

134 FERC ¶ 61,127
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Transmission Relay Loadability Reliability Standard

Docket No. RM08-13-001

ORDER NO. 733-A

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(Issued February 17, 2011)

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FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Jon Wellinghoff, Chairman;
Marc Spitzer, Philip D. Moeller,
John R. Norris, and Cheryl A. LaFleur.

Transmission Relay Loadability Reliability Standard Docket No. RM08-13-001

ORDER NO. 733-A

ORDER ON REHEARING, CLARIFICATION, AND REQUEST FOR AN
EXTENSION OF TIME

(Issued February 17, 2011)

1. In this order, the Commission grants several requests for clarification and grants rehearing, in part, and denies rehearing, in part, of the Final Rule in Order No. 733¹ which approved and directed modifications to the Transmission Relay Loadability Reliability Standard (PRC-023-1) submitted to the Commission for approval by the North American Electric Reliability Corporation (NERC), the Commission-certified Electric Reliability Organization (ERO) for the United States.² We also grant NERC's request for an extension to allow 24 months from the date of this order for NERC to comply with the Final Rule.

¹ *Transmission Relay Loadability Reliability Standard*, Order No. 733, 130 FERC ¶ 61,221 (2010).

² *North American Electric Reliability Corp.*, 116 FERC ¶ 61,062, *order on reh'g & compliance*, 117 FERC ¶ 61,126 (2006), *aff'd, sub nom. Alcoa, Inc. v. FERC*, 564 F.3d 1342 (D.C. Cir. 2009).

Background

Procedural Background

2. On March 18, 2010, the Commission issued a Final Rule in this proceeding that approved Reliability Standard PRC-023-1 (Transmission Relay Loadability), a Standard that requires transmission owners, generator owners, and distribution providers to set load-responsive phase protection relays³ according to specific criteria in order to ensure that the relays reliably detect and protect the electric network from all fault conditions, but do not limit transmission loadability⁴ or interfere with system operators' ability to protect system reliability. In addition, pursuant to section 215(d)(5) of the Federal Power Act (FPA), the Commission directed NERC to develop certain modifications to PRC-023-1 to address issues identified by the Commission.

3. On April 19, 2010, eight petitioners⁵ requested rehearing and/or clarification of Order No. 733.

³ Load-responsive protection relays are a form of protective relays that detect and initiate the removal of faults on an electric system. They are designed to read electrical measurements, such as current, voltage, and frequency, and can be set to recognize certain measurements as indicating a fault. When a protective relay detects a fault on an element of the system that it is protecting, it sends a signal to an interrupting device (such as a circuit breaker) to disconnect the element from the rest of the system.

⁴ Loadability refers to the ability of protective relays to refrain from operating under load conditions.

⁵ NERC, The Edison Electric Institute (EEI), American Public Power Association (APPA), National Rural Electric Cooperative Association (NRECA), Transmission Access Policy Study Group (TAPS) (collectively, APPA, NRECA; and TAPS are referred to as the Trade Associations), Duke Energy Corporation (Duke), and Dominion
(continued...)

Reliability Standard PRC-023-1

4. Reliability Standard PRC-023-1 consists of three Requirements and Attachment A.⁶ Requirement R1 directs entities with certain transmission facilities to set their relays according to one of thirteen specific settings (sub-Requirements R1.1 through R1.13) designed to maximize loadability while maintaining Reliable Operation of the bulk electric system for all fault conditions. Requirement R2 provides additional directives for entities that elect certain settings. Requirement R3 directs planning coordinators to designate which facilities operated between 100 kV and 200 kV are critical to the reliability of the bulk electric system and are therefore subject to Requirement R1.⁷ Attachment A specifies the protection systems that are subject to and excluded from the Standard's Requirements.

Order No. 733

5. In addition to approving PRC-023-1, the Commission in Order No. 733 directed NERC to develop modifications to the Standard in several significant respects. For

Resources Services, Inc. (Dominion) filed requests for rehearing and/or clarification. Exelon Corporation filed supporting the NERC and EEI pleadings.

