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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  
SERC RELIABILITY CORPORATION FOR APPROVAL OF PROPOSED REGIONAL  
RELIABILITY STANDARD PRC-006-SERC-02**

Holly A. Hawkins  
General Counsel  
Rebecca Poulsen  
Legal Counsel  
SERC Reliability Corporation  
3701 Arco Corporate Drive, Suite 300  
Charlotte, NC 28273  
(704) 414-5238  
hhawkins@serc1.org  
rpoulsen@serc1.org

*Counsel for the SERC Reliability Corporation*

Shamai Elstein  
Senior Counsel  
Marisa Hecht  
Counsel  
North American Electric Reliability Corporation  
1325 G Street, N.W., Suite 600  
Washington, D.C. 20005  
(202) 400-3000  
shamai.elstein@nerc.net  
marisa.hecht@nerc.net

*Counsel for the North American Electric  
Reliability Corporation*

September 8, 2017

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<b>Exhibit A</b>	Proposed Regional Reliability Standard, PRC-006-SERC-02 – Automatic Underfrequency Load Shedding Requirements and Effective Date
<b>Exhibit B</b>	Order No. 672 Criteria for Proposed Regional Reliability Standard PRC-006-SERC-02
<b>Exhibit C</b>	Summary of Development History and Complete Record of Development
<b>Exhibit D</b>	SERC Engineering Committee Dynamics Review Subcommittee Roster



Violation Severity Levels (“VSLs”) (**Exhibits A and B**); and (iii) the retirement of regional Reliability Standard PRC-006-SERC-01. The NERC Board of Trustees adopted proposed regional Reliability Standard PRC-006-SERC-02 on August 10, 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 PRC-006-SERC-02; a demonstration that the proposed regional Reliability Standard meets the criteria identified by the Commission in Order No. 672<sup>6</sup> (**Exhibit B**); and a summary of the development history (**Exhibit C**).

## **I. EXECUTIVE SUMMARY**

Proposed regional Reliability Standard PRC-006-SERC-02 incorporates revisions that provide additional flexibility for Planning Coordinators to select the peak season for UFLS plans and additional clarity on the load that can be used for UFLS schemes in the SERC region. The proposed revisions resulted from a periodic review of PRC-006-SERC-01.

The purpose of proposed regional Reliability Standard PRC-006-SERC-02 is to establish consistent and coordinated requirements for the design, implementation, and analysis of automatic UFLS programs among all SERC applicable entities. The requirements address the following: (1) identifying a Planning Coordinator’s subregion as an island; (2) developing a UFLS plan to meet specified criteria; (3) conducting simulations for load and generation imbalance UFLS schemes; (4) implementing the UFLS scheme for entities with loads 100 MW or greater and for entities with

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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”).

loads less than 100 MW; (5) implementing changes to the scheme within a specified timeframe; and (6) providing certain information to SERC.

For the reasons discussed herein, NERC and SERC respectfully request the Commission approve proposed regional Reliability Standard PRC-006-SERC-02, the associated VRFs and VSLs, the Effective Date, and the retirement of the existing regional Reliability Standard PRC-006-SERC-01. 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>

Holly A. Hawkins\*  
General Counsel  
Rebecca Poulsen\*  
Legal Counsel  
SERC Reliability Corporation  
3701 Arco Corporate Drive, Suite 300  
Charlotte, NC 28273  
(704) 414-5238  
hhawkins@serc1.org  
rpoulsen@serc1.org

*Counsel for the SERC Reliability Corporation*

Shamai Elstein\*  
Senior Counsel  
Marisa Hecht\*  
Counsel  
North American Electric Reliability Corporation  
1325 G Street, N.W., Suite 600  
Washington, D.C. 20005  
(202) 400-3000  
shamai.elstein@nerc.net  
marisa.hecht@nerc.net

*Counsel for the North American Electric Reliability Corporation*

## **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

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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 (2017), to allow the inclusion of more than two persons on the service list in this proceeding.

SERC regional Reliability Standards development process; and (c) the history of development of PRC-006-SERC-02.

**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

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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) (2017).

<sup>12</sup> 16 U.S.C. § 824o(d)(2).

<sup>13</sup> 18 C.F.R. § 39.5(c)(1).

Commission will give due weight to the technical expertise of the ERO with respect to the content of a Reliability Standard.

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>

## **B. SERC 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 SERC regional Standards Development Procedure.<sup>16</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 SERC'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>17</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> *Amendments to Delegation Agreement with SERC Reliability Corporation*, Docket No. RR12-5-000 (June 12, 2012) (unpublished letter order) (approving revised SERC regional Standards Development Procedure), available at [http://www.nerc.com/FilingsOrders/us/FERCOrdersRules/LetterOrder\\_ApprovingAmdmts\\_SERCDelegation\\_2012\\_0612.pdf](http://www.nerc.com/FilingsOrders/us/FERCOrdersRules/LetterOrder_ApprovingAmdmts_SERCDelegation_2012_0612.pdf); The SERC Regional Standards Development Procedure is available at [https://www.serc1.org/docs/default-source/program-areas/standards-regional-criteria/standards-documents/serc-da-exhibit-c---regional-standards-development-procedure-\(6-12-12\).pdf?sfvrsn=9079681a\\_8](https://www.serc1.org/docs/default-source/program-areas/standards-regional-criteria/standards-documents/serc-da-exhibit-c---regional-standards-development-procedure-(6-12-12).pdf?sfvrsn=9079681a_8).

<sup>17</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. SERC considers the comments of all stakeholders, and a vote of stakeholders and the SERC Board of Directors is required to approve a regional Reliability Standard. In addition to SERC Board of Directors approval, NERC posts the regional Reliability Standard for an additional comment period. After the NERC posting and SERC Board of Directors approval, the NERC Board of Trustees must adopt the regional Reliability Standard before the regional Reliability Standard is submitted to the Commission for approval.

### **C. The Development History of Proposed PRC-006-SERC-02**

As further described in Exhibit C hereto, proposed regional Reliability Standard PRC-006-SERC-02 was developed by the SERC Engineering Committee Dynamics Review Subcommittee as part of a periodic review of PRC-006-SERC-01. On May 10, 2017, proposed regional Reliability Standard PRC-006-SERC-02 received the requisite approval from the registered ballot body, with a 100 percent affirmative vote. The SERC Board of Directors approved the regional standard on June 28, 2017. NERC posted the regional standard for a 45-day comment period concluding on July 24, 2017. There were no additional changes after this comment period. The NERC Board of Trustees subsequently adopted the regional standard on August 10, 2017.

## **IV. JUSTIFICATION FOR APPROVAL**

As discussed in detail in Exhibit B, proposed regional Reliability Standard PRC-006-SERC-02 – Automatic Underfrequency Load Shedding Requirements is just, reasonable, not unduly discriminatory or preferential, and in the public interest. As described more fully herein and in Exhibit B, the proposed regional Reliability Standard provides reliability benefits for the Bulk-Power System in the SERC region.

The purpose of proposed regional Reliability Standard PRC-006-SERC-02 is to establish consistent and coordinated requirements for the design, implementation, and analysis of automatic



UFLS programs among all SERC applicable entities. The provisions of the proposed regional standard provide specific requirements for the development, coordination, implementation, and analysis of UFLS schemes in the SERC region that are not included in the continent-wide Reliability Standard that addresses UFLS programs, Reliability Standard PRC-006-2 – Automatic Underfrequency Load Shedding. In approving PRC-006-SERC-01, the Commission stated that the regional Reliability Standard is, “designed to work in conjunction with NERC Reliability Standard PRC-006-1 to mitigate the consequences of an underfrequency event effectively while accommodating differences in system transmission and distribution topology among SERC planning coordinators due to historical design criteria, makeup of load demands, and generation resources.”<sup>18</sup> Proposed PRC-006-SERC-02 provides this same benefit with additional proposed enhancements. Therefore, the proposed regional Reliability Standard meets a reliability need for the SERC region, and as discussed below, the proposed modifications provide additional support for the reliable operation of the Bulk-Power System.

The proposed regional standard includes requirements for including a Planning Coordinator’s subregion as an identified island in the PRC-006-2 criteria (Requirement R1); selecting or developing a UFLS scheme that meets specified criteria (Requirement R2); conducting simulations of the UFLS scheme for an imbalance between load and generation when performing design assessments (Requirement R3); implementing the UFLS scheme in the SERC region for entities with a load of 100 MW or greater (Requirement R4); implementing the UFLS scheme in the SERC region for entities with a load of less than 100 MW (Requirement R5); implementing certain changes to the UFLS scheme within 18 months of notification by the Planning Coordinator

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<sup>18</sup> *Regional Reliability Standard PRC-006-SERC-01 —Automatic Underfrequency Load Shedding Requirements*, Order No. 772, 141 FERC ¶ 61,243, at P 14 (2012) (“Order No. 772”). Note that the current version of continent-wide Reliability Standard PRC-006 is version 2, although at the time of approval of PRC-006-SERC-01 the continent-wide standard was version 1. Proposed PRC-006-SERC-02 still works in conjunction with currently-effective Reliability Standard PRC-006-2.

(Requirement R6); providing certain information to SERC (Requirement R7); and providing information for post-event analysis of frequency disturbances to SERC (Requirement R8).

This section of the petition addresses: (A) the justification of the need for the proposed regional Reliability Standard; (B) the description and technical basis of the proposed revisions; and (C) the enforceability of the proposed regional standard.

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

Proposed regional Reliability Standard PRC-006-SERC-02 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 PRC-006-2, which does not include a detailed plan criteria or a maximum timeframe to implement changes to a UFLS scheme. As noted above, the Commission previously recognized that the additional specificity in the regional Reliability Standard helps to mitigate the consequences of an underfrequency event while accommodating differences in SERC system transmission and distribution topology.<sup>19</sup> Therefore, the proposed regional Reliability Standard PRC-006-SERC-02 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 reliability support to the SERC region in addition to the continent-wide standards.

**B. Description and Technical Basis of Proposed Revisions**

The proposed revisions provide more flexibility for Planning Coordinators to determine the peak season on which to base the UFLS plan and clarify that it is not only distribution load that can be used for a UFLS scheme. The proposed revisions specify that Planning Coordinators

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<sup>19</sup> *Id.*

may choose either summer or winter as the Peak Demand as part of its criteria for its UFLS scheme in Requirement R2, Part 2.1; remove “distribution” from Requirements R4, Part 4.1 and R5, Part 5.1; add the seasonal option to Requirements R4, Part 4.1 and R5, Part 5.1 to comport with the revisions in Requirement R2, Part 2.1; and clarify that an 18-month implementation timeframe is allowed with a change in Peak Demand season in Requirement R6.

In PRC-006-SERC-01, the requirements specify that the previous year’s actual Peak Demand must be used to develop the UFLS plan. The proposed revisions add language that allows the Planning Coordinator to consider seasonal reliability concerns when specifying the peak on which to base the UFLS plan. As a result, the Planning Coordinator can choose either the summer or winter season rather than base the plan solely on the actual Peak Demand. This revision enables the Planning Coordinator to broaden its considerations in developing the UFLS plan to support reliability.

Recognizing that changing the peak season may require the installation of additional UFLS relays, the proposed revisions include an 18-month timeframe for affected entities to implement the plan. This timeframe allows for sufficient budgeting, procurement, and installation time for additional equipment or for significant setting changes to existing equipment necessary to meet a revised UFLS scheme. However, those entities that do not change their seasonal selection will implement PRC-006-SERC-02 as determined by the proposed Effective Date in Section V below.

The proposed revision to remove “distribution” to describe substation or feeder demand clarifies the language of the standard. This change removes the implication that only distribution load can be used for a UFLS scheme. The clarification supports reliability by ensuring that the Reliability Standard language is clear and unambiguous in accordance with Order No. 672 criteria.

**C. Enforceability of Proposed Regional Reliability Standard PRC-006-SERC-02**

The proposed regional Reliability Standard includes VRFs and VSLs that are unchanged from PRC-006-SERC-01. 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.

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>20</sup>

**V. EFFECTIVE DATE**

NERC respectfully requests that the Commission approve the proposed regional Reliability Standard PRC-006-SERC-02 and the retirement of PRC-006-SERC-01 to become effective as set forth in the proposed Effective Date, provided in Exhibit A hereto. The proposed Effective Date of the proposed regional Reliability Standard is the on the first day of the first calendar quarter after approval by the Commission.

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<sup>20</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.”).

## VI. CONCLUSION

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

- the proposed regional Reliability Standard PRC-006-SERC-02 in **Exhibit A**;
- the other associated elements in the Reliability Standard in **Exhibit A**, including the VRFs and VSLs (**Exhibits A and B**);
- the retirement of existing regional Reliability Standard PRC-006-SERC-01; and
- the Effective Date, included in **Exhibit A**.

Respectfully submitted,

/s/ Marisa Hecht

Holly A. Hawkins  
General Counsel  
Rebecca Poulsen  
Legal Counsel  
SERC Reliability Corporation  
3701 Arco Corporate Drive, Suite 300  
Charlotte, NC 28273  
(704) 414-5238  
hhawkins@serc1.org  
rpoulsen@serc1.org

*Counsel for the SERC Reliability Corporation*

Date: September 8, 2017

Shamai Elstein  
Senior Counsel  
Marisa Hecht  
Counsel  
North American Electric Reliability Corporation  
1325 G Street, N.W., Suite 600  
Washington, D.C. 20005  
(202) 400-3000  
shamai.elstein@nerc.net  
marisa.hecht@nerc.net

*Counsel for the North American Electric Reliability Corporation*

**EXHIBIT A:**

**Proposed Regional Reliability Standard, PRC-006-SERC-02 – Automatic Underfrequency  
Load Shedding Requirements, and Effective Date**

**Proposed Regional Reliability Standard, PRC-006-SERC-02 – Automatic Underfrequency  
Load Shedding Requirements, and Effective Date - CLEAN**

## Effective Date

**Effective for SERC Region applicable Registered Entities on the first day of the first calendar quarter after approved by FERC**

## Introduction

1. **Title:** Automatic Underfrequency Load Shedding Requirements
2. **Number:** PRC-006-SERC-02
3. **Purpose:** To establish consistent and coordinated requirements for the design, implementation, and analysis of automatic underfrequency load shedding (UFLS) programs among all SERC applicable entities.
4. **Applicability:**
  - 4.1 Planning Coordinators
  - 4.2 UFLS entities shall mean all entities that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators. Such entities may include one or more of the following:
    - 4.2.1 Transmission Owners
    - 4.2.2 Distribution Providers
  - 4.3 Generator Owners
5. **Background**

The SERC UFLS Standard: PRC-006-SERC-01 (“SERC UFLS Standard”) was developed to provide regional UFLS requirements to entities in SERC. UFLS requirements have been in place at a continent-wide level and within SERC for many years prior to implementation of federally mandated reliability compliance standards in 2007.

When reliability standards were implemented in 2007, the Federal Energy Regulatory Commission (“FERC”), which is the government body with regulatory responsibility for electric reliability, issued FERC Order 693, recognizing 83 NERC Reliability Standards as enforceable by FERC and applicable to users, owners, and operators of the bulk power system (BPS). FERC did not approve the NERC UFLS standard, PRC-006-0 in Order 693. FERC’s reason for not approving PRC-006-0 was that it recognized PRC-006-0 as a “fill-in the blank standard,” and regional procedures associated with the standard were not submitted along with the standard. FERC’s ruling in Order 693 required Regional Entities to provide the regional requirements necessary for completing the UFLS standard.

In 2008, SERC commenced work on PRC-006-SERC-01. NERC also began work on revising PRC-006-0 at a continent-wide level. The SERC standard has been developed to be consistent with the NERC UFLS standard. PRC-006-SERC-02 was developed per periodic review of the standard.

PRC-006-1 clearly defines the roles and responsibilities of parties to whom the standard applies. The standard identifies the Planning Coordinator (“PC”) as the entity responsible for developing UFLS schemes within their PC area. The regional standard adds specificity not contained in the NERC standard for development and implementation of a UFLS scheme in the SERC Region that effectively mitigates the consequences of an underfrequency event.



