 18, 2010, FERC revisited the definition of Bulk Electric System in Order No. 743, which directed NERC to revise the definition to ensure that it encompasses all facilities necessary for operating an interconnected transmission network.<sup>7</sup>

On March 1, 2012, NERC submitted its proposed revision to the Bulk Electric System definition. The definition consisted of a “core” definition and a list of facilities and configurations that will be included in, or excluded from, the “core” definition based on the risk they present to the system. NERC proposed, the following definition of Bulk Electric System:

Unless modified by the [inclusion and exclusion] lists shown below, all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy.

On December 20, 2012, FERC issued Order No. 773,<sup>8</sup> a final rule approving NERC’s modifications to the definition of “bulk electric system” and the associated Rules of Procedure exception process to be effective July 1, 2013. On June 13, 2013, FERC granted NERC’s request for extension of time and extended the effective date for the revised definition of bulk electric system and the Rules of Procedure exception process to July 1, 2014.<sup>9</sup>

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<sup>7</sup> Order No. 743, 133 FERC ¶ 61,150 at P 16.

<sup>8</sup> *Revisions to Electric Reliability Organization Definition of Bulk Electric System and Rules of Procedure*, Order No. 773, 141 FERC ¶ 61,236 (2012), *order on reh’g*, Order No. 773-A, 143 FERC ¶ 61,053 (2013), *order on reh’g and clarification*, 144 FERC ¶ 61,174 (2013).

<sup>9</sup> *Revisions to Electric Reliability Organization Definition of Bulk Electric System and Rules of Procedure*, 143 FERC ¶ 61,231, at P 13 (2013).

On May 6, 2014, NERC filed proposed revisions to the definition of Bulk Electric System in response to FERC directives in Order Nos. 773 and 773-A, and to respond to industry concerns raised during the initial development of the revisions to the definition. On March 20, 2014, FERC issued an Order, approving the revised definition of Bulk Electric System.<sup>10</sup> The definition, as revised consists of the core definition, as quoted above, and Inclusions and Exclusions that address specific configurations of facilities. Inclusion I4 specifically addresses dispersed power producing resources, and provides:

**I4** - Dispersed power producing resources that aggregate to a total capacity greater than 75 MVA (gross nameplate rating), and that are connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage of 100 kV or above.

Thus, the facilities designated as BES are:

- a) The individual resources, and
- b) The system designed primarily for delivering capacity from the point where those resources aggregate to greater than 75 MVA to a common point of connection at a voltage of 100 kV or above.

The term “dispersed power producing resources” used in Inclusion I4 is not defined within the definition of “Bulk Electric System” or separately in the NERC Glossary. However, the *Bulk Electric System Definition Reference Document*<sup>11</sup> includes a description of what constitutes dispersed generation resource:

Dispersed power producing resources are small-scale power generation technologies using a system designed primarily for aggregating capacity providing an alternative to, or an enhancement of, the traditional electric power system. Examples could include but are not limited to: solar, geothermal, energy storage, flywheels, wind, micro-turbines, and fuel cells.

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<sup>10</sup> *N. Am. Elec. Reliability Corp.*, 146 FERC ¶ 61,199 (2014) (approving revised definition of Bulk Electric System).

<sup>11</sup> Available at: [http://www.nerc.com/pa/RAPA/BES%20DL/bes\\_phase2\\_reference\\_document\\_20140325\\_final\\_clean.pdf](http://www.nerc.com/pa/RAPA/BES%20DL/bes_phase2_reference_document_20140325_final_clean.pdf)

In its March 20, 2014 Order, FERC agreed that the facilities listed in I4 should be subject to the NERC Reliability Standards. Specifically, FERC affirmed that all forms of generation resources, including variable generation resources, should be included under I4. FERC explained that given the increasing presence of wind, solar, and other non-traditional forms of generation, continuing the inclusion of individual variable generation units within the scope of the Bulk Electric System definition is appropriate to ensure that, where necessary to support reliability, these units may be subject to Reliability Standards.<sup>12</sup> FERC determined that inclusion I4 is limited to individual resources that aggregate to a total capacity greater than 75 MVA, the same threshold applicable to other types of generating resources.<sup>13</sup>

In the same Order, FERC addressed the issue of whether individual power producing resources should be included under I4, and concluded that individually or in aggregate, variable generating resources can impact the reliability of the Bulk-Power System.<sup>14</sup> However, FERC also explained that under some circumstances, it may be appropriate that owners of these wind turbines be responsible for only a subset of the requirements applicable to other Generator Owners.<sup>15</sup> FERC deferred to NERC to consider the applicability of standards for dispersed generation resources through its standards development process, and specifically under Project 2014-01.<sup>16</sup>

### **C. History of Project 2014-01**

Project 2014-01, Standards Applicability for Dispersed Generation Resources, was initiated in response to industry request and designed to ensure that the Generator Owners and

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<sup>12</sup> *Order Approving Revised Definition*, PP 46-47.