⁶ Pursuant to section 40.3 of the Commission's regulations, all Commission-approved Reliability standards are available on NERC's website at www.nerc.com. See 18 C.F.R. § 40.3.

⁷ As approved by the Commission, the Standard applies to: (1) all transmission lines and transformers with low-voltage terminals operated or connected at 200 kV and above; and (2) those transmission lines and transformers with low-voltage terminals operated or connected between 100 kV and 200 kV that are designated by planning coordinators as critical to the reliability of the bulk electric system.

example, the Commission directed NERC to: (1) modify Requirement R3 to include a mandatory test for planning coordinators to use to identify which facilities between 100 kV and 200 kV are critical to the reliability of the bulk electric system (and therefore subject to the Standard); (2) make certain sub-100 kV facilities subject to the Standard;⁸ (3) revise sub-Requirement R1.10 to require entities to verify that the limiting piece of equipment is capable of sustaining the overload anticipated by the sub-Requirement's settings; and (4) revise Attachment A to make the Standard applicable to supervisory relays.

6. Additionally, the Commission adopted the proposal in its Notice of Proposed Rulemaking⁹ to require NERC to develop a new Reliability Standard addressing stable power swings.¹⁰ The Commission declined, however, to adopt its NOPR proposal to

⁸ The Commission stated that it expected NERC to use the same test applied to 100 – 200 kV facilities to identify critical sub-100 kV facilities.

⁹ *Transmission Relay Loadability Reliability Standard*, Notice of Proposed Rulemaking, FERC Stats. & Regs. ¶ 32,642 (2009) (NOPR).

¹⁰ Power swings are oscillations in power flow(s) on an electric system due to an event or disturbance such as a fault, loss of generation or load. Transient and stable power swings occur most commonly when a fault and faulted facilities are quickly removed from the system, typically within 0.1 second of detection, and the system and affected generators stabilize within several seconds, typically within 3 seconds. Dynamic, but stable power swings can occur when the system recovers from a disturbance and achieves transient stability, typically within 0-3 seconds, and then returns to a steady state over a longer period of time, typically within 3-30 seconds or even minutes. Prior to the system returning to a new steady state operating condition, it may exhibit power swings that may decrease rapidly or increase in magnitude. When the power swings decrease, the system will be able to achieve a new stable operating

(continued...)

require NERC to modify PRC-023-1 to address generator step-up and auxiliary transformer loadability.

Request for Rehearing and Clarification of Reliability Standard Directives

7. All petitioners offer some variant of the argument that the Commission exceeded its statutory authority by failing to give “due weight” to the technical expertise of the ERO and by directing NERC to develop a modification that requires entities to satisfy a legal standard beyond the statutorily required criteria of “Reliable Operation.”

Petitioners also challenge the technical reasoning or legal authority behind several of the Commission’s directives and interpretations, including: (1) the development of a test to identify critical facilities; (2) the modification of the Standard to apply to sub-100 kV facilities; (3) the modification of sub-Requirement R1.10; (4) the modification of Attachment A; and (5) the development of a Reliability Standard that addresses stable power swings. Finally, petitioners argue that the Commission erred in interpreting the Standard to apply to relays associated with generator step-up and auxiliary transformers that provide backup protection to bulk electric system elements.

Authority Under Section 215(d) of the FPA

8. Section 215(d)(2) of the FPA requires the Commission to give “due weight” to the technical expertise of the ERO when evaluating the content of a proposed Reliability

condition, provided that the relays protecting “healthy” facilities have not operated unnecessarily because of the stable power swing(s).

Standard or modification to a Standard.¹¹ Petitioners argue that the Commission failed on multiple occasions in Order No. 733 to give such “due weight” to NERC’s technical expertise.