## Requirements and Measures

- R1.** Each Planning Coordinator shall include its SERC subregion as an identified island in the criteria (required by the NERC PRC standard on UFLS) for selecting portions of the BPS that may form islands. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 1.1** A Planning Coordinator may adjust island boundaries to differ from subregional boundaries where necessary for the sole purpose of producing a contiguous subregional island more suitable for simulation.
- M1.** Each Planning Coordinator shall have evidence such as a methodology, procedure, report, or other documentation indicating that its criteria included selection of its SERC subregion(s) as an island per Requirement R1.
- R2.** Each Planning Coordinator shall select or develop an automatic UFLS scheme (percent of load to be shed, frequency set points, and time delays) for implementation by UFLS entities within its area that meets the following minimum requirements: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning ]*
- 2.1.** Have the capability of shedding at least 30 percent of the Peak Demand (MW) served from the Planning Coordinator's transmission system. The Peak Demand may be either summer or winter as determined by the Planning Coordinator.
- 2.2.** Shed load with a minimum of three frequency set points.
- 2.3.** The highest frequency set point for relays used to arrest frequency decline shall be no lower than 59.3 Hz and not higher than 59.5 Hz.
- 2.3.1** This does not apply to UFLS relays with time delay of one second or longer and a higher frequency setpoint applied to prevent the frequency from stalling at less than 60 Hz when recovering from an underfrequency event.
- 2.4.** The lowest frequency set point shall be no lower than 58.4 Hz.
- 2.5.** The difference between frequency set points shall be at least 0.2 Hz but no greater than 0.5 Hz.
- 2.6.** Time delay (from frequency reaching the set point to the trip signal) shall be at least six cycles.
- M2.** Each Planning Coordinator shall have evidence such as reports or other documentation that the UFLS scheme for its area meets the design requirements specified in Requirement R2.

- R3.** Each Planning Coordinator, when performing design assessments specified in the NERC PRC standard on UFLS, shall conduct simulations of its UFLS scheme for an imbalance between load and generation of 13%, 22%, and 25% for all identified island(s) where such imbalance equals  $[(\text{load} - \text{actual generation output}) / \text{load}]$ . *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M3.** Each Planning Coordinator shall have evidence such as reports or other documentation that it performed the simulations of its UFLS scheme as required in Requirement R3.
- R4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*
- 4.1.** The percent of load shedding to be implemented shall be based on the actual or estimated substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year's actual Peak Demand in the season specified by the Planning Coordinator in R2.
- 4.2.** The amount of load in each load shedding step shall be within -1.0 and +3.0 of the percentage specified by the Planning Coordinator (for example, if the specified percentage step load shed is 12%, the allowable range is 11 to 15%).
- 4.3.** The amount of total UFLS load of all steps combined shall be within -1.0 and +5.0 of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R4 (including all the data elements in Parts 4.1, 4.2, and 4.3) unless scheme changes per Requirement R6 are in process.
- R5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator, but shall not be required to have more than one UFLS step. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*.

- 5.1.** The percent of load shedding to be implemented shall be based on the actual or estimated substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year actual Peak Demand in the season specified by the Planning Coordinator in R2..
- 5.2.** The amount of total UFLS load shall be within  $\pm 5.0$  of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R5 (including all the data elements in Parts 5.1 and 5.2) unless scheme changes per Requirement R6 are in process.
- R6.** Each UFLS entity shall implement changes to the UFLS scheme which involve frequency settings, relay time delays, changes to the percentage of load in the scheme, or changes to the peak season selected in R2.1 within 18 months of notification by the Planning Coordinator. *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M6.** Each UFLS entity shall have evidence such as reports or other documentation demonstrating that it has made the appropriate scheme changes within 18 months per Requirement R6. Such evidence is only required if the Planning Coordinator makes changes to the UFLS scheme as specified in Requirement R6.
- R7.** Each Planning Coordinator shall provide the following information to SERC according to the schedule specified by SERC. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*
- 7.1.** Underfrequency trip set points (Hz)
- 7.2.** Total clearing time associated with each set point (sec). This includes the time from when frequency reaches the set point and ends when the breaker opens.
- 7.3.** Amount of previous year actual or estimated load associated with each set point, both in percent and in MW. The percentage and the Load demand (MW) shall be based on the time coincident with the previous year actual Peak Demand.
- M7.** Each Planning Coordinator shall have evidence such as reports or other documentation that data specified in Requirement R7 was provided to SERC in accordance with the schedule.

- R8.** Each Generator Owner shall provide the following information within 30 days of a request by SERC to facilitate post-event analysis of frequency disturbances. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*
- 8.1.** Generator protection automatic underfrequency and overfrequency trip set points (Hz).
  - 8.2.** Total clearing time associated with each set point (sec). This is defined as the time that begins when frequency reaches the set point and ends when the breaker opens. If inverse time underfrequency relays are used, provide the total clearing time at 59.0, 58.5, 58.0, and 57.0 Hz.
  - 8.3.** Maximum generator net MW that could be tripped automatically due to an underfrequency or overfrequency condition.
- M8.** Each Generator Owner shall have evidence such as reports or other documentation that data specified in Requirement R8 was provided to SERC as requested.

## Compliance

### **Compliance enforcement authority**

SERC Reliability Corporation

### **Compliance monitoring and assessment process**

- Compliance Audit
- Self-Certification
- Spot Checking
- Compliance Violation Investigation
- Self-Reporting
- Complaint

### **Evidence retention**

Each Planning Coordinator, UFLS Entity and Generator Owner shall keep data or evidence to show compliance as identified below unless directed by SERC to retain specific evidence for a longer period of time as part of an investigation.

Each Planning Coordinator, UFLS Entity and Generator Owner shall retain the current evidence of each Requirement and Measure as well as any evidence necessary to show compliance since the last compliance audit.

If a Planning Coordinator, UFLS Entity or Generator Owner is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the retention period specified above, whichever is longer.

The compliance enforcement authority shall keep the last audit records and all requested and submitted subsequent audit records.

**Time Horizons, Violation Risk Factors, and Violation Severity Levels**

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
R1	Long-term Planning	Medium	N/A	N/A	N/A	The Planning Coordinator did not have evidence that its criteria included selection of its SERC subregion(s) as an island, with or without adjusted boundaries.
R2	Long-term Planning	Medium	The Planning Coordinator's scheme did not meet one of the UFLS system design requirements identified in 2.2 through 2.6	The Planning Coordinator's scheme did not meet two of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet three of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet 2.1  <b>OR</b> Four or more of the UFLS system design requirements identified in 2.2 through 2.6.
R3	Long-term Planning	High	N/A	The Planning Coordinator failed to conduct one of the required simulations of its UFLS scheme.	N/A	The Planning Coordinator failed to conduct two of the required simulations of its UFLS scheme.
R4	Operations Planning	Medium	The UFLS entity's implemented UFLS scheme had one load shedding step outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had two load shedding steps outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			2.	2.	specified in 4.2.  <b>OR</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.	specified in 4.2.  <b>AND</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.
<b>R5</b>	Operations Planning	Medium	N/A	N/A	N/A	The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 5.2.
<b>R6</b>	Long-term Planning	High	The UFLS entity implemented required scheme changes but made them 1 to 30 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 31 to 40 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 41 to 50 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them more than 50 days after the scheduled date  <b>OR</b> The UFLS entity failed to implement the required scheme changes.
<b>R7</b>	Long-term Planning	Lower	The Planning Coordinator provided the data required in R7 to SERC 1 to 10 days	The Planning Coordinator provided the data required in R7 to SERC 11 to 20 days	The Planning Coordinator provided the data required in R7 to SERC 21 to 30 days	The Planning Coordinator provided the data required in R7 to SERC more than 30

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			after the scheduled submittal date.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC one piece of information listed in R7.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC two pieces of information listed in R7.	days after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC any of the information listed in R7.
<b>R8</b>	Long-term Planning	Lower	The Generator Owner provided the data required in R8 to SERC 1 to 10 days after the requested submittal date.	The Generator Owner provided the data required in R8 to SERC 11 to 20 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC one piece of information listed in R8.	The Generator Owner provided the data required in R8 to SERC 21 to 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC two pieces of information listed in R8.	The Generator Owner provided the data required in R8 to SERC more than 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC any of the information listed in R8.



## Regional Variances

None

## Interpretations

None

## Guideline and Technical Basis

### 1. Existing UFLS schemes

Each Planning Coordinator should consider the existing UFLS programs which are in place and should consider input from the UFLS entities in developing the UFLS scheme.

### 2. Basis for SERC standard requirements

SERC Standard PRC-006-SERC-02 is not a stand-alone standard, but was written to be followed in conjunction with NERC Standard PRC-006-1. The primary focus of SERC Standard PRC-006-SERC-02 was to provide region-specific requirements for the implementation of the higher tier NERC standard requirements with the goals of a) adding clarity and b) providing for consistency and a coordinated UFLS scheme for the SERC Region as a whole.

Generally speaking, requirements already in the NERC standard were not repeated in the SERC standard. Therefore, both the NERC and SERC standards must be followed to ensure full compliance.

### 3. Basis for applying a percentage load shedding value to Forecast Load versus Actual Load

The Planning Coordinator will develop a UFLS scheme to meet the performance requirements of NERC Standard PRC-006-2 Requirement R3 and SERC Standard PRC-006-SERC-02 Requirement R2. This development will result in certain percentages of load for each UFLS entity in the Planning Coordinator's area for which automatic under frequency load shedding must be implemented. The Planning Coordinator develops these percentages based on forecast peak load demand. However, the UFLS entity implements these percentages based on the previous year's actual peak demand. Applying the same percentage to these different base values was intentional to ensure that both the Planning Coordinator and UFLS entities had a clear, measurable value to use in performing their respective roles in meeting the standard. Planning Coordinators typically use forecast demands in their work. Whereas the previous year's actual (or estimated) demand is typically more available to UFLS entities. Additionally, the use of percentages based on these different base values tends to minimize the error due to the time lag between design and actual field implementation. Since a percentage is provided by the Planning Coordinator to the UFLS entities, any differences between the design values (i.e., forecast load) and the implemented values (i.e., previous year's actual) would naturally tend to match up reasonably well. For example, if the total planning area load in MW for which UFLS was installed during the time of implementation was slightly higher or lower than the MW value used in the design by the Planning Coordinator, multiplying by the specified percentage would result in an implemented load shedding scheme that also had a reasonably similar higher or lower MW value.

**4. Basis for May 1 and 18 month time frames**

Each UFLS entity must annually review that the amount of UFLS load shedding implemented is within a certain tolerance as specified by SERC Standard PRC-006-SERC-02 Requirement R 4 or Requirement R5 by May 1 of the current year. May 1 was chosen to allow sufficient time after the previous year's peak occurred to make adjustments in the field to the implementation if necessary to meet the tolerances specified in Requirement R4 or Requirement R5. Therefore, the May 1 date applies only to implementation of the existing percentages of load shedding specified by the Planning Coordinator. On the other hand, the 18-month time frame specified in PRC-006-SERC-02 Requirement R6 is intended to allow sufficient budgeting, procurement, and installation time for additional equipment, or for significant setting changes to existing equipment necessary to meet a revised load shedding scheme design that has been specified by the Planning Coordinator. During this 18-month transition period, the May 1 measurement of R4 or Requirement R5 would not apply.

**5. Basis for smaller entity threshold of 100 MW**

Most distribution substations have transformers rated in the range of 10 to 40 MVA. Usually most transformers would serve 1 to 4 feeders and each feeder will normally carry between 8 and 10 MVA. In general, assuming that each feeder would carry 10 MW, an entity with a load slightly greater than 100 MW would have at least 10 feeders available. For a program with three 10 % steps, only 3 feeders would be required to have under frequency load shed capabilities. The 100 MW threshold seems to provide adequate flexibility for implementing load shedding in three steps for entities slightly greater than 100 MW.

**Rationale:**

During development of this standard, text boxes were embedded within the standard to explain the rationale for various parts of the standard. Upon BOT approval, the text from each of the rationale text boxes was moved to this section.

**Rationale for R1:**

Studying the Region as an island is required by the NERC standard. Most regions have only one or a few different UFLS schemes. Where there is more than one scheme, studying this island demonstrates that the schemes are coordinated and performing adequately. Because there are so many different UFLS schemes in SERC (18 different schemes were represented in the 2007 SERC UFLS study), the SDT believes that applying the schemes to each subregion as an island is a necessary additional test of the coordination of the various UFLS schemes. Without this additional test, a poorly performing scheme may be masked by the large number of good performing schemes in the Region. A subregion island study, which would have a smaller number of schemes, would be more likely to uncover the poorly performing scheme and therefore get it fixed. This approach will result in a much better overall performance of the UFLS programs in SERC. The SDT recognized that there may be simulation problems due to opening the ties to utilities outside the subregion. Therefore, the subregion island boundaries are allowed to be adjusted to produce an island more suitable for simulation.

(Note: The SERC Subregions are identified in paragraph 4.2 of the SERC Reliability Corporation Bylaws: “The Region is currently geographically divided into five subregions that are identified as Southeastern, Central, VACAR, Delta, and Gateway.”)

**Rationale for R2:**

These requirements for the UFLS schemes in SERC have been in place for many years (except 2.6). The SDT believes that these requirements are still needed to ensure consistency for the various schemes which are used in SERC. Part 2.6 is designed to prevent spurious operations due to transient frequency swings.

**Rationale for R3:**

R4 of the NERC standard PRC-006-1 requires the PC to conduct assessments of UFLS schemes through dynamic simulations to verify that they meet performance requirements for generation/load imbalances of up to 25%. This requirement defines specific imbalances that are to be studied within SERC. The 13% and 22% levels were determined from simulations of the worst case frequency overshoot for the UFLS schemes in SERC.

**Rationale for R4:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. A 4 percentage point range is allowed for each individual step, but the allowed range for all steps combined is 6 percentage points.

**Rationale for R5:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. The SDT recognizes that UFLS entities with a load of less than 100 MW may have difficulty in implementing more than one UFLS step and in meeting a tight tolerance. The basis of the 100 MW comes from typical feeder load dropped by UFLS relays, and the use of a 100 MW threshold in other regional UFLS standards.

**Rationale for R6:**

The SDT believes it is necessary to put a requirement on how quickly changes to the scheme should be implemented. This requirement specifies that changes must be implemented within 18 months of notification by the PC. The 18 month interval was chosen to give a reasonable amount of time for making changes in the field. All of the SERC Region has existing UFLS schemes which, based on periodic simulations, have provided reliable protection for years. Events which result in islanding and an activation of the UFLS schemes are extremely rare in SERC. Therefore, the SDT does not believe that changes to an existing UFLS scheme will be needed in less than 18 months. However, if a PC determines there is a need for changing the UFLS scheme faster than 18 months, then the PC may require the implementation to be done sooner as allowed by NERC Reliability Standard PRC-006-1.

**Rationale for R7:**

The NERC standard requires that a UFLS database be maintained by the Planning Coordinator. This requirement specifies what data must be reported to SERC. A SERC UFLS database is needed to facilitate data sharing across the SERC Region, with other regions, and with NERC.

**Rationale for R8:**

The SDT believes that generator over and under frequency tripping data is needed to supplement the UFLS data provided by the Planning Coordinator for post-event analysis of frequency disturbances. This requirement states what data must be reported to SERC by the Generator Owners.

Since the inverse time curve cannot easily be placed into the SERC database, four clearing times based on data from the curve are requested. These clearing times are intended to cover a range of frequencies needed for event replication as well as provide information about generators that trip at a higher frequency than is allowed by the NERC standard.