<sup>13</sup> *Id.*

<sup>14</sup> *Id.*, P 48.

<sup>15</sup> *Id.*, P 49.

<sup>16</sup> *Id.*

Generator Operators of dispersed generation resources are appropriately assigned responsibility for performance in NERC Reliability Standard requirements that impact the reliability of the Bulk-Power System, given the unique operating characteristics of these resources.

The goal of Project 2014-01 was to review and revise the applicability of all of the Generator Owner- and Generator Operator-related Reliability Standards and ensure that only those dispersed generation resources that could affect the reliability of the Bulk-Power System are subject to applicable Reliability Standards. The standard drafting team identified PRC-005, FAC-008, PRC-023, PRC-025, PRC-004, and VAR-002 for further in-depth review. In addition, the standard drafting team considered the group of IRO, MOD, PRC and TOP Reliability Standards, which require outage and protection, control coordination, planning and data reporting, among other related reliability concerns.<sup>17</sup>

The standard drafting team established prioritization criteria for the review and modification of applicability changes recommended to the NERC Reliability Standards listed above. The team evaluated each requirement to identify the appropriate applicability that best supports the reliable operation of the Bulk-Power System. After the standard drafting team identified a standard or requirement where changes to the applicability were warranted, it performed a prioritization. Any standard or requirement which required modifications were assigned a high, medium, or low priority.<sup>18</sup> Reliability Standards PRC-004-2.1a, PRC-005-1.1b, PRC-005-2, VAR-002-2b and VAR-002-2b were identified as “high priority.” Following a

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<sup>17</sup> For a list of all Reliability Standards considered, *see* App. A to Ex. C.

<sup>18</sup> The standards and requirements priorities were established as follows: 1) high priority was assigned if compliance-related efforts with no appreciable reliability benefit would require not only significant resources but also would require efforts to be initiated by an entity well in advance of the implementation date; 2) medium priority was assigned if significant effort and resources with no appreciable reliability benefit would be required by an entity to be compliant; and 3) low priority was assigned to other changes that may need to be made to further ensure requirements add to reliability, but are not perceived as a significant compliance burden. *See* App. B to Ex. C.

technical review, the standard drafting team drafted revisions to these high-priority standards accordingly, as described in this filing.

A detailed description of the standard drafting team considerations for each reviewed Reliability Standard is included in the Draft Technical White Paper (“Technical White Paper”) (Exhibit C). Fifteen Reliability Standards were identified as medium priority and four as low priority. A list of these Reliability Standards is included in Appendix B to Exhibit C.

**D. History of the Proposed Reliability Standards**

1. PRC-004-2.1(i)a and PRC-004-4

NERC submitted Reliability Standard PRC-004-1 on April 4, 2006. On June 8, 2011, NERC filed an interpretation of Requirements R1 and R3 of PRC-004-1 and Requirements R1 and R2 of PRC-005-1. PRC-004-2 was submitted on March 4, 2011. PRC-004-2.1a was submitted on August 27, 2012. PRC-004-3, which will replace PRC-004-2.1a, was submitted on September 23, 2014.

2. PRC-005-2(i) and PRC-005-3(i)

Reliability Standard PRC-005-1 was submitted on April 4, 2006. On June 8, 2011, NERC filed an interpretation of Requirements R1 and R3 of PRC-004-1 and Requirements R1 and R2 of PRC-005-1. Reliability Standard PRC-005-2 was submitted on March 11, 2013, and Reliability Standard PRC-005-3 was submitted on February 21, 2014.

3. VAR-002-4

Reliability Standard VAR-002-1 was submitted on September 11, 2006. On May 13, 2009, NERC submitted VAR-002-1.1a, in order to address errata changes identified in the Reliability Standard. VAR-002-1.1b was submitted on May 13, 2009. VAR-002-2b was

submitted on November 28, 2012. Reliability Standard VAR-002-3 was submitted on June 12, 2014.