9. In general, petitioners make two distinct arguments regarding appropriate due weight. These arguments appear throughout the rehearing requests and are summarized below in the context of the petitioners’ challenge to specific Commission directives. The first argument asserts that, rather than giving “due weight” to NERC’s technical expertise, the Commission reviewed NERC’s proposals under an unspecified, but less deferential criterion. The second argument is that the prescriptive nature of the Final Rule results in confusion between the Commission’s obligation to give “due weight” to NERC’s technical expertise and the Commission’s authority under section 215(d)(5) to direct modifications to a Reliability Standard. Specifically, EEI argues that the Commission’s directive to develop a test to identify which facilities will be subject to the Reliability Standard violates the “due weight” requirement because it is so prescriptive that it denies the ERO the ability to exercise its technical discretion.

10. In the Final Rule, the Commission emphasized that NERC could comply with the Commission’s directives through alternative means than those proposed by the

¹¹ 16 U.S.C. § 824o(d)(2) (2006).

Commission.¹² The Commission explained that, pursuant to Order No. 693, prescriptive directives should be read as providing NERC sufficient guidance so that it “has an understanding of the Commission’s concerns and an appropriate, but not necessarily exclusive, outcome to address those concerns.”¹³ The Commission added that where it identified a concern and offered a specific approach to address the concern, it “will consider an equivalent alternative approach provided that the ERO demonstrates that the alternative will address the Commission’s underlying concern or goal as efficiently and effectively as the Commission’s proposal.”¹⁴

11. Upon review of Order No. 733, we find that the mandatory nature of some of the language setting forth the Commission’s guidance with respect to specific directives conflicts with the Commission’s references to Order No. 693 and creates the impression that the Commission prohibited NERC from developing an equally effective and efficient approach to the approach the Commission laid out in the order. In this order, we emphasize and affirm that we do not intend to prohibit NERC from exercising its technical expertise to develop a solution to an identified reliability concern that is equally

¹² Order No. 733, 130 FERC ¶ 61,221 at P 17-19, P 68, P 71, n. 82, P 186, P 203, P 264.

¹³ *Id.* P 17 (citing *Mandatory Reliability Standards for the Bulk-Power System*, Order No. 693, FERC Stats. & Regs. ¶ 31,242, at P 185, *order on reh’g*, Order No. 693-A, 120 FERC ¶ 61,053 (2007)).

¹⁴ Order No. 733, 130 FERC ¶ 61,221 at P 18 (citing Order No. 693, FERC Stats. & Regs. ¶ 31,242 at P 186).

effective and efficient as the one proposed in Order No. 733. To that end, we here attempt to more clearly delineate between the concerns that must be addressed by the ERO and the guidance we are providing so that the ERO understands the underlying concern.

12. We also reaffirm that, consistent with Order No. 693, detailed guidance should be read as providing the ERO with further elaboration of the Commission's concerns and offering a specific, but not exclusive, approach to addressing those concerns. As Order No. 693 states, the ERO has the discretion in how to comply with a Commission directive by developing a response that addresses the concern or goal underlying the directive in a manner as efficiently and effectively as the Commission's guidance.¹⁵ The ERO is not required to adopt the Commission's guidance into the Reliability Standard, but is required to develop its response to the Commissioner's concerns through the stakeholder evaluation process contained within the Reliability Standard development process. That process promotes a full vetting of technical issues and solutions, and encourages participation by interested entities. The discussion accompanying our directives provides guidance to assist the ERO in performing its role in developing Reliability Standards, and does not preempt its technical expertise.¹⁶

¹⁵ Order No. 693, FERC Stats. & Regs. ¶ 31,242 at P 186.

¹⁶ *See id.* P 185; *North American Electric Reliability Corp.*, 132 FERC ¶ 61,218, at P 32 (2010).

13. As we have stated, we recognize that Order No. 733 may not have been sufficiently clear as to what the specific reliability concern was and what was intended to be guidance. Thus, in this order we attempt to clarify this issue. We reiterate that, in each instance where the Commission directed the ERO to modify PRC-023-1 in a specific manner, we will accept an alternative method that addresses the concern identified by the Commission, provided that the ERO demonstrates that the alternative will adequately address the Commission's underlying concern or goal as efficiently and effectively as the Commission's proposal. If the ERO decides to propose an alternative approach to address a Commission concern, it must explain in detail, and with a technical record sufficient enough for the Commission to make an informed decision, how its alternative addresses the Commission's concern.¹⁷ Here, while the ERO is required to develop a test that will identify all facilities that must be made subject to the Reliability Standard in order for the Standard to achieve its purpose, and while we require that test to include some specific elements to provide assurance of its utility,¹⁸ the ERO may propose to comply with this requirement in a different manner than in the specific way set forth

¹⁷ *Revision to Electric Reliability Organization Definition of Bulk Electric System*, Order No. 743, 133 FERC ¶ 61,150, at P 35 (2010).