**Version History**

Version	Date	Action	Change Tracking
1	September 19, 2011	SERC Board Approved	
1	November 3, 2011	Adopted by NERC Board of Trustees	
1	December 20, 2012	FERC Order issued approving PRC-006-SERC-01	
1	March 11, 2013	Modified the Rationale and changed the VRF for Requirement R6 from "Medium" to "High" per a compliance filing (Filed on 3/11/13)	
2	June 28, 2017	SERC Board Approved	
2	August 10, 2017	Adopted by NERC Board of Trustees	

**\* FOR INFORMATIONAL PURPOSES ONLY \***

**Enforcement Dates: Standard PRC-006-SERC-02 — Automatic Underfrequency Load Shedding Requirements**

**United States**

<b>Standard</b>	<b>Requirement</b>	<b>Enforcement Date</b>	<b>Inactive Date</b>
PRC-006-SERC-02	All	TBD	

**Proposed Regional Reliability Standard, PRC-006-SERC-02 – Automatic Underfrequency  
Load Shedding Requirements, and Effective Date - REDLINE**

**Effective Dates**

**Effective for SERC Region applicable Registered Entities on the first day of the first calendar quarter after approved by FERC.**

Requirement	Jurisdiction									
	Alberta	British-Columbia	Manitoba	New-Brunswick	Newfound-land	Nova-Scotia	Ontario	Quebec	Saskatch-ewan	USA
R1	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14
R2	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14
R3	NA	NA	NA	NA	NA	NA	NA	NA	NA	10/1/14
R4, R5, and R6	NA	NA	NA	NA	NA	NA	NA	NA	NA	10/1/15
R7	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14
R8	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14

~~Requirement R1 shall become effective 12 months after the first day of the first quarter following regulatory approval, but no sooner than 12 months following regulatory approval of NERC PRC-006-1. This 12-month period is consistent with the effective date of R2 of PRC-006-1.~~

~~Requirement R2 shall become effective 12 months after the first day of the first quarter following regulatory approval. This 12-month period is needed to allow time for entities to ensure a minimum time delay of six cycles on existing UFLS relays as specified in part 2.6.~~

~~Requirements R3 shall become effective 18 months after the first day of the first quarter following regulatory approval. This additional six-month period is needed to allow time to perform and coordinate studies necessary to assess the overall effectiveness of the UFLS schemes in the SERC Region.~~

~~Requirements R4, R5, and R6 shall become effective 30 months after the first day of the first quarter following regulatory approval. This additional 18 months is needed to allow time for any necessary changes to be made to the existing UFLS schemes in the SERC Region.~~

~~Requirement R7 shall become effective six months following the effective date of R8 of the NERC standard PRC-006-1, but no sooner than one year following the first day of the first calendar quarter after applicable regulatory approval of PRC-006-SERC-01. R8 of the NERC standard requires each UFLS entity to provide UFLS data to the Planning Coordinator (PC). R7 of the SERC standard requires the PC to provide this data to SERC.~~

~~Requirement R8 shall become effective 12 months after the first day of the first quarter following regulatory approval. This 12-month period is needed to allow time for Generator Owners (GO) to collect and make an initial data filing.~~



## Introduction

1. **Title:** Automatic Underfrequency Load Shedding Requirements
2. **Number:** PRC-006-SERC-012
3. **Purpose:** To establish consistent and coordinated requirements for the design, implementation, and analysis of automatic underfrequency load shedding (UFLS) programs among all SERC applicable entities.
4. **Applicability:**
  - 4.1 Planning Coordinators
  - 4.2 UFLS entities shall mean all entities that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators. Such entities may include one or more of the following:
    - 4.2.1 Transmission Owners
    - 4.2.2 Distribution Providers
  - 4.3 Generator Owners

### 5. Background

The SERC UFLS Standard: PRC-006-SERC-01 (“SERC UFLS Standard”) was developed to provide regional UFLS requirements to entities in SERC. UFLS requirements have been in place at a continent-wide level and within SERC for many years prior to implementation of federally mandated reliability compliance standards in 2007.

When reliability standards were implemented in 2007, the Federal Energy Regulatory Commission (“FERC”), which is the government body with regulatory responsibility for electric reliability, issued FERC Order 693, recognizing 83 NERC Reliability Standards as enforceable by FERC and applicable to users, owners, and operators of the bulk power system (BPS). FERC did not approve the NERC UFLS standard, PRC-006-0 in Order 693. FERC’s reason for not approving PRC-006-0 was that it recognized PRC-006-0 as a “fill-in the blank standard,” and regional procedures associated with the standard were not submitted along with the standard. FERC’s ruling in Order 693 required Regional Entities to provide the regional requirements necessary for completing the UFLS standard.

In 2008, SERC commenced work on PRC-006-SERC-01. NERC also began work on revising PRC-006-0 at a continent-wide level. The SERC standard has been developed to be consistent with the NERC UFLS standard. [PRC-006-SERC-02 was developed per periodic review of the standard.](#)

PRC-006-1 clearly defines the roles and responsibilities of parties to whom the standard applies. The standard identifies the Planning Coordinator (“PC”) as the entity responsible for developing UFLS schemes within their PC area. The regional standard adds specificity not contained in the NERC standard for development and implementation of a UFLS scheme in the SERC Region that effectively mitigates the consequences of an underfrequency event.

## Requirements and Measures

- R1.** Each Planning Coordinator shall include its SERC subregion as an identified island in the criteria (required by the NERC PRC standard on UFLS) for selecting portions of the BPS that may form islands. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 1.1** A Planning Coordinator may adjust island boundaries to differ from subregional boundaries where necessary for the sole purpose of producing a contiguous subregional island more suitable for simulation.
- M1.** Each Planning Coordinator shall have evidence such as a methodology, procedure, report, or other documentation indicating that its criteria included selection of its SERC subregion(s) as an island per Requirement R1.
- R2.** Each Planning Coordinator shall select or develop an automatic UFLS scheme (percent of load to be shed, frequency set points, and time delays) for implementation by UFLS entities within its area that meets the following minimum requirements: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning ]*
- 2.1.** Have the capability of shedding at least 30 percent of the Peak Demand (MW) served from the Planning Coordinator's transmission system. The Peak Demand may be either summer or winter as determined by the Planning Coordinator.
- 2.2.** Shed load with a minimum of three frequency set points.
- 2.3.** The highest frequency set point for relays used to arrest frequency decline shall be no lower than 59.3 Hz and not higher than 59.5 Hz.
- 2.3.1** This does not apply to UFLS relays with time delay of one second or longer and a higher frequency setpoint applied to prevent the frequency from stalling at less than 60 Hz when recovering from an underfrequency event.
- 2.4.** The lowest frequency set point shall be no lower than 58.4 Hz.
- 2.5.** The difference between frequency set points shall be at least 0.2 Hz but no greater than 0.5 Hz.
- 2.6.** Time delay (from frequency reaching the set point to the trip signal) shall be at least six cycles.
- M2.** Each Planning Coordinator shall have evidence such as reports or other documentation that the UFLS scheme for its area meets the design requirements specified in Requirement R2.

- R3.** Each Planning Coordinator, when performing design assessments specified in the NERC PRC standard on UFLS, shall conduct simulations of its UFLS scheme for an imbalance between load and generation of 13%, 22%, and 25% for all identified island(s) where such imbalance equals  $[(\text{load minus actual generation output}) / \text{load}]$ . *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M3.** Each Planning Coordinator shall have evidence such as reports or other documentation that it performed the simulations of its UFLS scheme as required in Requirement R3.
- R4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*
- 4.1.** The percent of load shedding to be implemented shall be based on the actual or estimated ~~distribution~~-substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year's actual Peak Demand in the season specified by the Planning Coordinator in R2.
- 4.2.** The amount of load in each load shedding step shall be within -1.0 and +3.0 of the percentage specified by the Planning Coordinator (for example, if the specified percentage step load shed is 12%, the allowable range is 11 to 15%).
- 4.3.** The amount of total UFLS load of all steps combined shall be within -1.0 and +5.0 of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R4 (including all the data elements in Parts 4.1, 4.2, and 4.3) unless scheme changes per Requirement R6 are in process.
- R5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator, but shall not be required to have more than one UFLS step. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning].*

- 5.1.** The percent of load shedding to be implemented shall be based on the actual or estimated ~~distribution~~-substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year actual Peak Demand in the season specified by the Planning Coordinator in R2.
- 5.2.** The amount of total UFLS load shall be within  $\pm 5.0$  of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R5 (including all the data elements in Parts 5.1 and 5.2) unless scheme changes per Requirement R6 are in process.
- R6.** Each UFLS entity shall implement changes to the UFLS scheme which involve frequency settings, relay time delays, ~~or~~ changes to the percentage of load in the scheme, or changes to the peak season selected in R2.1 within 18 months of notification by the Planning Coordinator. *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M6.** Each UFLS entity shall have evidence such as reports or other documentation demonstrating that it has made the appropriate scheme changes within 18 months per Requirement R6. Such evidence is only required if the Planning Coordinator makes changes to the UFLS scheme as specified in Requirement R6.
- R7.** Each Planning Coordinator shall provide the following information to SERC according to the schedule specified by SERC. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*
- 7.1.** Underfrequency trip set points (Hz)
- 7.2.** Total clearing time associated with each set point (sec). This includes the time from when frequency reaches the set point and ends when the breaker opens.
- 7.3.** Amount of previous year actual or estimated load associated with each set point, both in percent and in MW. The percentage and the Load demand (MW) shall be based on the time coincident with the previous year actual Peak Demand.
- M7.** Each Planning Coordinator shall have evidence such as reports or other documentation that data specified in Requirement R7 was provided to SERC in accordance with the schedule.

- R8.** Each Generator Owner shall provide the following information within 30 days of a request by SERC to facilitate post-event analysis of frequency disturbances. [*Violation Risk Factor: Lower*] [*Time Horizon: Long-term Planning*]
- 8.1.** Generator protection automatic underfrequency and overfrequency trip set points (Hz).
  - 8.2.** Total clearing time associated with each set point (sec). This is defined as the time that begins when frequency reaches the set point and ends when the breaker opens. If inverse time underfrequency relays are used, provide the total clearing time at 59.0, 58.5, 58.0, and 57.0 Hz.
  - 8.3.** Maximum generator net MW that could be tripped automatically due to an underfrequency or overfrequency condition.
- M8.** Each Generator Owner shall have evidence such as reports or other documentation that data specified in Requirement R8 was provided to SERC as requested.

## Compliance

### **Compliance enforcement authority**

SERC Reliability Corporation

### **Compliance monitoring and assessment process**

- Compliance Audit
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### **Evidence retention**

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Each Planning Coordinator, UFLS Entity and Generator Owner shall retain the current evidence of each Requirement and Measure as well as any evidence necessary to show compliance since the last compliance audit.

If a Planning Coordinator, UFLS Entity or Generator Owner is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the retention period specified above, whichever is longer.

The compliance enforcement authority shall keep the last audit records and all requested and submitted subsequent audit records.

**Time Horizons, Violation Risk Factors, and Violation Severity Levels**

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
R1	Long-term Planning	Medium	N/A	N/A	N/A	The Planning Coordinator did not have evidence that its criteria included selection of its SERC subregion(s) as an island, with or without adjusted boundaries.
R2	Long-term Planning	Medium	The Planning Coordinator's scheme did not meet one of the UFLS system design requirements identified in 2.2 through 2.6	The Planning Coordinator's scheme did not meet two of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet three of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet 2.1  <b>OR</b> Four or more of the UFLS system design requirements identified in 2.2 through 2.6.
R3	Long-term Planning	High	N/A	The Planning Coordinator failed to conduct one of the required simulations of its UFLS scheme.	N/A	The Planning Coordinator failed to conduct two of the required simulations of its UFLS scheme.
R4	Operations Planning	Medium	The UFLS entity's implemented UFLS scheme had one load shedding step outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had two load shedding steps outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range

Table 1						
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			Lower	Moderate	High	Severe
			2.	2.	specified in 4.2.  <b>OR</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.	specified in 4.2.  <b>AND</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.
R5	Operations Planning	Medium	N/A	N/A	N/A	The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 5.2.
R6	Long-term Planning	High	The UFLS entity implemented required scheme changes but made them 1 to 30 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 31 to 40 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 41 to 50 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them more than 50 days after the scheduled date  <b>OR</b> The UFLS entity failed to implement the required scheme changes.
R7	Long-term Planning	Lower	The Planning Coordinator provided the data required in R7 to SERC 1 to 10 days	The Planning Coordinator provided the data required in R7 to SERC 11 to 20 days	The Planning Coordinator provided the data required in R7 to SERC 21 to 30 days	The Planning Coordinator provided the data required in R7 to SERC more than 30



Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			after the scheduled submittal date.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC one piece of information listed in R7.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC two pieces of information listed in R7.	days after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC any of the information listed in R7.
<b>R8</b>	Long-term Planning	Lower	The Generator Owner provided the data required in R8 to SERC 1 to 10 days after the requested submittal date.	The Generator Owner provided the data required in R8 to SERC 11 to 20 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC one piece of information listed in R8.	The Generator Owner provided the data required in R8 to SERC 21 to 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC two pieces of information listed in R8.	The Generator Owner provided the data required in R8 to SERC more than 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC any of the information listed in R8.

## Regional Variances

None

## Interpretations

None

## Guideline and Technical Basis

### 1. Existing UFLS schemes

Each Planning Coordinator should consider the existing UFLS programs which are in place and should consider input from the UFLS entities in developing the UFLS scheme.

### 2. Basis for SERC standard requirements

SERC Standard PRC-006-SERC-~~01-02~~ is not a stand-alone standard, but was written to be followed in conjunction with NERC Standard PRC-006-1. The primary focus of SERC Standard PRC-006-SERC-~~01-02~~ was to provide region-specific requirements for the implementation of the higher tier NERC standard requirements with the goals of a) adding clarity and b) providing for consistency and a coordinated UFLS scheme for the SERC Region as a whole. Generally speaking, requirements already in the NERC standard were not repeated in the SERC standard. Therefore, both the NERC and SERC standards must be followed to ensure full compliance.

### 3. Basis for applying a percentage load shedding value to Forecast Load versus Actual Load

The Planning Coordinator will develop a UFLS scheme to meet the performance requirements of NERC Standard PRC-006-~~1-2~~ Requirement R3 and SERC Standard PRC-006-SERC-~~01-02~~ Requirement R2. This development will result in certain percentages of load for each UFLS entity in the Planning Coordinator's area for which automatic under frequency load shedding must be implemented. The Planning Coordinator develops these percentages based on forecast peak load demand. However, the UFLS entity implements these percentages based on the previous year's actual peak demand. Applying the same percentage to these different base values was intentional to ensure that both the Planning Coordinator and UFLS entities had a clear, measurable value to use in performing their respective roles in meeting the standard. Planning Coordinators typically use forecast demands in their work. Whereas the previous year's actual (or estimated) demand is typically more available to UFLS entities. Additionally, the use of percentages based on these different base values tends to minimize the error due to the time lag between design and actual field implementation. Since a percentage is provided by the Planning Coordinator to the UFLS entities, any differences between the design values (i.e., forecast load) and the implemented values (i.e., previous year's actual) would naturally tend to match up reasonably well. For example, if the total planning area load in MW for which UFLS was installed during the time of implementation was slightly higher or lower than the MW value used in the design by the Planning Coordinator, multiplying by the specified percentage would result in an implemented load shedding scheme that also had a reasonably similar higher or lower MW value.

#### 4. Basis for May 1 and 18 month time frames

Each UFLS entity must annually review that the amount of UFLS load shedding implemented is within a certain tolerance as specified by SERC Standard PRC-006-SERC-01-02 Requirement R 4 or Requirement R5 by May 1 of the current year. May 1 was chosen to allow sufficient time after the previous year's peak occurred to make adjustments in the field to the implementation if necessary to meet the tolerances specified in Requirement R4 or Requirement R5. Therefore, the May 1 date applies only to implementation of the existing percentages of load shedding specified by the Planning Coordinator. On the other hand, the 18-month time frame specified in PRC-006-SERC-01-02 Requirement R6 is intended to allow sufficient budgeting, procurement, and installation time for additional equipment, or for significant setting changes to existing equipment necessary to meet a revised load shedding scheme design that has been specified by the Planning Coordinator. During this 18-month transition period, the May 1 measurement of R4 or Requirement R5 would not apply.

#### 5. Basis for smaller entity threshold of 100 MW

Most distribution substations have transformers rated in the range of 10 to 40 MVA. Usually most transformers would serve 1 to 4 feeders and each feeder will normally carry between 8 and 10 MVA. In general, assuming that each feeder would carry 10 MW, an entity with a load slightly greater than 100 MW would have at least 10 feeders available. For a program with three 10 % steps, only 3 feeders would be required to have under frequency load shed capabilities. The 100 MW threshold seems to provide adequate flexibility for implementing load shedding in three steps for entities slightly greater than 100 MW.