**E. Design and Operational Characteristics of Dispersed Power Producing Resources**

The findings of the standard drafting team's review are included in the Technical White Paper, which is referenced here for informational purposes. The standard drafting team concluded that the design and operational characteristics of dispersed power producing resources are different than traditional generation. Dispersed power producing resources are typically comprised of many individual generating units and in most cases, the units are similar in design and produced by the same manufacturer. The aggregated capability of the facility may contribute significantly to the reliability of the Bulk-Power System, and therefore, the equipment utilized to aggregate the individual units to a common point of interconnection with the transmission system should be operated and maintained as required by the NERC Reliability Standards subject to this filing.<sup>19</sup>

As explained in the Technical White Paper, the equipment is often geographically dispersed and the generating capacity of individual generating modules can be as small as a few hundred watts to as large as several megawatts. Some of the factors leading to the specific design and operational characteristics of dispersed generators include:

- Practical maximum size for wind generators to be transported and installed at a height above ground to optimally utilize the available wind resource;
- Spacing of wind generators geographically to avoid interference between units;
- Solar panel conversion efficiency and solar resource concentration to obtain usable output; and

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<sup>19</sup> *Technical White Paper*, P 3.2.3.

- Cost-effective transformation and transmission of electricity.<sup>20</sup>

The use of small generating units results in a large number of units (e.g., several hundred wind generators or several million solar panels) installed collectively as a single facility, which is connected to the Bulk-Power System at the point of interconnection.

The standard drafting team determined that dispersed generation resources interconnected to the transmission system typically have a control system that controls voltage and power output of the aggregate facility. The control system is capable of recognizing the capability of each individual unit or inverter included in the facility, to appropriately distribute the volume of generation contribution required of the facility across the available units or inverters. The variable generation control system must also recognize and account for the variation of uncontrollable factors that affect the individual units, such as wind speed and solar irradiance levels.<sup>21</sup>

As noted in the Technical White paper, dispersed power producing resources often rely on a variable energy source. A facility operator is often unable to provide a precise forecast of the expected output to a Balancing Authority, Transmission Operator or Reliability Coordinator although the short-term forecasting capability continued to improve.

Dispersed power producing resources by their nature result in each individual generating unit potentially experiencing varied power system parameters (e.g., voltage, frequency, etc.) due to varied impedances and other variations in the aggregating facilities design. Many older dispersed power producing resources have limited ability to provide essential reliability services but due to technological improvements, newer dispersed generation resources are capable of providing system support for voltage and frequency. For efficiency, the facilities are designed to

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<sup>20</sup> *Technical White Paper*, P 3.2.1.

<sup>21</sup> *Id.*



provide the system requirements at the point of interconnection to the transmission system and not at the individual unit level.<sup>22</sup>

For these reasons, the standard drafting team determined that the unavailability or failure of any one individual generating resource may have a negligible impact on the aggregated capability of the facility, and individual resources have limited effect on the reliability of the Bulk-Power System.<sup>23</sup> Therefore, it is more appropriate to apply the Reliability Standard requirements at the aggregate facility level rather than at the individual generating unit.

#### **IV. JUSTIFICATION**

As discussed in Exhibit D and below, the standard drafting team determined the proposed changes to the Reliability Standards satisfy the Reliability Standards criteria, and are just, reasonable, not unduly discriminatory or preferential, and in the public interest. Provided below is the following: (A) a description of each proposed Reliability Standard and its reliability purpose; and (B) justification for each of the proposed Reliability Standards on a requirement-by-requirement basis.

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<sup>22</sup> *Id.*, P 4.10.4.

<sup>23</sup> *Id.*, PP 3.2.2-3.2.3.

**A. Proposed Reliability Standards PRC-004-2.1(i)a and PRC-004-4**

1. Purpose of PRC-004-2.1(i)a

Reliability Standard PRC-004-2.1a, which is currently in effect, is designed to ensure that all transmission and generation Protection System Misoperations affecting the reliability of the Bulk Electric System are analyzed and mitigated. The proposed PRC-004-2.1(i)a reflects changes made to the currently-effective PRC-004-2.1a.<sup>24</sup>

2. Purpose of PRC-004-4

The previously submitted Reliability Standard PRC-004-3, is designed to identify and correct the causes of Misoperations of Protection Systems for Bulk Electric System Elements. The proposed PRC-004-4 reflects changes to version PRC-004-3.

The revisions included in PRC-004-2.1(i)a and PRC-004-4 are necessary to ensure the proposed changes will continue to be carried forward while the versions of this Reliability Standard are being enhanced to ensure the reliability of the Bulk-Power System.

3. Justification for Proposed Revisions

*a) PRC-004-2.1(i)a*

Based on the findings of the Technical White Paper, the standard drafting team made two revisions of PRC-004-2.1(i)a. Requirements R2 and R3 were modified to clarify that they are applicable to the aggregate facilities at the point of interconnection and not to the individual units. The proposed revisions are intended to provide for consistent application of the Requirements to Bulk Electric System generator Facilities listed in Inclusion I4 – Dispersed Power Producing Resources.