¹⁸ As stated below, these specific elements are consistency with existing Reliability Standards and the system performance levels for all Category of Contingencies used in transmission planning, a definition of desirable system performance, and a description of the steady state and dynamic base cases that the planning coordinator must use in identifying critical facilities.

by the Commission, provided that the ERO can show that its alternative addresses the Commission's concern in an equally efficient and effective manner.

Test for Identifying Critical Facilities

14. As approved by the Commission, Requirement R3 of PRC-023-1 requires planning coordinators to identify which facilities between 100 kV and 200 kV are critical to the reliability of the bulk electric system, but does not specify the test that planning coordinators must use to make this determination. In the NOPR, the Commission described this approach as an “add in” approach because it does not subject any specific facilities to the Reliability Standard, but requires planning coordinators to study and “add in” facilities they determine to be critical to the reliability of the bulk electric system.¹⁹ The Commission expressed concern that using an “add in” approach could result in an under-identification of facilities, and proposed to direct the ERO to revise Requirement R3 to require a “rule out” approach that would subject all 100 kV-200 kV facilities to the Reliability Standard unless and until the relevant planning coordinator ruled out the facility by determining that it was not critical to the reliability of the bulk electric system.²⁰

15. In response to the NOPR, the Commission received numerous comments opposing the “rule out” approach and, in the Final Rule, decided against it. The Commission

¹⁹ NOPR, FERC Stats. & Regs. ¶ 32,642 at P 40.

²⁰ NOPR, FERC Stats. & Regs. ¶ 32,642 at P 40, P 43.

explained that after further consideration it determined that its concerns about the “add in” approach could be addressed by directing the ERO to modify Requirement R3 to specify a comprehensive and rigorous test that all planning coordinators must use to identify all critical facilities.²¹ The Commission stated that it had proposed the “rule out” approach because it was concerned by the absence in Requirement R3 of a mandatory test for planning coordinators to use when identifying critical facilities.²² The Commission explained that without such a test it had no assurance that planning coordinators would identify all facilities that must be subject to the Reliability Standard in order for the Standard to achieve its goal.²³ Consequently, the Commission found that the absence of a test was a specific matter that the ERO needed to address, and directed the ERO to develop a test that would identify all critical facilities.

²¹ Order No. 733, 130 FERC ¶ 61,221 at P 48, P 50 (“After reflecting on the rationale behind the “rule out” approach — namely, the goal of ensuring that planning coordinators identify all critical facilities between 100 kV and 200 kV — and considering the comments, we conclude that, from a reliability standpoint, it should not matter whether PRC-023-1 employs an “add in” approach or a “rule out” approach because both approaches should ultimately result in the same list of critical facilities. In other words, given a uniform and robust test, the facilities that would be “added in” under an “add in” approach should be the same as the facilities that would remain subject to the Reliability Standard after non-critical facilities are ruled out under the “rule out” approach.”).

²² *Id.* P 70.