#### Rationale:

During development of this standard, text boxes were embedded within the standard to explain the rationale for various parts of the standard. Upon BOT approval, the text from each of the rationale text boxes was moved to this section.

#### Rationale for R1:

Studying the Region as an island is required by the NERC standard. Most regions have only one or a few different UFLS schemes. Where there is more than one scheme, studying this island demonstrates that the schemes are coordinated and performing adequately. Because there are so many different UFLS schemes in SERC (18 different schemes were represented in the 2007 SERC UFLS study), the SDT believes that applying the schemes to each subregion as an island is a necessary additional test of the coordination of the various UFLS schemes. Without this additional test, a poorly performing scheme may be masked by the large number of good performing schemes in the Region. A subregion island study, which would have a smaller number of schemes, would be more likely to uncover the poorly performing scheme and therefore get it fixed. This approach will result in a much better overall performance of the UFLS programs in SERC. The SDT recognized that there may be simulation problems due to opening the ties to utilities outside the subregion. Therefore, the subregion island boundaries are allowed to be adjusted to produce an island more suitable for simulation.

(Note: The SERC Subregions are identified in paragraph 4.2 of the SERC Reliability Corporation Bylaws: “The Region is currently geographically divided into five subregions that are identified as Southeastern, Central, VACAR, Delta, and Gateway.”)

**Rationale for R2:**

These requirements for the UFLS schemes in SERC have been in place for many years (except 2.6). The SDT believes that these requirements are still needed to ensure consistency for the various schemes which are used in SERC. Part 2.6 is designed to prevent spurious operations due to transient frequency swings.

**Rationale for R3:**

R4 of the NERC standard PRC-006-1 requires the PC to conduct assessments of UFLS schemes through dynamic simulations to verify that they meet performance requirements for generation/load imbalances of up to 25%. This requirement defines specific imbalances that are to be studied within SERC. The 13% and 22% levels were determined from simulations of the worst case frequency overshoot for the UFLS schemes in SERC.

**Rationale for R4:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. A 4 percentage point range is allowed for each individual step, but the allowed range for all steps combined is 6 percentage points.

**Rationale for R5:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. The SDT recognizes that UFLS entities with a load of less than 100 MW may have difficulty in implementing more than one UFLS step and in meeting a tight tolerance. The basis of the 100 MW comes from typical feeder load dropped by UFLS relays, and the use of a 100 MW threshold in other regional UFLS standards.

**Rationale for R6:**

The SDT believes it is necessary to put a requirement on how quickly changes to the scheme should be implemented. This requirement specifies that changes must be implemented within 18 months of notification by the PC. The 18 month interval was chosen to give a reasonable amount of time for making changes in the field. All of the SERC Region has existing UFLS schemes which, based on periodic simulations, have provided reliable protection for years. Events which result in islanding and an activation of the UFLS schemes are extremely rare in SERC. Therefore, the SDT does not believe that changes to an existing UFLS scheme will be needed in less than 18 months. However, if a PC determines there is a need for changing the UFLS scheme faster than 18 months, then the PC may require the implementation to be done sooner as allowed by NERC Reliability Standard PRC-006-1.

**Rationale for R7:**

The NERC standard requires that a UFLS database be maintained by the Planning Coordinator. This requirement specifies what data must be reported to SERC. A SERC UFLS database is needed to facilitate data sharing across the SERC Region, with other regions, and with NERC.

**Rationale for R8:**

The SDT believes that generator over and under frequency tripping data is needed to supplement the UFLS data provided by the Planning Coordinator for post-event analysis of frequency disturbances. This requirement states what data must be reported to SERC by the Generator Owners.

Since the inverse time curve cannot easily be placed into the SERC database, four clearing times based on data from the curve are requested. These clearing times are intended to cover a range of frequencies needed for event replication as well as provide information about generators that trip at a higher frequency than is allowed by the NERC standard.

**Version History**

Version	Date	Action	Change Tracking
1	September 19, 2011	SERC Board Approved	
1	November 3, 2011	Adopted by NERC Board of Trustees	
1	December 20, 2012	FERC Order issued approving PRC-006-SERC-01	
1	March 11, 2013	Modified the Rationale and changed the VRF for Requirement R6 from “Medium” to “High” per a compliance filing (Filed on 3/11/13)	
2	<u>June 28, 2017</u>	<u>SERC Board Approved</u>	
2	<u>August 10, 2017</u>	<u>Adopted by NERC Board of Trustees</u>	

\* FOR INFORMATIONAL PURPOSES ONLY \*

**Enforcement Dates: Standard PRC-006-SERC-~~01~~02 — Automatic Underfrequency Load Shedding Requirements**

**United States**

<b>Standard</b>	<b>Requirement</b>	<b>Effective Date of Standard</b>	<b>Phased In-Implementation-Date (if-applicable)</b>	<b>Inactive Date</b>
<del>PRC-006-SERC-01</del>	R1.	04/01/2014		
<del>PRC-006-SERC-01</del>	1.1.	04/01/2014		
<del>PRC-006-SERC-01</del>	R2.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.1.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.2.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.3.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.3.1.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.4.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.5.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.6.	04/01/2014		
<del>PRC-006-SERC-01</del>	R3.		10/01/2014	
<del>PRC-006-SERC-01</del>	R4.		10/01/2015	
<del>PRC-006-SERC-01</del>	4.1.		10/01/2015	
<del>PRC-006-SERC-01</del>	4.2.		10/01/2015	
<del>PRC-006-SERC-01</del>	4.3.		10/01/2015	
<del>PRC-006-SERC-01</del>	R5.		10/01/2015	
<del>PRC-006-SERC-01</del>	5.1.		10/01/2015	
<del>PRC-006-SERC-01</del>	5.2.		10/01/2015	

<b>Standard</b>	<b>Requirement</b>	<b>Enforcement Date</b>	<b>Inactive Date</b>
<u>PRC-006-SERC-02</u>	<u>All</u>	<u>TBD</u>	

**Exhibit B**

**Order No. 672 Criteria for Proposed Regional Reliability Standard PRC-006-SERC-02**

## EXHIBIT B

### Order No. 672 Criteria for Proposed PRC-006-SERC-02

In Order No. 672,<sup>1</sup> the Commission identified a number of criteria it will use to analyze Reliability Standards proposed for approval to ensure they are just, reasonable, not unduly discriminatory or preferential, and in the public interest. The discussion below identifies these factors and explains how the proposed regional Reliability Standard 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.<sup>2</sup>**

The purpose of proposed regional Reliability Standard PRC-006-SERC-02 is to establish consistent and coordinated requirements for the design, implementation, and analysis of automatic UFLS programs among all SERC applicable entities. The proposed PRC-006-SERC-02 regional Reliability Standard is technically sound as it continues to meet the same performance of regional Reliability Standard PRC-006-SERC-01.<sup>3</sup> Proposed PRC-006-SERC-02 is more stringent than the related continent-wide NERC Reliability Standard PRC-006-2, which does not include detailed plan criteria or a maximum timeframe to implement changes to a UFLS scheme.

**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**

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<sup>1</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, *order on reh'g*, Order No. 672-A, FERC Stats. & Regs. ¶ 31,212 (2006).

<sup>2</sup> Order No. 672 at P 321.  
Order No. 672 at P 324.

<sup>3</sup> PRC-006-SERC-01 was approved by the Commission on December 20, 2012. *See regional Reliability Standard PRC-006-SERC-01 – Automatic Underfrequency Load Shedding Requirements*, Order No. 772, 141 FERC ¶ 61,243 (2012).



**what is required and who is required to comply.<sup>4</sup>**

Proposed PRC-006-SERC-02 is only applicable to Planning Coordinators, UFLS entities, and Generator Owners within the SERC region. The proposed standard clarifies “UFLS entities” in Section 4.2 of the Applicability section of the standard. As explained in greater detail in the petition, the proposed regional Reliability Standard includes eight requirements that specify which entities should take action.

**3. A proposed Reliability Standard must include clear and understandable consequences and a range of penalties (monetary and/or non-monetary) for a violation.<sup>5</sup>**

Proposed PRC-006-SERC-02 does not have any changes to the VRFs and VSLs approved for PRC-006-SERC-01. The VRFs and VSLs for the proposed regional Reliability Standard continues to comport with NERC and Commission guidelines. The VSLs assigned for each Requirement ensure uniformity and consistency in the determination of penalties. The VSLs do not use any ambiguous terminology. For these reasons, the proposed regional Reliability Standards includes clear and understandable consequences in accordance with Order No. 672. Upon approval by the Commission, the ranges of penalties for violations will continue to be based on the applicable VRF and VSL in accordance with the sanctions table and the supporting penalty determination process described in the Commission-approved NERC Sanction Guidelines, Appendix 4B to the NERC Rules of Procedure.

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<sup>4</sup> Order No. 672 at P 322.

Order No. 672 at P 325. The proposed Reliability Standard should be clear and unambiguous regarding what is required and who is required to comply. Users, owners, and operators of the Bulk-Power System must know what they are required to do to maintain reliability.

<sup>5</sup> Order No. 672 at P 326. The possible consequences, including range of possible penalties, for violating a proposed Reliability Standard should be clear and understandable by those who must comply.

**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.<sup>6</sup>**

Proposed PRC-006-SERC-02 identifies clear and objective criterion or measures for compliance so that it can be enforced in a consistent and non-preferential manner. The regional Reliability Standard contains individual measures that support the Requirements by plainly identifying how the Requirements will be assessed and enforced. These measures continue to ensure that the Requirements will be assessed and enforced in a clear, consistent, and non-preferential manner, 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.<sup>7</sup>**

Proposed PRC-006-SERC-02 achieves its reliability goals effectively and efficiently. The proposed revisions provide greater flexibility and clarity to registered entities responsible for compliance. The proposed regional Reliability Standard builds on the Bulk-Power System reliability protections provided by the NERC automatic UFLS standard by adding specificity for the SERC Region.

**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.<sup>8</sup>**

Proposed PRC-006-SERC-02 does not reflect a compromise that does not adequately protect Bulk-Power System reliability.

**7. Proposed Reliability Standards must be designed to apply throughout North America to the maximum extent achievable with a single Reliability Standard**

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<sup>6</sup> Order No. 672 at P 327.

<sup>7</sup> Order No. 672 at P 328.

<sup>8</sup> Order No. 672 at P 329.  
Order No. 672 at P 330.

**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.<sup>9</sup>**

As a regional Reliability Standard, proposed PRC-006-SERC-02 is designed to work in conjunction with NERC Reliability Standard PRC-006-1 while accommodating differences in system transmission and distribution topology among SERC planning coordinators and will be enforceable for registered entities within the SERC region.

**8. Proposed Reliability Standards should cause no undue negative effect on competition or restriction of the grid beyond any restriction necessary for reliability.<sup>10</sup>**

The proposed regional Reliability Standard would not restrict competition or available transmission capability beyond what is necessary for reliability.

**9. The implementation time for the proposed Reliability Standard is reasonable.<sup>11</sup>**

The implementation time for the proposed regional Reliability Standard is reasonable. Because proposed PRC-006-SERC-02 provides additional flexibility and clarity rather than imposing any new obligations on registered entities, an effective date of the first day of the first calendar quarter after FERC approval is reasonable.

**10. The Reliability Standard was developed in an open and fair manner and in accordance with the Commission-approved Reliability Standard development process.<sup>12</sup>**

The proposed regional Reliability Standard was developed in accordance with NERC's and SERC's Commission-approved processes for developing and approving Reliability Standards. SERC develops Regional Reliability Standards in accordance with the SERC

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<sup>9</sup> Order No. 672 at P 331.

<sup>10</sup> Order No. 672 at P 332.

<sup>11</sup> Order No. 672 at P 333.

<sup>12</sup> Order No. 672 at P 334.

regional Standards Development Procedure. The development process is open to any person who is an interested stakeholder. For more detail, please see the complete development history included as Exhibit C.

**11. NERC must explain any balancing of vital public interests in the development of proposed Reliability Standards.<sup>13</sup>**

NERC and SERC have not identified competing vital public interests with respect to the request for approval of the regional Reliability Standard, and no comments were received during the development of the regional Reliability Standard indicating conflicts with other vital public interests.

**12. Proposed Reliability Standards must consider any other appropriate factors.<sup>14</sup>**

No other factors relevant to whether the proposed regional Reliability Standard is just and reasonable were identified.

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<sup>13</sup> Order No. 672 at P 335.

<sup>14</sup> Order No. 672 at P 323.

The proposed regional Reliability Standard was developed in accordance with NERC's and SERC's Commission-approved processes for developing and approving Reliability Standards. SERC develops regional Reliability Standards in accordance with the SERC regional Standards Development Procedure. The development process is open to any person who is an interested stakeholder. For more detail, please see the complete development history included as Exhibit C.

**11. NERC must explain any balancing of vital public interests in the development of proposed Reliability Standards.<sup>13</sup>**

NERC and SERC have not identified competing vital public interests with respect to the request for approval of the regional Reliability Standard, and no comments were received during the development of the regional Reliability Standard indicating conflicts with other vital public interests.

**12. Proposed Reliability Standards must consider any other appropriate factors.<sup>14</sup>**

No other factors relevant to whether the proposed regional Reliability Standard is just and reasonable were identified.

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<sup>13</sup> Order No. 672 at P 335. Finally, we understand that at times development of a proposed Reliability Standard may require that a particular reliability goal must be balanced against other vital public interests, such as environmental, social and other goals. We expect the ERO to explain any such balancing in its application for approval of a proposed Reliability Standard.

<sup>14</sup> Order No. 672 at P 323. In considering whether a proposed Reliability Standard is just and reasonable, we will consider the following general factors, as well as other factors that are appropriate for the particular Reliability Standard proposed.

**Exhibit C**

**Summary of Development History and Complete Record of Development**

## **Summary of Development History**

## **Summary of Development History**

The development record for proposed regional Reliability Standard PRC-006-SERC-02 is summarized below.

### **I. Overview of the SERC Engineering Committee Dynamics Review Subcommittee**

When evaluating a proposed Reliability Standard, the Commission is expected to give “due weight” to the technical expertise of the ERO.<sup>1</sup> For proposed regional Reliability Standard PRC-006-SERC-02, the technical expertise of the ERO is derived from the SERC Engineering Committee Dynamics Review Subcommittee that conducted the five-year periodic review of PRC-006-SERC-01.<sup>2</sup> A roster of the SERC Engineering Committee Dynamics Review Subcommittee members is included in Exhibit D.

### **II. Standard Development History**

#### **A. Five-year Periodic Review**

SERC conducted a five-year periodic review of PRC-006-SERC-01 in accordance with the SERC regional Standards Development Procedure. The SERC Engineering Committee Dynamics Review Subcommittee recommended the proposed revisions in PRC-006-SERC-02 as a result of this review.

#### **B. Initial Comment Period and Ballot**

The SERC Standards Committee posted proposed regional Reliability Standard PRC-006-SERC-02 for comment from October 25, 2016 through December 7, 2016. SERC received comments from seven individuals. SERC posted proposed regional Reliability Standard PRC-006-SERC-02 for initial ballot from March 16, 2017 through April 12, 2017. SERC received one

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<sup>1</sup> Section 215(d)(2) of the Federal Power Act; 16 U.S.C. §824(d) (2) (2012).

<sup>2</sup> The SERC Regional Standards Development Procedure is available at [http://serc1.org/docs/default-source/program-areas/standards-regional-criteria/standards-documents/serc-da-exhibit-c---regional-standards-development-procedure-\(6-12-12\).pdf?sfvrsn=9079681a\\_8](http://serc1.org/docs/default-source/program-areas/standards-regional-criteria/standards-documents/serc-da-exhibit-c---regional-standards-development-procedure-(6-12-12).pdf?sfvrsn=9079681a_8).



comment during the initial ballot. Based on the comments received, the SERC Engineering Committee Dynamics Review Subcommittee determined to make non-substantive changes to the proposed standard.<sup>3</sup>

### **C. Final Ballot and SERC Board of Directors Approval**

Proposed regional Reliability Standard PRC-006-SERC-02 received 100 percent affirmative votes from SERC stakeholders participating in the final ballot on May 10, 2017. The SERC Board Executive Committee, by delegated authority from the SERC Board of Directives, approved the standard on June 28, 2017.