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<sup>24</sup> For explanation of the naming convention for the various versions of PRC-004, see *Draft Plan for Standards Drafting Team Coordination and Balloting Multiple Versions of Standards* (included in Exhibit F), Sept. 5, 2014 at p. 1.

Requirement R2 and Requirement R3 exclude from the standard applicability these “common-mode failure” Protection Systems type scenarios, which are affecting less than or equal to 75 MVA aggregated nameplate generating capability at dispersed generating facilities.

The applicable language of the proposed PRC-004-2.1(i)a read as follows:

**R2.** The Generator Owner shall analyze its generator and generator interconnection Facility Protection System Misoperations, and shall develop and implement a Corrective Action Plan to avoid future Misoperations of a similar nature according to the Regional Entity’s procedures.

- For Misoperations occurring on the Protection Systems of individual dispersed power producing resources identified under Inclusion I4 of the BES definition where the Misoperations affected an aggregate nameplate rating of less than or equal to 75 MVA of BES facilities, this requirement does not apply.

**R3.** The Transmission Owner, any Distribution Provider that owns a transmission Protection System, and the Generator Owner shall each provide to its Regional Entity, documentation of its Misoperations analyses and Corrective Action Plans according to the Regional Entity’s procedures.

- For Misoperations occurring on the Protection Systems of individual dispersed power producing resources identified under Inclusion I4 of the BES definition where the Misoperations affected an aggregate nameplate rating of less than or equal to 75 MVA of BES facilities, this requirement does not apply.

As explained in the Technical White Paper, Misoperations occurring on the Protection Systems of individual generation resources identified under Inclusion I4 of the Bulk Electric System definition do not have a material impact on Bulk Electric System reliability when considered individually. The aggregate capability of these resources may impact Bulk Electric System reliability if a number of Protection Systems on the individual power producing resources incorrectly operated or failed to operate as designed during a system event.

Based on its experience, the standard drafting team determined that there is minimal impact to Bulk-Power System reliability from analyzing, reporting and developing Corrective

Action Plans for each individual generating unit that trips at a dispersed power producing resource site.<sup>25</sup>

During the review process, the standard drafting team also recognized that many turbine technologies do not have the design capability of providing sufficient data for an entity to evaluate whether a Misoperation has occurred. As noted above, dispersed power producing resources by their nature result in each individual generating unit potentially experiencing varied power system parameters (e.g., voltage, frequency, etc.) due to varied impedances and other variations in the aggregating facilities design. As discussed in the Technical White Paper, these variances limit the ability of an entity to determine whether an individual unit correctly responded to a system disturbance.<sup>26</sup>

Based on these findings, Requirement R2 and Requirement R3 were modified reflect the potential for the Protection Systems of aggregate facilities at the point of interconnection to affect the reliability of the Bulk Electric System. The proposed revisions are consistent with the revised Bulk Electric System definition.

*b) PRC-004-4*

Based on the findings of the Technical White Paper, the standard drafting team made one reversion of Requirement 4 of PRC-004-3. Subrequirement 4.2.1.5 was added to section 4.2 to clarify that the Facilities listed in section 4.2 include the aggregate dispersed generating facilities and not the individual units. The proposed revision is intended to provide for consistent application of the Requirement to generator Facilities included in the Bulk Electric System definition through Inclusion I4. The language of the proposed subrequirement 4.2.1.5 read as follows:

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<sup>25</sup> *Technical White Paper* (Exhibit C), P 4.10.4.

<sup>26</sup> *Id.*

**4.2.1.5** Protection Systems of individual dispersed power producing resources identified under Inclusion I4 of the BES definition where the Misoperations affected an aggregate nameplate rating of less than or equal to 75 MVA of BES Facilities.

The technical considerations listed above for the proposed PRC-004-2.1(i)a are applicable to the revisions of PRC-004-4 as well. The revisions are consistent with the revised Bulk Electric System definition.

**B. Proposed Reliability Standards PRC-005-2(i) and PRC-005-3(i)**

Because PRC-005-1.1b will be phased out on April 1, 2015, the standard drafting team recommended only guidance on PRC-005-1.1b rather than suggesting language changes to the Reliability Standard. The standard drafting team did not recommend revising the applicability of PRC-005-1.1b for dispersed generation resources.<sup>27</sup>

1. Purpose of PRC-005-2(i)

The purpose of Reliability Standard PRC-005-1.1b, which is currently in effect, is to ensure that all transmission and generation Protection Systems affecting the reliability of the Bulk Electric System are maintained and tested. The proposed PRC-005-2(i) reflects changes to PRC-005-2.