### **D. NERC Comment Period and Board of Trustees Approval**

NERC posted proposed regional Reliability Standard PRC-006-SERC-02 for a 45-day public comment period from June 9, 2017 to July 24, 2017.<sup>4</sup> The NERC Board of Trustees adopted proposed regional Reliability Standard PRC-006-SERC-02 on August 10, 2017.<sup>5</sup>

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<sup>3</sup> The Consideration of Comments for the Initial Comment Period and Ballot is available at [http://serc1.org/docs/default-source/program-areas/standards-regional-criteria/regional-criteria-and-guidelines/posted-for-ballot/consideration-of-comments-document-prc-006-serc-02-06-12-17-final.pdf?sfvrsn=df1bbac0\\_2](http://serc1.org/docs/default-source/program-areas/standards-regional-criteria/regional-criteria-and-guidelines/posted-for-ballot/consideration-of-comments-document-prc-006-serc-02-06-12-17-final.pdf?sfvrsn=df1bbac0_2).

<sup>4</sup> The NERC web page for Regional Reliability Standards Under Development is available at <http://www.nerc.com/pa/Stand/Pages/RegionalReliabilityStandardsUnderDevelopment.aspx>.

<sup>5</sup> NERC, *Board of Trustees Agenda Package*, Agenda Item 9d (PRC-006-SERC-02 Automatic Underfrequency Load Shedding Requirements), available at [http://www.nerc.com/gov/bot/Agenda%20highlights%20and%20Mintues%202013/Board\\_Open\\_Meeting\\_August\\_10\\_2017\\_Agenda\\_Package\\_v2%20\(002\).pdf](http://www.nerc.com/gov/bot/Agenda%20highlights%20and%20Mintues%202013/Board_Open_Meeting_August_10_2017_Agenda_Package_v2%20(002).pdf).

## **Complete Record of Development**

SERC Reliability Corporation (SERC)

PRC-006-SERC-02

Automatic  
Underfrequency  
Load Shedding  
Requirements

PRC-006-SERC-02

Clean (1) | Redline (2)

SERC Ballot Results (3)

SERC Consideration of Comments Form (4)

Info (5)

Submit Comments

Unofficial Comment Form (Word) (6)

Comments Received (7)

## Effective Date

**Effective for SERC Region applicable Registered Entities on the first day of the first calendar quarter after approved by FERC**

## Introduction

1. **Title:** Automatic Underfrequency Load Shedding Requirements
2. **Number:** PRC-006-SERC-02
3. **Purpose:** To establish consistent and coordinated requirements for the design, implementation, and analysis of automatic underfrequency load shedding (UFLS) programs among all SERC applicable entities.
4. **Applicability:**
  - 4.1 Planning Coordinators
  - 4.2 UFLS entities shall mean all entities that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators. Such entities may include one or more of the following:
    - 4.2.1 Transmission Owners
    - 4.2.2 Distribution Providers
  - 4.3 Generator Owners
5. **Background**

The SERC UFLS Standard: PRC-006-SERC-01 (“SERC UFLS Standard”) was developed to provide regional UFLS requirements to entities in SERC. UFLS requirements have been in place at a continent-wide level and within SERC for many years prior to implementation of federally mandated reliability compliance standards in 2007.

When reliability standards were implemented in 2007, the Federal Energy Regulatory Commission (“FERC”), which is the government body with regulatory responsibility for electric reliability, issued FERC Order 693, recognizing 83 NERC Reliability Standards as enforceable by FERC and applicable to users, owners, and operators of the bulk power system (BPS). FERC did not approve the NERC UFLS standard, PRC-006-0 in Order 693. FERC’s reason for not approving PRC-006-0 was that it recognized PRC-006-0 as a “fill-in the blank standard,” and regional procedures associated with the standard were not submitted along with the standard. FERC’s ruling in Order 693 required Regional Entities to provide the regional requirements necessary for completing the UFLS standard.

In 2008, SERC commenced work on PRC-006-SERC-01. NERC also began work on revising PRC-006-0 at a continent-wide level. The SERC standard has been developed to be consistent with the NERC UFLS standard. PRC-006-SERC-02 was developed per periodic review of the standard.

PRC-006-1 clearly defines the roles and responsibilities of parties to whom the standard applies. The standard identifies the Planning Coordinator (“PC”) as the entity responsible for developing UFLS schemes within their PC area. The regional standard adds specificity not contained in the NERC standard for development and implementation of a UFLS scheme in the SERC Region that effectively mitigates the consequences of an underfrequency event.

## Requirements and Measures

- R1.** Each Planning Coordinator shall include its SERC subregion as an identified island in the criteria (required by the NERC PRC standard on UFLS) for selecting portions of the BPS that may form islands. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 1.1** A Planning Coordinator may adjust island boundaries to differ from subregional boundaries where necessary for the sole purpose of producing a contiguous subregional island more suitable for simulation.
- M1.** Each Planning Coordinator shall have evidence such as a methodology, procedure, report, or other documentation indicating that its criteria included selection of its SERC subregion(s) as an island per Requirement R1.
- R2.** Each Planning Coordinator shall select or develop an automatic UFLS scheme (percent of load to be shed, frequency set points, and time delays) for implementation by UFLS entities within its area that meets the following minimum requirements: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning ]*
- 2.1.** Have the capability of shedding at least 30 percent of the Peak Demand (MW) served from the Planning Coordinator's transmission system. The Peak Demand may be either summer or winter as determined by the Planning Coordinator.
- 2.2.** Shed load with a minimum of three frequency set points.
- 2.3.** The highest frequency set point for relays used to arrest frequency decline shall be no lower than 59.3 Hz and not higher than 59.5 Hz.
- 2.3.1** This does not apply to UFLS relays with time delay of one second or longer and a higher frequency setpoint applied to prevent the frequency from stalling at less than 60 Hz when recovering from an underfrequency event.
- 2.4.** The lowest frequency set point shall be no lower than 58.4 Hz.
- 2.5.** The difference between frequency set points shall be at least 0.2 Hz but no greater than 0.5 Hz.
- 2.6.** Time delay (from frequency reaching the set point to the trip signal) shall be at least six cycles.
- M2.** Each Planning Coordinator shall have evidence such as reports or other documentation that the UFLS scheme for its area meets the design requirements specified in Requirement R2.

- R3.** Each Planning Coordinator, when performing design assessments specified in the NERC PRC standard on UFLS, shall conduct simulations of its UFLS scheme for an imbalance between load and generation of 13%, 22%, and 25% for all identified island(s) where such imbalance equals  $[(\text{load minus actual generation output}) / \text{load}]$ . *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M3.** Each Planning Coordinator shall have evidence such as reports or other documentation that it performed the simulations of its UFLS scheme as required in Requirement R3.
- R4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*
- 4.1.** The percent of load shedding to be implemented shall be based on the actual or estimated substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year's actual Peak Demand in the season specified by the Planning Coordinator in R2.
- 4.2.** The amount of load in each load shedding step shall be within -1.0 and +3.0 of the percentage specified by the Planning Coordinator (for example, if the specified percentage step load shed is 12%, the allowable range is 11 to 15%).
- 4.3.** The amount of total UFLS load of all steps combined shall be within -1.0 and +5.0 of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R4 (including all the data elements in Parts 4.1, 4.2, and 4.3) unless scheme changes per Requirement R6 are in process.
- R5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator, but shall not be required to have more than one UFLS step. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*.

- 5.1.** The percent of load shedding to be implemented shall be based on the actual or estimated substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year actual Peak Demand in the season specified by the Planning Coordinator in R2..
- 5.2.** The amount of total UFLS load shall be within  $\pm 5.0$  of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R5 (including all the data elements in Parts 5.1 and 5.2) unless scheme changes per Requirement R6 are in process.
- R6.** Each UFLS entity shall implement changes to the UFLS scheme which involve frequency settings, relay time delays, changes to the percentage of load in the scheme, or changes to the peak season selected in R2.1 within 18 months of notification by the Planning Coordinator. *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M6.** Each UFLS entity shall have evidence such as reports or other documentation demonstrating that it has made the appropriate scheme changes within 18 months per Requirement R6. Such evidence is only required if the Planning Coordinator makes changes to the UFLS scheme as specified in Requirement R6.
- R7.** Each Planning Coordinator shall provide the following information to SERC according to the schedule specified by SERC. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*
- 7.1.** Underfrequency trip set points (Hz)
- 7.2.** Total clearing time associated with each set point (sec). This includes the time from when frequency reaches the set point and ends when the breaker opens.
- 7.3.** Amount of previous year actual or estimated load associated with each set point, both in percent and in MW. The percentage and the Load demand (MW) shall be based on the time coincident with the previous year actual Peak Demand.
- M7.** Each Planning Coordinator shall have evidence such as reports or other documentation that data specified in Requirement R7 was provided to SERC in accordance with the schedule.

- R8.** Each Generator Owner shall provide the following information within 30 days of a request by SERC to facilitate post-event analysis of frequency disturbances. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*
- 8.1.** Generator protection automatic underfrequency and overfrequency trip set points (Hz).
  - 8.2.** Total clearing time associated with each set point (sec). This is defined as the time that begins when frequency reaches the set point and ends when the breaker opens. If inverse time underfrequency relays are used, provide the total clearing time at 59.0, 58.5, 58.0, and 57.0 Hz.
  - 8.3.** Maximum generator net MW that could be tripped automatically due to an underfrequency or overfrequency condition.
- M8.** Each Generator Owner shall have evidence such as reports or other documentation that data specified in Requirement R8 was provided to SERC as requested.



## Compliance

### **Compliance enforcement authority**

SERC Reliability Corporation

### **Compliance monitoring and assessment process**

- Compliance Audit
- Self-Certification
- Spot Checking
- Compliance Violation Investigation
- Self-Reporting
- Complaint

### **Evidence retention**

Each Planning Coordinator, UFLS Entity and Generator Owner shall keep data or evidence to show compliance as identified below unless directed by SERC to retain specific evidence for a longer period of time as part of an investigation.

Each Planning Coordinator, UFLS Entity and Generator Owner shall retain the current evidence of each Requirement and Measure as well as any evidence necessary to show compliance since the last compliance audit.

If a Planning Coordinator, UFLS Entity or Generator Owner is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the retention period specified above, whichever is longer.

The compliance enforcement authority shall keep the last audit records and all requested and submitted subsequent audit records.

**Time Horizons, Violation Risk Factors, and Violation Severity Levels**

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
R1	Long-term Planning	Medium	N/A	N/A	N/A	The Planning Coordinator did not have evidence that its criteria included selection of its SERC subregion(s) as an island, with or without adjusted boundaries.
R2	Long-term Planning	Medium	The Planning Coordinator's scheme did not meet one of the UFLS system design requirements identified in 2.2 through 2.6	The Planning Coordinator's scheme did not meet two of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet three of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet 2.1  <b>OR</b> Four or more of the UFLS system design requirements identified in 2.2 through 2.6.
R3	Long-term Planning	High	N/A	The Planning Coordinator failed to conduct one of the required simulations of its UFLS scheme.	N/A	The Planning Coordinator failed to conduct two of the required simulations of its UFLS scheme.
R4	Operations Planning	Medium	The UFLS entity's implemented UFLS scheme had one load shedding step outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had two load shedding steps outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			2.	2.	specified in 4.2.  <b>OR</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.	specified in 4.2.  <b>AND</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.
<b>R5</b>	Operations Planning	Medium	N/A	N/A	N/A	The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 5.2.
<b>R6</b>	Long-term Planning	High	The UFLS entity implemented required scheme changes but made them 1 to 30 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 31 to 40 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 41 to 50 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them more than 50 days after the scheduled date  <b>OR</b> The UFLS entity failed to implement the required scheme changes.
<b>R7</b>	Long-term Planning	Lower	The Planning Coordinator provided the data required in R7 to SERC 1 to 10 days	The Planning Coordinator provided the data required in R7 to SERC 11 to 20 days	The Planning Coordinator provided the data required in R7 to SERC 21 to 30 days	The Planning Coordinator provided the data required in R7 to SERC more than 30

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			after the scheduled submittal date.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC one piece of information listed in R7.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC two pieces of information listed in R7.	days after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC any of the information listed in R7.
<b>R8</b>	Long-term Planning	Lower	The Generator Owner provided the data required in R8 to SERC 1 to 10 days after the requested submittal date.	The Generator Owner provided the data required in R8 to SERC 11 to 20 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC one piece of information listed in R8.	The Generator Owner provided the data required in R8 to SERC 21 to 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC two pieces of information listed in R8.	The Generator Owner provided the data required in R8 to SERC more than 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC any of the information listed in R8.

## Regional Variances

None

## Interpretations

None

## Guideline and Technical Basis

### 1. Existing UFLS schemes

Each Planning Coordinator should consider the existing UFLS programs which are in place and should consider input from the UFLS entities in developing the UFLS scheme.

### 2. Basis for SERC standard requirements

SERC Standard PRC-006-SERC-02 is not a stand-alone standard, but was written to be followed in conjunction with NERC Standard PRC-006-1. The primary focus of SERC Standard PRC-006-SERC-02 was to provide region-specific requirements for the implementation of the higher tier NERC standard requirements with the goals of a) adding clarity and b) providing for consistency and a coordinated UFLS scheme for the SERC Region as a whole.

Generally speaking, requirements already in the NERC standard were not repeated in the SERC standard. Therefore, both the NERC and SERC standards must be followed to ensure full compliance.

### 3. Basis for applying a percentage load shedding value to Forecast Load versus Actual Load

The Planning Coordinator will develop a UFLS scheme to meet the performance requirements of NERC Standard PRC-006-2 Requirement R3 and SERC Standard PRC-006-SERC-02 Requirement R2. This development will result in certain percentages of load for each UFLS entity in the Planning Coordinator's area for which automatic under frequency load shedding must be implemented. The Planning Coordinator develops these percentages based on forecast peak load demand. However, the UFLS entity implements these percentages based on the previous year's actual peak demand. Applying the same percentage to these different base values was intentional to ensure that both the Planning Coordinator and UFLS entities had a clear, measurable value to use in performing their respective roles in meeting the standard. Planning Coordinators typically use forecast demands in their work. Whereas the previous year's actual (or estimated) demand is typically more available to UFLS entities. Additionally, the use of percentages based on these different base values tends to minimize the error due to the time lag between design and actual field implementation. Since a percentage is provided by the Planning Coordinator to the UFLS entities, any differences between the design values (i.e., forecast load) and the implemented values (i.e., previous year's actual) would naturally tend to match up reasonably well. For example, if the total planning area load in MW for which UFLS was installed during the time of implementation was slightly higher or lower than the MW value used in the design by the Planning Coordinator, multiplying by the specified percentage would result in an implemented load shedding scheme that also had a reasonably similar higher or lower MW value.

**4. Basis for May 1 and 18 month time frames**

Each UFLS entity must annually review that the amount of UFLS load shedding implemented is within a certain tolerance as specified by SERC Standard PRC-006-SERC-02 Requirement R 4 or Requirement R5 by May 1 of the current year. May 1 was chosen to allow sufficient time after the previous year's peak occurred to make adjustments in the field to the implementation if necessary to meet the tolerances specified in Requirement R4 or Requirement R5. Therefore, the May 1 date applies only to implementation of the existing percentages of load shedding specified by the Planning Coordinator. On the other hand, the 18-month time frame specified in PRC-006-SERC-02 Requirement R6 is intended to allow sufficient budgeting, procurement, and installation time for additional equipment, or for significant setting changes to existing equipment necessary to meet a revised load shedding scheme design that has been specified by the Planning Coordinator. During this 18-month transition period, the May 1 measurement of R4 or Requirement R5 would not apply.

**5. Basis for smaller entity threshold of 100 MW**

Most distribution substations have transformers rated in the range of 10 to 40 MVA. Usually most transformers would serve 1 to 4 feeders and each feeder will normally carry between 8 and 10 MVA. In general, assuming that each feeder would carry 10 MW, an entity with a load slightly greater than 100 MW would have at least 10 feeders available. For a program with three 10 % steps, only 3 feeders would be required to have under frequency load shed capabilities. The 100 MW threshold seems to provide adequate flexibility for implementing load shedding in three steps for entities slightly greater than 100 MW.