2. Purpose of PRC-005-3(i)

The purpose of Reliability Standard PRC-005-2, which will become enforceable as provided in the Implementation Plan, and PRC-005-3, is to document and implement programs for the maintenance of all Protection Systems and Automatic Reclosing affecting the reliability of the Bulk Electric System so that they are kept in working order. Proposed PRC-005-3(i) reflects changes to PRC-005-3.<sup>28</sup>

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<sup>27</sup> *Technical White Paper* (Exhibit C), P 4.10.6.

<sup>28</sup> *Draft Plan for Standards Drafting Team Coordination and Balloting Multiple Versions of Standards*,

The revisions included in PRC-005-2(i) and PRC-005-3(i) are necessary to ensure the proposed changes will continue to be carried forward while the versions of this Reliability Standard are being enhanced to ensure the reliability of the Bulk-Power System.

3. Justification for Proposed Revisions

a) *PRC-005-2(i)*

Based on the findings of the Technical White Paper, the standard drafting team made one revision to PRC-005-2. To differentiate between typical Bulk Electric System generator Facilities and Bulk Electric System generators at dispersed power producing facilities, section 4.2.5 was separated into two sections – 4.2.5 and 4.2.6. For this purpose, subsection 4.2.5.3 was deleted and subsection 4.2.5.4 was renumbered to 4.2.5.3. The applicable language of the proposed PRC-005-2(i) reads as follows:

**4.2 Facilities:**

**4.2.5 Protection Systems for the following BES generator Facilities for generators not identified through Inclusion I4 of the BES definition:**

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**4.2.5.3 Protection Systems for station service or excitation transformers connected to the generator bus of generators which are part of the BES, that act to trip the generator either directly or via lockout or tripping auxiliary relays.**

**4.2.6 Protection Systems for the following BES generator Facilities for dispersed power producing resources identified through Inclusion I4 of the BES definition:**

**4.2.6.1 Protection Systems for Facilities used in aggregating dispersed BES generation from the point where those resources aggregate to greater than 75 MVA to a common point of connection at 100 kV or above.**

As explained in the Technical White Paper, the aggregated capability of the individual generating units may in some cases affect the reliability of the Bulk-Power System. Ensuring

that certain equipment utilized to aggregate the individual units to a common point of transmission interconnection are operated and maintained as required in PRC-005 could provide reliability benefits. The standard drafting team determined that when evaluated individually, the generating units themselves do not have the same impact on Bulk-Power System reliability as the system used to aggregate the units. The unavailability or failure of any one individual generating unit would have a negligible impact on the aggregated capability of the Facility. This is irrespective to whether the dispersed generation resource became unavailable due to occurrence of a legitimate fault condition or due to a failure of a control system, protective element, dc supply, etc.<sup>29</sup>

The standard drafting team noted that the Protection Systems typically utilized in these generating units includes elements which would automatically remove the individual unit from service for certain internal or external conditions, including an internal fault in the unit. Typically, these units are designed to provide generation output at low voltage levels, (i.e., less than 1000 V). Should these protection elements fail to remove the generating unit for this scenario, the impacts would be limited to the loss the individual generating unit and potentially the next device upstream in the collection system of the dispersed power producing resource. However, this would only result in the loss of a portion of the aggregated capability of the Facility, which is equally likely to occur due to a scenario in which a fault occurs on the collection system.<sup>30</sup>

As highlighted in the Technical White Paper, internal faults on the low voltage system of these generating units would not be discernible on the interconnected transmission systems, as these faults are similar to a fault occurring on a typical utility distribution system fed from a

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<sup>29</sup> Ex. C. at P 4.10.7.

<sup>30</sup> Ex. C at P 4.10.7.

substation designed to serve customer load. The collection system equipment (e.g., breakers, relays, etc.) used to aggregate the individual units may be relied upon to clear the fault condition in both of the above scenarios, which further justifies ensuring portions of the Bulk Electric System collection equipment is maintained appropriately as per this Reliability Standard.<sup>31</sup>

For these reasons, the standard drafting team concluded that activities such as Protection System maintenance on each individual generating unit at a dispersed generation Facility would not provide any additional reliability benefits to the BPS, but Protection System maintenance on facilities where generation aggregates to 75 MVA or more would. The proposed revisions are consistent with the revised Bulk Electric System definition.