**Rationale:**

During development of this standard, text boxes were embedded within the standard to explain the rationale for various parts of the standard. Upon BOT approval, the text from each of the rationale text boxes was moved to this section.

**Rationale for R1:**

Studying the Region as an island is required by the NERC standard. Most regions have only one or a few different UFLS schemes. Where there is more than one scheme, studying this island demonstrates that the schemes are coordinated and performing adequately. Because there are so many different UFLS schemes in SERC (18 different schemes were represented in the 2007 SERC UFLS study), the SDT believes that applying the schemes to each subregion as an island is a necessary additional test of the coordination of the various UFLS schemes. Without this additional test, a poorly performing scheme may be masked by the large number of good performing schemes in the Region. A subregion island study, which would have a smaller number of schemes, would be more likely to uncover the poorly performing scheme and therefore get it fixed. This approach will result in a much better overall performance of the UFLS programs in SERC. The SDT recognized that there may be simulation problems due to opening the ties to utilities outside the subregion. Therefore, the subregion island boundaries are allowed to be adjusted to produce an island more suitable for simulation.

(Note: The SERC Subregions are identified in paragraph 4.2 of the SERC Reliability Corporation Bylaws: “The Region is currently geographically divided into five subregions that are identified as Southeastern, Central, VACAR, Delta, and Gateway.”)

**Rationale for R2:**

These requirements for the UFLS schemes in SERC have been in place for many years (except 2.6). The SDT believes that these requirements are still needed to ensure consistency for the various schemes which are used in SERC. Part 2.6 is designed to prevent spurious operations due to transient frequency swings.

**Rationale for R3:**

R4 of the NERC standard PRC-006-1 requires the PC to conduct assessments of UFLS schemes through dynamic simulations to verify that they meet performance requirements for generation/load imbalances of up to 25%. This requirement defines specific imbalances that are to be studied within SERC. The 13% and 22% levels were determined from simulations of the worst case frequency overshoot for the UFLS schemes in SERC.

**Rationale for R4:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. A 4 percentage point range is allowed for each individual step, but the allowed range for all steps combined is 6 percentage points.

**Rationale for R5:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. The SDT recognizes that UFLS entities with a load of less than 100 MW may have difficulty in implementing more than one UFLS step and in meeting a tight tolerance. The basis of the 100 MW comes from typical feeder load dropped by UFLS relays, and the use of a 100 MW threshold in other regional UFLS standards.

**Rationale for R6:**

The SDT believes it is necessary to put a requirement on how quickly changes to the scheme should be implemented. This requirement specifies that changes must be implemented within 18 months of notification by the PC. The 18 month interval was chosen to give a reasonable amount of time for making changes in the field. All of the SERC Region has existing UFLS schemes which, based on periodic simulations, have provided reliable protection for years. Events which result in islanding and an activation of the UFLS schemes are extremely rare in SERC. Therefore, the SDT does not believe that changes to an existing UFLS scheme will be needed in less than 18 months. However, if a PC determines there is a need for changing the UFLS scheme faster than 18 months, then the PC may require the implementation to be done sooner as allowed by NERC Reliability Standard PRC-006-1.

**Rationale for R7:**

The NERC standard requires that a UFLS database be maintained by the Planning Coordinator. This requirement specifies what data must be reported to SERC. A SERC UFLS database is needed to facilitate data sharing across the SERC Region, with other regions, and with NERC.

**Rationale for R8:**

The SDT believes that generator over and under frequency tripping data is needed to supplement the UFLS data provided by the Planning Coordinator for post-event analysis of frequency disturbances. This requirement states what data must be reported to SERC by the Generator Owners.

Since the inverse time curve cannot easily be placed into the SERC database, four clearing times based on data from the curve are requested. These clearing times are intended to cover a range of frequencies needed for event replication as well as provide information about generators that trip at a higher frequency than is allowed by the NERC standard.

**Version History**

Version	Date	Action	Change Tracking
1	September 19, 2011	SERC Board Approved	
1	November 3, 2011	Adopted by NERC Board of Trustees	
1	December 20, 2012	FERC Order issued approving PRC-006-SERC-01	
1	March 11, 2013	Modified the Rationale and changed the VRF for Requirement R6 from "Medium" to "High" per a compliance filing (Filed on 3/11/13)	
2	June 28, 2017	SERC Board Approved	
2	August 10, 2017	Adopted by NERC Board of Trustees	



**\* FOR INFORMATIONAL PURPOSES ONLY \***

**Enforcement Dates: Standard PRC-006-SERC-02 — Automatic Underfrequency Load Shedding Requirements**

**United States**

<b>Standard</b>	<b>Requirement</b>	<b>Enforcement Date</b>	<b>Inactive Date</b>
PRC-006-SERC-02	All	TBD	

**Effective Dates**

**Effective for SERC Region applicable Registered Entities on the first day of the first calendar quarter after approved by FERC.**

Requirement	Jurisdiction									
	Alberta	British-Columbia	Manitoba	New-Brunswick	Newfoundland	Nova-Scotia	Ontario	Quebec	Saskatchewan	USA
R1	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14
R2	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14
R3	NA	NA	NA	NA	NA	NA	NA	NA	NA	10/1/14
R4, R5, and R6	NA	NA	NA	NA	NA	NA	NA	NA	NA	10/1/15
R7	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14
R8	NA	NA	NA	NA	NA	NA	NA	NA	NA	4/1/14

~~Requirement R1 shall become effective 12 months after the first day of the first quarter following regulatory approval, but no sooner than 12 months following regulatory approval of NERC PRC-006-1. This 12-month period is consistent with the effective date of R2 of PRC-006-1.~~

~~Requirement R2 shall become effective 12 months after the first day of the first quarter following regulatory approval. This 12-month period is needed to allow time for entities to ensure a minimum time delay of six cycles on existing UFLS relays as specified in part 2.6.~~

~~Requirements R3 shall become effective 18 months after the first day of the first quarter following regulatory approval. This additional six-month period is needed to allow time to perform and coordinate studies necessary to assess the overall effectiveness of the UFLS schemes in the SERC Region.~~

~~Requirements R4, R5, and R6 shall become effective 30 months after the first day of the first quarter following regulatory approval. This additional 18 months is needed to allow time for any necessary changes to be made to the existing UFLS schemes in the SERC Region.~~

~~Requirement R7 shall become effective six months following the effective date of R8 of the NERC standard PRC-006-1, but no sooner than one year following the first day of the first calendar quarter after applicable regulatory approval of PRC-006-SERC-01. R8 of the NERC standard requires each UFLS entity to provide UFLS data to the Planning Coordinator (PC). R7 of the SERC standard requires the PC to provide this data to SERC.~~

~~Requirement R8 shall become effective 12 months after the first day of the first quarter following regulatory approval. This 12-month period is needed to allow time for Generator Owners (GO) to collect and make an initial data filing.~~

## Introduction

1. **Title:** Automatic Underfrequency Load Shedding Requirements
2. **Number:** PRC-006-SERC-012
3. **Purpose:** To establish consistent and coordinated requirements for the design, implementation, and analysis of automatic underfrequency load shedding (UFLS) programs among all SERC applicable entities.
4. **Applicability:**
  - 4.1 Planning Coordinators
  - 4.2 UFLS entities shall mean all entities that are responsible for the ownership, operation, or control of UFLS equipment as required by the UFLS program established by the Planning Coordinators. Such entities may include one or more of the following:
    - 4.2.1 Transmission Owners
    - 4.2.2 Distribution Providers
  - 4.3 Generator Owners

5. **Background**

The SERC UFLS Standard: PRC-006-SERC-01 (“SERC UFLS Standard”) was developed to provide regional UFLS requirements to entities in SERC. UFLS requirements have been in place at a continent-wide level and within SERC for many years prior to implementation of federally mandated reliability compliance standards in 2007.

When reliability standards were implemented in 2007, the Federal Energy Regulatory Commission (“FERC”), which is the government body with regulatory responsibility for electric reliability, issued FERC Order 693, recognizing 83 NERC Reliability Standards as enforceable by FERC and applicable to users, owners, and operators of the bulk power system (BPS). FERC did not approve the NERC UFLS standard, PRC-006-0 in Order 693. FERC’s reason for not approving PRC-006-0 was that it recognized PRC-006-0 as a “fill-in the blank standard,” and regional procedures associated with the standard were not submitted along with the standard. FERC’s ruling in Order 693 required Regional Entities to provide the regional requirements necessary for completing the UFLS standard.

In 2008, SERC commenced work on PRC-006-SERC-01. NERC also began work on revising PRC-006-0 at a continent-wide level. The SERC standard has been developed to be consistent with the NERC UFLS standard. [PRC-006-SERC-02 was developed per periodic review of the standard.](#)

PRC-006-1 clearly defines the roles and responsibilities of parties to whom the standard applies. The standard identifies the Planning Coordinator (“PC”) as the entity responsible for developing UFLS schemes within their PC area. The regional standard adds specificity not contained in the NERC standard for development and implementation of a UFLS scheme in the SERC Region that effectively mitigates the consequences of an underfrequency event.

## Requirements and Measures

- R1.** Each Planning Coordinator shall include its SERC subregion as an identified island in the criteria (required by the NERC PRC standard on UFLS) for selecting portions of the BPS that may form islands. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*
- 1.1** A Planning Coordinator may adjust island boundaries to differ from subregional boundaries where necessary for the sole purpose of producing a contiguous subregional island more suitable for simulation.
- M1.** Each Planning Coordinator shall have evidence such as a methodology, procedure, report, or other documentation indicating that its criteria included selection of its SERC subregion(s) as an island per Requirement R1.
- R2.** Each Planning Coordinator shall select or develop an automatic UFLS scheme (percent of load to be shed, frequency set points, and time delays) for implementation by UFLS entities within its area that meets the following minimum requirements: *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning ]*
- 2.1.** Have the capability of shedding at least 30 percent of the Peak Demand (MW) served from the Planning Coordinator's transmission system. The Peak Demand may be either summer or winter as determined by the Planning Coordinator.
- 2.2.** Shed load with a minimum of three frequency set points.
- 2.3.** The highest frequency set point for relays used to arrest frequency decline shall be no lower than 59.3 Hz and not higher than 59.5 Hz.
- 2.3.1** This does not apply to UFLS relays with time delay of one second or longer and a higher frequency setpoint applied to prevent the frequency from stalling at less than 60 Hz when recovering from an underfrequency event.
- 2.4.** The lowest frequency set point shall be no lower than 58.4 Hz.
- 2.5.** The difference between frequency set points shall be at least 0.2 Hz but no greater than 0.5 Hz.
- 2.6.** Time delay (from frequency reaching the set point to the trip signal) shall be at least six cycles.
- M2.** Each Planning Coordinator shall have evidence such as reports or other documentation that the UFLS scheme for its area meets the design requirements specified in Requirement R2.

- R3.** Each Planning Coordinator, when performing design assessments specified in the NERC PRC standard on UFLS, shall conduct simulations of its UFLS scheme for an imbalance between load and generation of 13%, 22%, and 25% for all identified island(s) where such imbalance equals  $[(\text{load minus actual generation output}) / \text{load}]$ . *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M3.** Each Planning Coordinator shall have evidence such as reports or other documentation that it performed the simulations of its UFLS scheme as required in Requirement R3.
- R4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*
- 4.1.** The percent of load shedding to be implemented shall be based on the actual or estimated ~~distribution~~-substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year's actual Peak Demand in the season specified by the Planning Coordinator in R2.
- 4.2.** The amount of load in each load shedding step shall be within -1.0 and +3.0 of the percentage specified by the Planning Coordinator (for example, if the specified percentage step load shed is 12%, the allowable range is 11 to 15%).
- 4.3.** The amount of total UFLS load of all steps combined shall be within -1.0 and +5.0 of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M4.** Each UFLS entity that has a total load of 100 MW or greater in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R4 (including all the data elements in Parts 4.1, 4.2, and 4.3) unless scheme changes per Requirement R6 are in process.
- R5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall implement the UFLS scheme developed by their Planning Coordinator, but shall not be required to have more than one UFLS step. UFLS entities may implement the UFLS scheme developed by the Planning Coordinator by coordinating with other UFLS entities. The UFLS scheme shall meet the following requirements on May 1 of each calendar year. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning].*

- 5.1.** The percent of load shedding to be implemented shall be based on the actual or estimated ~~distribution~~-substation or feeder demand (including losses) of the UFLS entities at the time coincident with the previous year actual Peak Demand in the season specified by the Planning Coordinator in R2.
- 5.2.** The amount of total UFLS load shall be within  $\pm 5.0$  of the percentage specified by the Planning Coordinator for the total UFLS load in the UFLS scheme.
- M5.** Each UFLS entity that has a total load less than 100 MW in a Planning Coordinator area in the SERC Region shall have evidence such as reports or other documentation demonstrating that its implementation of the UFLS scheme on May 1 of each calendar year meets the requirements of Requirement R5 (including all the data elements in Parts 5.1 and 5.2) unless scheme changes per Requirement R6 are in process.
- R6.** Each UFLS entity shall implement changes to the UFLS scheme which involve frequency settings, relay time delays, ~~or~~ changes to the percentage of load in the scheme, or changes to the peak season selected in R2.1 within 18 months of notification by the Planning Coordinator. *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*
- M6.** Each UFLS entity shall have evidence such as reports or other documentation demonstrating that it has made the appropriate scheme changes within 18 months per Requirement R6. Such evidence is only required if the Planning Coordinator makes changes to the UFLS scheme as specified in Requirement R6.
- R7.** Each Planning Coordinator shall provide the following information to SERC according to the schedule specified by SERC. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*
- 7.1.** Underfrequency trip set points (Hz)
- 7.2.** Total clearing time associated with each set point (sec). This includes the time from when frequency reaches the set point and ends when the breaker opens.
- 7.3.** Amount of previous year actual or estimated load associated with each set point, both in percent and in MW. The percentage and the Load demand (MW) shall be based on the time coincident with the previous year actual Peak Demand.
- M7.** Each Planning Coordinator shall have evidence such as reports or other documentation that data specified in Requirement R7 was provided to SERC in accordance with the schedule.

- R8.** Each Generator Owner shall provide the following information within 30 days of a request by SERC to facilitate post-event analysis of frequency disturbances. [*Violation Risk Factor: Lower*] [*Time Horizon: Long-term Planning*]
- 8.1.** Generator protection automatic underfrequency and overfrequency trip set points (Hz).
  - 8.2.** Total clearing time associated with each set point (sec). This is defined as the time that begins when frequency reaches the set point and ends when the breaker opens. If inverse time underfrequency relays are used, provide the total clearing time at 59.0, 58.5, 58.0, and 57.0 Hz.
  - 8.3.** Maximum generator net MW that could be tripped automatically due to an underfrequency or overfrequency condition.
- M8.** Each Generator Owner shall have evidence such as reports or other documentation that data specified in Requirement R8 was provided to SERC as requested.



## Compliance

### **Compliance enforcement authority**

SERC Reliability Corporation

### **Compliance monitoring and assessment process**

- Compliance Audit
- Self-Certification
- Spot Checking
- Compliance Violation Investigation
- Self-Reporting
- Complaint

### **Evidence retention**

Each Planning Coordinator, UFLS Entity and Generator Owner shall keep data or evidence to show compliance as identified below unless directed by SERC to retain specific evidence for a longer period of time as part of an investigation.

Each Planning Coordinator, UFLS Entity and Generator Owner shall retain the current evidence of each Requirement and Measure as well as any evidence necessary to show compliance since the last compliance audit.

If a Planning Coordinator, UFLS Entity or Generator Owner is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the retention period specified above, whichever is longer.

The compliance enforcement authority shall keep the last audit records and all requested and submitted subsequent audit records.