*b) PRC-005-3(i)*

Based on the findings of the Technical White Paper, the standard drafting team made one revision to PRC-005-3. The language of Reliability Standard PRC-005-3 includes provisions for Automatic Reclosing, which are not part of PRC-005-2. However the revisions associated with dispersed generation are the same for both versions of the Reliability Standard. To differentiate between typical Bulk Electric System generator Facilities and Bulk Electric System generators at dispersed power producing facilities, section 4.2.5 was separated into two sections – 4.2.5 and 4.2.6. For this purpose, subsection 4.2.5.3 was deleted and subsection 4.2.5.4 was renumbered to 4.2.5.3. Section 4.2.6 (Automatic Reclosing) was also renumbered to Section 4.2.7 to reflect the proposed changes. The applicable language of the proposed PRC-005-3(i) reads as follows:

**4.2 Facilities:**

**4.2.5 Protection Systems for the following BES generator Facilities for generators not identified through Inclusion I4 of the BES definition:**

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**4.2.5.3 Protection Systems for station service or excitation transformers connected to the generator bus of generators**

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<sup>31</sup> *Id.*



which are part of the BES, that act to trip the generator either directly or via lockout or tripping auxiliary relays.

**4.2.6** Protection Systems for the following BES generator Facilities for dispersed power producing resources identified through Inclusion I4 of the BES definition:

**4.2.6.1** Protection Systems for Facilities used in aggregating dispersed BES generation from the point where those resources aggregate to greater than 75 MVA to a common point of connection at 100 kV or above.

**4.2.7** Automatic reclosing, including:

**4.2.7.1** Automatic Reclosing applied on the terminals of Elements connected to the BES bus located at generating plant substations where the total installed gross generating plant capacity is greater than the gross capacity of the largest BES generating unit within the Balancing Authority Area.

**4.2.7.2** Automatic Reclosing applied on the terminals of all BES Elements at substations one bus away from generating plants specified in Section 4.2.6.1 when the substation is less than 10 circuit-miles from the generating plant substation.

**4.2.7.3** Automatic Reclosing applied as an integral part of an SPS specified in Section 4.2.4.

The technical considerations listed above for the proposed PRC-005-2(i) are applicable to the revisions of PRC-004-4 as well. The proposed changes are consistent with the revised Bulk Electric System definition.

**C. Proposed Reliability Standard VAR-002-4**

1. Purpose of VAR-002-4

This Reliability Standard ensures that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained. Reliability Standard VAR-002-3, which is currently in effect, ensures that generators provide reactive support and voltage control within the generating Facility capabilities in order to protect equipment and maintain reliable operation

of the Interconnection. The proposed VAR-002-4 reflects the applicable changes made to PRC-005-3.<sup>32</sup>

Reliability Standard VAR-002 addresses control and management of reactive resources and provides voltage control where it has an impact on the Bulk Electric System. For dispersed power producing resources identified in Inclusion I4, the requirement that addresses reporting of changes in reactive capability should not apply at the individual generator level due to the unique characteristics and small scale of individual dispersed power producing resources. Instead, it should apply to the aggregate facility at the point of transmission interconnection.

## 2. Justification for Proposed Revisions

Based on the findings of the Technical White Paper, the standard drafting team made two revisions to VAR-002-3. Requirements R4 and R5 were revised to clarify applicability of the Requirements of this standard at generator Facilities and provide for consistent application of the Requirements to generator Facilities listed in Inclusion I4 of the revised Bulk Electric System definition. The standard drafting team added explanatory language to Requirement R4 to exclude reporting for individual generating units. Requirement R5.1 was modified in the same manner by adding a footnote to the language that clarifies the requirement applies only to those transformers that have at least one winding at a voltage of 100 kV or above. The applicable language of the proposed VAR-002-4 read as follows:

**R4.** Each Generator Operator shall notify its associated Transmission Operator within 30 minutes of becoming aware of a change in reactive capability due to factors other than a status change described in Requirement R3. If the capability has been restored within 30 minutes of the Generator Operator becoming aware of such change, then the Generator Operator is not required to notify the Transmission Operator of the change in reactive capability.

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<sup>32</sup> *Draft Plan for Standards Drafting Team Coordination and Balloting Multiple Versions of Standards,* at p. 2.

- Reporting of status or capability changes as stated in Requirement R4 is not applicable to the individual generating units of dispersed power producing resources identified through Inclusion I4 of the Bulk Electric System definition.

**R5.** The Generator Owner shall provide the following to its associated Transmission Operator and Transmission Planner within 30 calendar days of a request.

5.1. For generator step-up transformers [FN5] and auxiliary transformers [FN5] with primary voltages equal to or greater than the generator terminal voltage:

- 5.1.1. Tap settings.
- 5.1.2. Available fixed tap ranges.
- 5.1.3. Impedance data.