**Time Horizons, Violation Risk Factors, and Violation Severity Levels**

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
R1	Long-term Planning	Medium	N/A	N/A	N/A	The Planning Coordinator did not have evidence that its criteria included selection of its SERC subregion(s) as an island, with or without adjusted boundaries.
R2	Long-term Planning	Medium	The Planning Coordinator's scheme did not meet one of the UFLS system design requirements identified in 2.2 through 2.6	The Planning Coordinator's scheme did not meet two of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet three of the UFLS system design requirements identified in 2.2 through 2.6.	The Planning Coordinator's scheme did not meet 2.1  <b>OR</b> Four or more of the UFLS system design requirements identified in 2.2 through 2.6.
R3	Long-term Planning	High	N/A	The Planning Coordinator failed to conduct one of the required simulations of its UFLS scheme.	N/A	The Planning Coordinator failed to conduct two of the required simulations of its UFLS scheme.
R4	Operations Planning	Medium	The UFLS entity's implemented UFLS scheme had one load shedding step outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had two load shedding steps outside the range specified in 4.	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range	The UFLS entity's implemented UFLS scheme had three or more load shedding steps outside the range

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			2.	2.	specified in 4.2.  <b>OR</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.	specified in 4.2.  <b>AND</b> The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 4.3.
R5	Operations Planning	Medium	N/A	N/A	N/A	The UFLS entity's implemented UFLS scheme had a total load outside the range specified in 5.2.
R6	Long-term Planning	High	The UFLS entity implemented required scheme changes but made them 1 to 30 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 31 to 40 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them 41 to 50 days after the scheduled date.	The UFLS entity implemented required scheme changes but made them more than 50 days after the scheduled date  <b>OR</b> The UFLS entity failed to implement the required scheme changes.
R7	Long-term Planning	Lower	The Planning Coordinator provided the data required in R7 to SERC 1 to 10 days	The Planning Coordinator provided the data required in R7 to SERC 11 to 20 days	The Planning Coordinator provided the data required in R7 to SERC 21 to 30 days	The Planning Coordinator provided the data required in R7 to SERC more than 30

Table 1						
R#	Time Horizon	VRF	Violation Severity Level			
			Lower	Moderate	High	Severe
			after the scheduled submittal date.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC one piece of information listed in R7.	after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC two pieces of information listed in R7.	days after the scheduled submittal date.  <b>OR</b> The Planning Coordinator did not provide to SERC any of the information listed in R7.
<b>R8</b>	Long-term Planning	Lower	The Generator Owner provided the data required in R8 to SERC 1 to 10 days after the requested submittal date.	The Generator Owner provided the data required in R8 to SERC 11 to 20 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC one piece of information listed in R8.	The Generator Owner provided the data required in R8 to SERC 21 to 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC two pieces of information listed in R8.	The Generator Owner provided the data required in R8 to SERC more than 30 days after the requested submittal date.  <b>OR</b> The Generator Owner did not provide to SERC any of the information listed in R8.

## Regional Variances

None

## Interpretations

None

## Guideline and Technical Basis

### 1. Existing UFLS schemes

Each Planning Coordinator should consider the existing UFLS programs which are in place and should consider input from the UFLS entities in developing the UFLS scheme.

### 2. Basis for SERC standard requirements

SERC Standard PRC-006-SERC-~~01-02~~ is not a stand-alone standard, but was written to be followed in conjunction with NERC Standard PRC-006-1. The primary focus of SERC Standard PRC-006-SERC-~~01-02~~ was to provide region-specific requirements for the implementation of the higher tier NERC standard requirements with the goals of a) adding clarity and b) providing for consistency and a coordinated UFLS scheme for the SERC Region as a whole. Generally speaking, requirements already in the NERC standard were not repeated in the SERC standard. Therefore, both the NERC and SERC standards must be followed to ensure full compliance.

### 3. Basis for applying a percentage load shedding value to Forecast Load versus Actual Load

The Planning Coordinator will develop a UFLS scheme to meet the performance requirements of NERC Standard PRC-006-~~1-2~~ Requirement R3 and SERC Standard PRC-006-SERC-~~01-02~~ Requirement R2. This development will result in certain percentages of load for each UFLS entity in the Planning Coordinator's area for which automatic under frequency load shedding must be implemented. The Planning Coordinator develops these percentages based on forecast peak load demand. However, the UFLS entity implements these percentages based on the previous year's actual peak demand. Applying the same percentage to these different base values was intentional to ensure that both the Planning Coordinator and UFLS entities had a clear, measurable value to use in performing their respective roles in meeting the standard. Planning Coordinators typically use forecast demands in their work. Whereas the previous year's actual (or estimated) demand is typically more available to UFLS entities. Additionally, the use of percentages based on these different base values tends to minimize the error due to the time lag between design and actual field implementation. Since a percentage is provided by the Planning Coordinator to the UFLS entities, any differences between the design values (i.e., forecast load) and the implemented values (i.e., previous year's actual) would naturally tend to match up reasonably well. For example, if the total planning area load in MW for which UFLS was installed during the time of implementation was slightly higher or lower than the MW value used in the design by the Planning Coordinator, multiplying by the specified percentage would result in an implemented load shedding scheme that also had a reasonably similar higher or lower MW value.

#### 4. Basis for May 1 and 18 month time frames

Each UFLS entity must annually review that the amount of UFLS load shedding implemented is within a certain tolerance as specified by SERC Standard PRC-006-SERC-01-02 Requirement R 4 or Requirement R5 by May 1 of the current year. May 1 was chosen to allow sufficient time after the previous year's peak occurred to make adjustments in the field to the implementation if necessary to meet the tolerances specified in Requirement R4 or Requirement R5. Therefore, the May 1 date applies only to implementation of the existing percentages of load shedding specified by the Planning Coordinator. On the other hand, the 18-month time frame specified in PRC-006-SERC-01-02 Requirement R6 is intended to allow sufficient budgeting, procurement, and installation time for additional equipment, or for significant setting changes to existing equipment necessary to meet a revised load shedding scheme design that has been specified by the Planning Coordinator. During this 18-month transition period, the May 1 measurement of R4 or Requirement R5 would not apply.

#### 5. Basis for smaller entity threshold of 100 MW

Most distribution substations have transformers rated in the range of 10 to 40 MVA. Usually most transformers would serve 1 to 4 feeders and each feeder will normally carry between 8 and 10 MVA. In general, assuming that each feeder would carry 10 MW, an entity with a load slightly greater than 100 MW would have at least 10 feeders available. For a program with three 10 % steps, only 3 feeders would be required to have under frequency load shed capabilities. The 100 MW threshold seems to provide adequate flexibility for implementing load shedding in three steps for entities slightly greater than 100 MW.

#### Rationale:

During development of this standard, text boxes were embedded within the standard to explain the rationale for various parts of the standard. Upon BOT approval, the text from each of the rationale text boxes was moved to this section.

#### Rationale for R1:

Studying the Region as an island is required by the NERC standard. Most regions have only one or a few different UFLS schemes. Where there is more than one scheme, studying this island demonstrates that the schemes are coordinated and performing adequately. Because there are so many different UFLS schemes in SERC (18 different schemes were represented in the 2007 SERC UFLS study), the SDT believes that applying the schemes to each subregion as an island is a necessary additional test of the coordination of the various UFLS schemes. Without this additional test, a poorly performing scheme may be masked by the large number of good performing schemes in the Region. A subregion island study, which would have a smaller number of schemes, would be more likely to uncover the poorly performing scheme and therefore get it fixed. This approach will result in a much better overall performance of the UFLS programs in SERC. The SDT recognized that there may be simulation problems due to opening the ties to utilities outside the subregion. Therefore, the subregion island boundaries are allowed to be adjusted to produce an island more suitable for simulation.

(Note: The SERC Subregions are identified in paragraph 4.2 of the SERC Reliability Corporation Bylaws: “The Region is currently geographically divided into five subregions that are identified as Southeastern, Central, VACAR, Delta, and Gateway.”)

**Rationale for R2:**

These requirements for the UFLS schemes in SERC have been in place for many years (except 2.6). The SDT believes that these requirements are still needed to ensure consistency for the various schemes which are used in SERC. Part 2.6 is designed to prevent spurious operations due to transient frequency swings.

**Rationale for R3:**

R4 of the NERC standard PRC-006-1 requires the PC to conduct assessments of UFLS schemes through dynamic simulations to verify that they meet performance requirements for generation/load imbalances of up to 25%. This requirement defines specific imbalances that are to be studied within SERC. The 13% and 22% levels were determined from simulations of the worst case frequency overshoot for the UFLS schemes in SERC.

**Rationale for R4:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. A 4 percentage point range is allowed for each individual step, but the allowed range for all steps combined is 6 percentage points.

**Rationale for R5:**

The SDT believes it is necessary to put a requirement on how well the UFLS scheme is implemented. This requirement specifies how close the actual load shedding amounts must be to the percentage of load called for in the scheme. The SDT recognizes that UFLS entities with a load of less than 100 MW may have difficulty in implementing more than one UFLS step and in meeting a tight tolerance. The basis of the 100 MW comes from typical feeder load dropped by UFLS relays, and the use of a 100 MW threshold in other regional UFLS standards.

**Rationale for R6:**

The SDT believes it is necessary to put a requirement on how quickly changes to the scheme should be implemented. This requirement specifies that changes must be implemented within 18 months of notification by the PC. The 18 month interval was chosen to give a reasonable amount of time for making changes in the field. All of the SERC Region has existing UFLS schemes which, based on periodic simulations, have provided reliable protection for years. Events which result in islanding and an activation of the UFLS schemes are extremely rare in SERC. Therefore, the SDT does not believe that changes to an existing UFLS scheme will be needed in less than 18 months. However, if a PC determines there is a need for changing the UFLS scheme faster than 18 months, then the PC may require the implementation to be done sooner as allowed by NERC Reliability Standard PRC-006-1.

**Rationale for R7:**

The NERC standard requires that a UFLS database be maintained by the Planning Coordinator. This requirement specifies what data must be reported to SERC. A SERC UFLS database is needed to facilitate data sharing across the SERC Region, with other regions, and with NERC.

**Rationale for R8:**

The SDT believes that generator over and under frequency tripping data is needed to supplement the UFLS data provided by the Planning Coordinator for post-event analysis of frequency disturbances. This requirement states what data must be reported to SERC by the Generator Owners.

Since the inverse time curve cannot easily be placed into the SERC database, four clearing times based on data from the curve are requested. These clearing times are intended to cover a range of frequencies needed for event replication as well as provide information about generators that trip at a higher frequency than is allowed by the NERC standard.

**Version History**

Version	Date	Action	Change Tracking
1	September 19, 2011	SERC Board Approved	
1	November 3, 2011	Adopted by NERC Board of Trustees	
1	December 20, 2012	FERC Order issued approving PRC-006-SERC-01	
1	March 11, 2013	Modified the Rationale and changed the VRF for Requirement R6 from "Medium" to "High" per a compliance filing (Filed on 3/11/13)	
2	<u>June 28, 2017</u>	<u>SERC Board Approved</u>	
2	<u>August 10, 2017</u>	<u>Adopted by NERC Board of Trustees</u>	



\* FOR INFORMATIONAL PURPOSES ONLY \*

**Enforcement Dates: Standard PRC-006-SERC-~~01~~02 — Automatic Underfrequency Load Shedding Requirements**

**United States**

<b>Standard</b>	<b>Requirement</b>	<b>Effective Date of Standard</b>	<b>Phased In-Implementation-Date (if-applicable)</b>	<b>Inactive Date</b>
<del>PRC-006-SERC-01</del>	R1.	04/01/2014		
<del>PRC-006-SERC-01</del>	1.1.	04/01/2014		
<del>PRC-006-SERC-01</del>	R2.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.1.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.2.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.3.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.3.1.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.4.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.5.	04/01/2014		
<del>PRC-006-SERC-01</del>	2.6.	04/01/2014		
<del>PRC-006-SERC-01</del>	R3.		10/01/2014	
<del>PRC-006-SERC-01</del>	R4.		10/01/2015	
<del>PRC-006-SERC-01</del>	4.1.		10/01/2015	
<del>PRC-006-SERC-01</del>	4.2.		10/01/2015	
<del>PRC-006-SERC-01</del>	4.3.		10/01/2015	
<del>PRC-006-SERC-01</del>	R5.		10/01/2015	
<del>PRC-006-SERC-01</del>	5.1.		10/01/2015	
<del>PRC-006-SERC-01</del>	5.2.		10/01/2015	

<b>Standard</b>	<b>Requirement</b>	<b>Enforcement Date</b>	<b>Inactive Date</b>
<u>PRC-006-SERC-02</u>	<u>All</u>	<u>TBD</u>	



# SERC RELIABILITY CORPORATION

Evaluation | Analysis | Assistance | Operating Experience

May 15, 2017

**TO: SERC CIPC Representatives and Alternates  
SERC EC Representatives and Alternates  
SERC OC Representatives and Alternates  
SERC Registered Entity Compliance Contacts**

**FROM THE DESK OF:** David Greene

The Final Ballots for the **SERC Regional Standards Development Procedure** and **PRC-006-SERC-01 Automatic Underfrequency Load Shedding Reliability Standard** have both **concluded** and **both items have passed their final ballots.**

**Results:**

**SERC Regional Standards Development Procedure:** (no change from the Initial Ballot)

**100% Affirmative Weighted Sector Vote** (67% required to pass)

**73% of Ballot Members voted** (47 of 64, 67% required to pass); 44 Affirmative Votes, 3 Abstain

**PRC-006-SERC-01 Automatic Underfrequency Load Shedding:** (single Negative vote with Initial Ballot changed to an Affirmative vote)

**100% Affirmative Weighted Sector Vote** (67% required to pass)

**71% of Ballot Members voted** (44 of 62, 67% required to pass); 44 Affirmative Votes

Both items will be presented for approval to the SERC Board Executive Committee (BEC) at the June 28, 2017 BEC meeting. Once approved by the SERC BEC, each item will be sent to NERC for approval. Once approved by the NERC Board of Trustees (BOT), each item will be sent to FERC for approval. Once approved by the FERC Commissioners, each item will begin implementation.

Questions may be directed to: [David Greene](#) / 704-414-5238

**All other questions may be directed to [SERC Support](#).**

## Consideration of Comments Form

The SERC Standards Committee posted *PRC-006-SERC-02* for comment from October 25, 2016 through December 7, 2016 and posted *PRC-006-SERC-02* for Initial Ballot from March 16, 2017 through April 12, 2017, in accordance with the SERC Regional Standard Development Procedure. *PRC-006-SERC-02* passed Final Ballot on May 10, 2017. This document contains comments and responses from the initial comment posting and Initial Ballot posting.

### Background:

FERC approved the SERC Regional Standard - *PRC-006-SERC-01 Automatic Underfrequency Load Shedding (UFLS) Requirements* on December 20, 2012. *PRC-006-SERC-02* incorporates revisions to the standard per its five-year periodic review.

### Major Changes to this Revision of the SERC Standard:

- Added language to Requirements 2.1, 4.1 and 5.1 to allow flexibility for the Planning Coordinator to choose the peak season on which to base the UFLS plan.
- Removed the term “distribution” from Requirements 4.1 and 5.1 to prevent the misinterpretation that only distribution load can be used for a UFLS scheme.
- Added “changes to the peak season selected in R2.1” to the list in Requirement 6 of items each UFLS entity must implement within an 18-month timeframe.
- Definition for Planning Coordinator area was added to provide clarity since the term is used in the standard’s requirements. (Note: the proposed definition was removed per comments received)

These revisions were incorporated into the standard after comments received from SERC applicable entities were evaluated by the SERC Dynamics Review Subcommittee.

Comments were received from the following:

From the initial comment posting

1. Mark Riley Associated Electric Cooperative, Inc.
2. Sean Bodkin, Dominion Virginia Power
3. Darrell Vinson, Entergy Services, Inc.
4. Rich Bauer, NERC
5. Rene Free, Santee Cooper
6. Philip Kleckley, SCE & G
7. Dennis Chastain, Tennessee Valley Authority

From the Initial Ballot posting

1. David Jendras, Ameren

Commenter	Comment	Response
<p><b>Question 1:</b> Do you agree with the Planning Coordinator specifying the peak season to base the UFLS plan upon?</p>		
<p>Yes: 7 No: 0 No Response: 0</p>		
None	None	N/A
<p><b>Question 2:</b> Do you agree with the proposed implementation plan? The short implementation plan was specified because the changes to the standard do not require any immediate changes to applicable entities' current UFLS plans.</p>		
<p>Yes: 6 No: 1 No Response: 0</p>		
<p>Sean Bodkin, Dominion Virginia Power</p>	<p>The changes to the determination of the 'season' by the Planning Coordinator could result in some entities having to change internal processes, procedures, and reporting. An implementation period of 12-18 months would allow for any seasonal changes to be accommodated.</p>	<p>The change allowing the Planning Coordinator to determine either summer or winter peak adds flexibility, thus the SERC DRS does not agree with extending the standard's implementation plan and delaying the ability for applicable entities to utilize the added flexibility. Applicable entities can continue to use their existing processes if they choose not to use the flexibility of seasonal selection. R6 allows 18 months to implement changes to the UFLS scheme which involve frequency settings, relay time delays, or changes to the percentage of load in the scheme as requested by the Planning Coordinator.</p>
<p><b>Question 3:</b> Please identify anything you believe needs to be modified before this revision of the document can be approved by the SERC Standards Committee.</p>		
<p>Yes: N/A No: N/A No Response: 2</p>		
<p>Sean Bodkin, Dominion Virginia Power</p>	<p>As a defined term, Planning Coordinator area should all be capitalized (i.e. Planning Coordinator Area) to denote a single defined term. If accepted, this should also be capitalized throughout the rest of the document.</p> <p>In the new definition Planning Coordinator area, transmission</p>	<p>The SERC standard refers Planning Coordinator area in a similar fashion as in the in the NERC standard PRC-006. The proposed Definition will be removed from the SERC standard.</p> <p>See also NERC <i>Reliability Functional Model Technical Document</i> for further information related to Planning Coordinator area.</p>

Commenter	Comment	Response
	<p>system should align with the NERC Glossary and the defined term Transmission should be used. In 2.1 'transmission' should also be capitalized.</p> <p>In R2.1, consider using the term determined instead of chosen.</p> <p>The Guideline and Technical basis section should be updated to the proposed version (02) rather than retaining all of the references to the original (01) version of the proposed standard. The references to the NERC standard PRC-006-1 should be updated to the current version (2).</p> <p>The Guideline and Technical basis section #5. Remove distribution.</p> <p>Section 4 (basis for implementation schedule) should be updated to this version's implementation plan.</p>	<p>Revised 'chosen' to 'determined'.</p> <p>Revised versions for SERC and NERC Standards as specified.</p> <p>The term distribution is intended to describe typical load demographics for &lt;100MW UFLS schemes thus is acceptable in the context of this explanatory material.</p> <p>The change allowing the Planning Coordinator to determine either summer or winter peak adds flexibility, thus the SERC DRS does not agree with extending the standard's implementation plan and delaying the ability for applicable entities to utilize the added flexibility. Applicable entities can continue to use their existing processes if they choose not to use the flexibility of seasonal selection. R6 allows 18 months implement changes to the UFLS scheme which involve frequency settings, relay time delays, or changes to the percentage of load in the scheme as required by the Planning Coordinator.</p>

Commenter	Comment	Response
Darrell Vinson, Entergy Services, Inc	R6 should be clarified to explain that it is in reference to changes handed down from MISO, not the typical annual adjustments that have to be made because of load changes. This is explained in section 4 of the Guidelines and Technical Basis section, but it would be helpful if the clarification was included in R6.	<p>R4 specifies the annual adjustments made by the UFLS entity. R6 specifies the 18 months for the UFLS entity to implement changes to the UFLS scheme at the direction of the Planning Coordinator which involve frequency settings, relay time delays, or changes to the percentage of load in the scheme. R6 is limited in scope to frequency settings, relay time delays, or changes to the percentage of load in the scheme.</p> <p>The SERC DRS declined to make changes to the wording of R6.</p>
Rich Bauer, NERC	I think the addition of a “no greater than” trip time would be a good enhancement. R2.6 specifies a minimum trip time but it does not specify a maximum trip time. When shedding load to arrest a frequency decline and avoid blackout, the expedience of shedding load at those frequency levels, is critical to being able to arrest the decline.	<p>A specific ‘no greater than trip time’ is unnecessary because the upper limit on trip time is constrained by the performance requirements of NERC PRC-006-2 R3.</p>
Philip Kleckley, SCE&G	The first sentence of Section 6. Background refers to “PRC-006-SERC-1” (the “0” is missing from “01”). This is inconsistent with the standard designation of “PRC-006-SERC-01”.	<p>Correction made.</p>

Commenter	Comment	Response
<p>Dennis Chastain, Tennessee Valley Authority</p>	<p>The SERC Standards Committee should consider whether the proposed addition of a definition for “Planning Coordinator area” is appropriate in this SERC region standard. This term is not presently defined in the “Glossary of Terms Used in NERC Reliability Standards” (as of 11/28/16). A defined term for “Planning Coordinator Area” would have implications for the entire ERO; therefore we believe this definition would be better addressed using the process outlined in the NERC Standard Processes Manual, beginning with the submittal of a SAR. This is essentially the same recommendation made by the NERC Alignment of Terms (Project 2015-04) drafting team in response to industry comments to that team to define “Planning Coordinator Area” [see “Consideration of Comments” document for comment period that closed 7/27/2015, posted on the Project 2015-04 project web page]. A definition developed by the SERC DRS, that has ERO-wide implications,</p>	<p>The SERC standard refers Planning Coordinator area in a similar fashion as in the in the NERC standard PRC-006. The proposed Definition will be removed from the SERC standard.</p> <p>See also NERC <i>Reliability Functional Model Technical Document</i> for further information relating to Planning Coordinator area.</p>

Commenter	Comment	Response
	does not demonstrate an appropriate level of industry vetting.	
<b>Question 4:</b> Please provide any other comments on this revision of the document.		
Yes: N/A No: N/A No Response: 7		
None	None	N/A
<b>Comments Received from Initial Ballot</b>		
David Jendras Ameren	We recommend that selection of Peak Season be added to the three items specified in R6.	The SERC DRS agrees and is adding “changes to the peak season selected in R2.1” to the list of items that are mentioned in R6.



# Regional Reliability Standards Announcement

SERC Reliability Corporation  
PRC-006-SERC-02

Comment period open through July 24, 2017

## [Now Available](#)

The SERC Reliability Corporation (SERC) has requested NERC to post Regional Reliability Standard **PRC-006-SERC-02 – Automatic Underfrequency Load Shedding Requirements** for industry review and comment as permitted by the NERC Rules of Procedure.

## Commenting

Use the [electronic form](#) to submit comments. If you experience any difficulties in using the electronic form, contact [Mat Bunch](#). The form must be submitted by **8 p.m. Eastern, Monday, July 24, 2017**. An unofficial Word version of the comment form is posted on the [Regional Reliability Standards Under Development](#) page.

## Regional Reliability Standards Development Process

Section 300 of [NERC's Rules of Procedures of the Electric Reliability Organization](#) governs the regional reliability standards development process.

## Background

The SERC Dynamics Review Subcommittee members drafted PRC-006-SERC-02 for the standard's periodic five-year review, which passed final SERC Regional ballot on May 10, 2017 with a 100% affirmative vote. The five-year review resulted in the following modifications to the Regional Reliability Standard:

- Removal of the term 'distribution' from Requirements R4.1 and R5.1 to prevent the misinterpretation that only distribution load can be used for a UFLS scheme;
- Addition of Requirements 2.1, 4.1 and 5.1, which add flexibility for the Planning Coordinator to choose the peak season (summer or winter) on which to base the UFLS plan. PRC-006-SERC-01 specifies using the previous year actual peak demand. The revision allows the Planning Coordinator to consider seasonal reliability concerns when specifying the peak on which to base the UFLS plan;
- Additional changes to the peak season selected in R2.1 to the list of items that are mentioned in R6 that allow an 18 month implementation. Changing the peak season that the UFLS plan is based on may require additional UFLS relays to be installed, thus may require more time to implement the plan.

Although the technical aspects of this Regional Reliability Standard have been vetted through SERC's Regional Standards development process, the final approval process for a Regional Reliability Standard requires NERC publicly to notice and request comment on the criteria outlined in the [comment form](#).

Documents and information about this project are available on the [SERC's Standards Under Development](#) page.

For more information or assistance, contact Standards Developer, [Mat Bunch](#) (via email) or at (404) 446-9785.

North American Electric Reliability Corporation  
3353 Peachtree Rd, NE  
Suite 600, North Tower  
Atlanta, GA 30326  
404-446-2560 | [www.nerc.com](http://www.nerc.com)

# Unofficial Comment Form

SERC Reliability Corporation

PRC-006-SERC-02

**DO NOT** use this form for submitting comments. Use the [electronic form](#) to submit comments on the proposed modifications to the Regional Reliability Standard **PRC-006-SERC-02 – Automatic Underfrequency Load Shedding Requirements**. The electronic form must be submitted by **8 p.m. Eastern, Monday, July 24, 2017**.

Documents and information about this project are available on the [SERC's Standards Under Development](#) page. If you have questions, contact Standards Developer, [Mat Bunch](#) (via email) or at (404) 446-9785.

## Background Information

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## NERC Criteria for Developing or Modifying a Regional Reliability Standard

Regional Reliability Standard shall be: (1) a regional reliability standard that is more stringent than the continent-wide reliability standard, including a regional standard that addresses matters that the continent-wide reliability standard does not; or (2) a regional reliability standard that is necessitated by a physical difference in the bulk power system. Regional reliability standards shall provide for as much uniformity as possible with reliability standards across the interconnected bulk power system of the North American continent. Regional reliability standards, when approved by FERC and applicable authorities in Mexico and Canada, shall be made part of the body of NERC reliability standards and shall be enforced upon all applicable bulk power system owners, operators, and users within the applicable area, regardless of membership in the region.

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

**Open** — Regional reliability standards shall provide that any person or entity that is directly and materially affected by the reliability of the bulk power system within the regional entity shall be able to participate in the development and approval of reliability standards. There shall be no undue financial barriers to participation. Participation shall not be conditional upon membership in the regional entity, a regional entity or any organization, and shall not be unreasonably restricted on the basis of technical qualifications or other such requirements.

**Inclusive** — Regional reliability standards shall provide that any person with a direct and material interest has a right to participate by expressing an opinion and its basis, having that position considered, and appealing through an established appeals process, if adversely affected.

**Balanced** — Regional reliability standards shall have a balance of interests and shall not be dominated by any two-interest categories and no single-interest category shall be able to defeat a matter.

**Due Process** — Regional reliability standards shall provide for reasonable notice and opportunity for public comment. At a minimum, the standard shall include public notice of the intent to develop a standard, a public comment period on the proposed standard, due consideration of those public comments, and a ballot of interested stakeholders.

**Transparent** — All actions material to the development of regional reliability standards shall be transparent. All standards development meetings shall be open and publicly noticed on the regional entity's Web site.

Review the revised PRC-006-SERC-02 regional standard and answer the following questions.

1. Do you agree the development of PRC-006-SERC-02 met the "Open" criteria as outlined above? If "No", please explain in the comment area below.

Yes  
 No

Comments:

2. Do you agree the development of PRC-006-SERC-02 met the "Inclusive" criteria as outlined above? If "No", please explain in the comment area below.

Yes  
 No

Comments:

3. Do you agree the development of PRC-006-SERC-02 met the “Balanced” criteria as outlined above? If “No”, please explain in the comment area below.

Yes

No

Comments:

4. Do you agree the development of PRC-006-SERC-02 met the “Due Process” criteria as outlined above? If “No”, please explain in the comment area below.

Yes

No

Comments:

5. Do you agree the development of PRC-006-SERC-02 met the “Transparent” criteria as outlined above? If “No”, please explain in the comment area below.

Yes

No

Comments:

## Comment Report

**Project Name:** Regional Reliability Standard (SERC Reliability Corporation) | PRC-006-SERC-02  
Comment Period Start Date: 6/9/2017  
Comment Period End Date: 7/24/2017  
Associated Ballots:

There were 0 sets of responses, including comments from approximately 0 different people from approximately 0 companies representing 0 of the Industry Segments as shown in the table on the following pages.

## Questions

1. Do you agree the development of PRC-006-SERC-02 met the “Open” criteria as outlined above? If “No”, please explain in the comment area below.
2. Do you agree the development of PRC-006-SERC-02 met the “Inclusive” criteria as outlined above? If “No”, please explain in the comment area below.
3. Do you agree the development of PRC-006-SERC-02 met the “Balanced” criteria as outlined above? If “No”, please explain in the comment area below.
4. Do you agree the development of PRC-006-SERC-02 met the “Due Process” criteria as outlined above? If “No”, please explain in the comment area below.
5. Do you agree the development of PRC-006-SERC-02 met the “Transparent” criteria as outlined above? If “No”, please explain in the comment area below.

<b>Organization Name</b>	<b>Name</b>	<b>Segment(s)</b>	<b>Region</b>	<b>Group Name</b>	<b>Group Member Name</b>	<b>Group Member Organization</b>	<b>Group Member Segment(s)</b>	<b>Group Member Region</b>
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**Exhibit D**

**SERC Engineering Committee Dynamics Review Subcommittee Roster**

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# EC Dynamics Review Subcommittee

[BACK](#) | [GO TO COMMITTEE PORTAL](#)

The Engineering Committee (EC) Dynamics Review Subcommittee (DRS) advises the EC concerning issues related to the dynamic performance and dynamic simulation of the power system.

## OFFICERS

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Venkat Kolluri

Chair

Entergy

## PRIMARY SERC STAFF

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David Greene

Program Manager, Operations

704-414-5238

[dgreene@serc1.org](mailto:dgreene@serc1.org)

## DOCUMENTS

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Scope Document - SERC Dynamics Review Subcommittee

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# EC Dynamics Review Subcommittee

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The Engineering Committee (EC) Dynamics Review Subcommittee (DRS) advises the EC concerning issues related to the dynamic performance and dynamic simulation of the power system.

## OFFICERS

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Venkat Kolluri

Chair

Entergy

## PRIMARY SERC STAFF

---

Joe Spencer

Corporate Liaison

704-940-8208

[jspencer@serc1.org](mailto:jspencer@serc1.org)

## DOCUMENTS

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Scope Document - SERC Dynamics Review Subcommittee

EC Dynamics Review Subcommittee (DRS)  
Committee Members Roster Report by Company

Committee Member	Representing
Robbie Bottoms Tennessee Valley Authority <i>Elec. Engineer Planning</i>	Central Subregion Representative
Tom Cain Tennessee Valley Authority <i>Electrical Engineer</i>	Central Subregion Alternate
Zakia El Omari Georgia Transmission Corporation <i>Bulk System Planning</i>	Southeastern Subregion Alternate
Rick Foster Ameren Services Company <i>Consulting Engineer</i>	Gateway Subregion Representative
Jonathan Glidewell Southern Company Services, Inc. - Trans <i>Engineer, SR</i>	Southeastern Subregion Representative
Venkat Kolluri Entergy <i>Manager, Transmission Planning</i>	Chair Delta Subregion Representative
Mei Li Entergy <i>Engineer II</i>	Delta Subregion Alternate
Jeffrey Neal South Carolina Electric & Gas Company <i>Engineer-Assoc</i>	VACAR Subregion Representative
John O'Connor Duke Energy Progress, LLC <i>Principal Engineer</i>	At-Large Representative
John Sullivan Ameren Services Company	Gateway Subregion Alternate

<i>Engineer</i>	
Yishan Zhao Duke Energy Carolinas, LLC <i>Engineer III</i>	VACAR Subregion Alternate
<b>SERC Staff Support</b>	<b>Representing</b>
Banna Underland SERC Reliability Corporation <i>Technical Writer</i>	SERC Staff Administrative Support
Evan Shuvo SERC Reliability Corporation <i>Reliability Engineer</i>	SERC Staff Support
Joe Spencer SERC Reliability Corporation <i>Corporate Liaison</i>	SERC Staff Support
David Greene SERC Reliability Corporation <i>Program Manager, Operations</i>	SERC Staff Support
Maria Haney SERC Reliability Corporation <i>Program Manager, Reliability Assessments &amp; Performance Analysis</i>	SERC Staff Support
Mitchell Hecht SERC Reliability Corporation <i>Program Support Assistant</i>	SERC Staff Administrative Support
Gaurav Karandikar SERC Reliability Corporation <i>Program Manager - Engineering</i>	SERC Staff Support
Nathaniel Davis SERC Reliability Corporation <i>RA Reliability Engineer</i>	SERC Staff Support