[FN5] For dispersed power producing resources identified through Inclusion I4 of the Bulk Electric System definition, this requirement applies only to those transformers that have at least one winding at a voltage of 100 kV or above.]

The standard drafting team determined that Requirement R4 should not apply at the individual generator level due to the unique characteristics and small scale of individual dispersed power producing resources. Other standards, such as proposed TOP-003 require the GO to provide real-time data as directed by the Transmission Operator, thus ensuring the reliability of the Bulk-Power System.

With respect to the proposed changes to Requirement R5, the standard drafting team determined that the Transmission Operator and Transmission Planner only need to review tap settings, available fixed tap ranges, impedance data and the voltage range with step-change in percentage for load-tap changing transformers on main generator step-up unit transformers. These step-up transformers connect dispersed power producing resources identified through Inclusion I4 of the Bulk Electric System definition to the transmission system.

As noted in the Technical White Paper, the individual generator transformers are not intended, designed, or installed to improve voltage performance at the point of interconnection

and for this reason have traditionally been excluded from Requirement R4 and R5 of VAR-002-2b (similar requirements are R5 and R6 for VAR-002-3).

Based on these facts, the proposed revisions clarify that Requirements R4 and R5 are not applicable to the individual generators. The proposed revisions are consistent with the revised Bulk Electric System definition.

## **V. ENFORCEABILITY OF PROPOSED RELIABILITY STANDARDS**

The proposed Reliability Standards include VRFs and VSLs. Because the Requirements contained in proposed Reliability Standards track with those contained in the already approved or proposed versions of the Reliability Standards, the standard drafting team determined that no revisions were necessary to the VSLs and VRFs for the proposed Reliability Standards.

The VSLs provide guidance on the way that NERC will enforce the Requirements of the proposed Reliability Standards. 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 Reliability Standards comport with NERC and FERC guidelines related to their assignment. For a detailed review of the VRFs, the VSLs, and analysis of how the VRFs and VSLs were determined using these guidelines, please see Exhibit E.

The proposed Reliability Standards also include 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. The Measures for the proposed Reliability Standards also remain unchanged from previous versions.

Respectfully submitted,

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**EXHIBITS A—C and E – F**

(Available on the NERC Website at

[http://www.nerc.com/FilingsOrders/ca/Canadian%20Filings%20and%20Orders%20DL/Attachments\\_DGR\\_PRC-VAR.pdf](http://www.nerc.com/FilingsOrders/ca/Canadian%20Filings%20and%20Orders%20DL/Attachments_DGR_PRC-VAR.pdf))

## **Exhibit D**

### **Reliability Standards Criteria**

The discussion below explains how the proposed Reliability Standards has met or exceeded the criteria.

**1. Proposed Reliability Standards must be designed to achieve a specified reliability goal and must contain a technically sound means to achieve that goal.**

The proposed Reliability Standards continue to achieve specific reliability goals and have included targeted language to clarify the applicability with respect to dispersed power producing resources. Proposed Reliability Standard PRC-004-2.1(i)a, is designed to ensure that all transmission and generation Protection System Misoperations affecting the reliability of the Bulk Electric System are analyzed and mitigated. Similarly, the purpose of proposed Reliability Standard PRC-004-4 is to identify and correct the causes of Misoperations of Protection Systems for Bulk Electric System Elements. The purpose of Reliability Standards PRC-005-2(i) and PRC-005-3 (i), is to document and implement programs for the maintenance of all transmission and generation Protection Systems (and Automatic Reclosing in PRC-005-3(i)) affecting the reliability of the Bulk Electric System so that they are kept in working order. The purpose of Reliability Standard VAR-002-4, is to ensure that generators provide reactive support and voltage control within the generating Facility capabilities in order to protect equipment and maintain reliable operation of the Interconnection.

2. **Proposed Reliability Standards must be applicable only to users, owners and operators of the bulk power system, and must be clear and unambiguous as to what is required and who is required to comply.**

Proposed Reliability Standard PRC-004-2.1(i)a applies to Transmission Owners (TOs) Distribution Providers (DPs) that own a transmission Protection System, and Generator Owners (GOs). Proposed PRC-004-4 applies to TOs, GOs, and DPs. Proposed Reliability Standards PRC-005-2(i) and PRC-005-3(i) apply to TOs, GOs and DPs. Proposed Reliability Standard VAR-002-4 applies to GOs and Generator Operators. All of the proposed Reliability Standards have improved the clarity of the coverage with respect to dispersed generation resources and are, therefore, more clear than the prior versions. Other substantive Requirements in the Reliability Standards remain unchanged.

3. **A proposed Reliability Standard must include clear and understandable consequences and a range of penalties (monetary and/or non-monetary) for a violation.**

The VRFs and VSLs for each of the proposed standards comport with NERC and FERC guidelines related to their assignment. The assignment of the severity level for each VSL is consistent with the corresponding Requirement and the VSLs should ensure uniformity and consistency in the determination of penalties. The VSLs do not use any ambiguous terminology, thereby supporting uniformity and consistency in the determination of similar penalties for similar violations.

Because the Requirements contained in proposed Reliability Standards track with those contained in the already approved or proposed versions of the Reliability Standards, the



standards drafting team determined that no revisions were necessary to the VSLs and VRFs for the proposed Reliability Standards.

For these reasons, the proposed Reliability Standards include clear and understandable consequences.

- 4. A proposed Reliability Standard must identify clear and objective criterion or measure for compliance, so that it can be enforced in a consistent and non preferential manner.**

The proposed Reliability Standards contain Measures that support each requirement by clearly identifying what is required and how the requirement will be enforced. The Measures for the proposed Reliability Standards remain unchanged from previous versions. These Measures help provide clarity regarding how the requirements will be enforced, and ensure that the requirements will be enforced in a clear, consistent, and non-preferential manner and without prejudice to any party.

- 5. Proposed Reliability Standards should achieve a reliability goal effectively and efficiently — but do not necessarily have to reflect “best practices” without regard to implementation cost or historical regional infrastructure design.**

The proposed Reliability Standards achieve the reliability goals effectively and efficiently. The proposed Reliability Standards improve reliability by ensuring the equipment utilized to aggregate individual dispersed generation units to a common point of interconnection with the Bulk-Power System is operated and maintained as required by the NERC Reliability Standards.

6. **Proposed Reliability Standards cannot be “lowest common denominator,” i.e., cannot reflect a compromise that does not adequately protect Bulk-Power System reliability. Proposed Reliability Standards can consider costs to implement for smaller entities, but not at consequences of less than excellence in operating system reliability.**

The proposed Reliability Standards do not reflect a “lowest common denominator” approach. The changes reflected in the Proposed Reliability Standards are supported by technical analysis in the draft technical paper in Exhibit C and are targeted to a specific issue and balance the applicability of the coverage of the proposed Reliability Standards with the reliability needs specific to dispersed generation resources.

7. **Proposed Reliability Standards must be designed to apply throughout North America to the maximum extent achievable with a single Reliability Standard while not favoring one geographic area or regional model. It should take into account regional variations in the organization and corporate structures of transmission owners and operators, variations in generation fuel type and ownership patterns, and regional variations in market design if these affect the proposed Reliability Standard.**

The proposed Reliability Standards apply throughout North America and do not favor one geographic area or regional model.

8. **Proposed Reliability Standards should cause no undue negative effect on competition or restriction of the grid beyond any restriction necessary for reliability.**

The proposed Reliability Standards do not restrict the available transmission capability or limit use of the Bulk-Power System in a preferential manner.

**9. The implementation time for the proposed Reliability Standard is reasonable.**

The proposed effective dates for the proposed Reliability Standards are just and reasonable and appropriately balance the urgency in the need to implement the standards against the reasonableness of the time allowed for those who must comply to develop necessary procedures or other relevant capability. This will allow applicable entities adequate time to ensure compliance with the requirements. The proposed effective dates are explained in the proposed Implementation Plans, attached as Exhibit B. The Implementation Plans reflect timing needed to align changes related to dispersed power producing resources with the version being modified in some cases since those versions are still in implementation or pending approval. The timing is also set to become effective on an expedited basis to parallel the implementation of the revised definition of Bulk Electric System.

**10. The Reliability Standard was developed in an open and fair manner and in accordance with the Reliability Standard development process.**

The proposed Reliability Standards were developed in accordance with NERC's ANSI-accredited processes for developing and approving Reliability Standards. Exhibit E includes a summary of the Reliability Standards development proceedings, and details the processes followed to develop the standards.

These processes included, among other things, multiple comment periods, pre-ballot review periods, and balloting periods. Additionally, all meetings of the drafting team were properly noticed and open to the public.

**11. NERC must explain any balancing of vital public interests in the development of proposed Reliability Standards.**

NERC has identified no competing public interests regarding the request for approval of these proposed Reliability Standards. No comments were received that indicated the proposed Standards conflict with other vital public interests.

**12. Proposed Reliability Standards must consider any other appropriate factors.**

No other negative factors relevant to whether the proposed Reliability Standards are just and reasonable were identified.