²³ *Id.*

16. As the Commission explained in both the NOPR and Final Rule, and as NERC stated in its petition for approval,²⁴ PRC-023-1 was developed to address Recommendation 21A of the Blackout Report.²⁵ Consequently, in both the NOPR and Final Rule, the Commission stated that the Reliability Standard must apply to those facilities necessary to prevent undesirable system performance like the undesirable performance that occurred during the August 2003 Blackout. Since neither the Blackout Report nor the Reliability Standard established a test for planning coordinators to use in identifying those facilities, the Commission provided the ERO with guidance on how to develop a test that would provide assurance that planning coordinators would identify all critical facilities necessary to prevent undesirable system performance like the undesirable performance that occurred during the August 2003 Blackout. The Commission began by stating the basic requirements the test would have to satisfy: (1) inclusion of, or consistency with the system simulations and assessments that are already required by the existing TPL Reliability Standards; (2) satisfaction of the system performance levels for all Category of Contingencies required by the transmission planning reliability standards; (3) establishment of some definition of desirable system

²⁴ NOPR, FERC Stats. & Regs. ¶ 32,642 at P 14, P 42; Order No. 733, 130 FERC ¶ 61,221 at P 73, P 78.

²⁵ *U.S.-Canada Power System Outage Task Force, Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations* (Apr. 2004) (Blackout Report), available at <http://www.ferc.gov/industries/electric/indus-act/blackout.asp>.

performance; and (4) a description of the steady state and dynamic base cases that the planning coordinator must use in identifying facilities.²⁶ The Commission then provided its view, based on the Blackout Report, of one possible definition of desirable system performance and on one possible description of the steady state and dynamic base cases that planning coordinators must use in assessing which facilities are subject to the Reliability Standard.²⁷

17. The Commission also noted that, while NERC did not propose a test to identify critical facilities, it included in its NOPR comments the criteria for identifying critical sub-200 kV facilities that the NERC System Protection and Control Task Force developed for Regional Entities to use during NERC's voluntary relay review and mitigation program.²⁸ The Commission concluded that these criteria, if applied appropriately, would identify some, but likely not all, critical sub-200 kV facilities.

²⁶ *Id.* at 79-80. The requirements of the Transmission Planning Reliability Standards require that entities have studies to show that their portion of the bulk electric system is stable and within voltage and thermal limits for a variety of contingencies and base cases that cover critical system conditions. Those studies include steady-state and dynamic simulations which require specific base cases. Steady-state base cases are used to evaluate whether the Bulk-Power System will remain within specified current and steady-state voltage limits before and after contingencies in all of the base cases. Dynamic refers to the response of the Bulk-Power System following a transient electric system event such as a fault, tripping and reclosing (if applicable) of a Bulk-Power System element, or planned load shedding. Dynamic base cases evaluate, for example, phase angles, currents and voltages before, during, and after the event to determine whether the Bulk-Power System will remain stable.

²⁷ Order No. 733, 130 FERC ¶ 61,221 at P 80-90.

²⁸ Order No. 733, 130 FERC ¶ 61,221 at P 74.

Consequently, in addition to providing general guidance on what a mandatory test must include, the Commission discussed how the voluntary criteria could be revised into a fully acceptable test.

Rehearing Requests

18. Petitioners raise two types of arguments regarding the Commission's directive to the ERO to develop a test to identify critical facilities. First, petitioners raise variations of the argument that the Commission failed to give "due weight" to the technical expertise of the ERO. Second, petitioners challenge specific elements of the Commission's guidance on desirable system performance and the required base cases.

"Due Weight" Related Rehearing Requests

19. The Trade Associations argue that the Commission exceeded its authority by prescribing the specific technical content of the test that NERC must develop to identify operationally significant facilities. The Trade Associations explain that the Commission provided NERC with more than 10 pages of specific and complex technical guidance on what the test must include, and argue that the specificity of the Commission's guidance leaves NERC with no room to exercise its technical expertise.²⁹ The Trade Associations acknowledge that the Commission can require NERC to modify a Reliability Standard to address a specific matter, but they argue that the Commission cannot all but draft the

²⁹ Trade Associations at 8.

technical content of the modification.³⁰ The Trade Associations maintain that the Commission should take a more general approach toward modifications and direct NERC to develop a test without specifying what the test must include. In the alternative, the Trade Associations argue that the Commission should clarify that its guidance is merely a list of concerns that NERC should consider in developing the test.³¹

20. EEI connects the prescriptive nature of the Commission's guidance with a challenge to the framework for modifications that the Commission established in Order No. 693. EEI maintains that, in directing NERC to develop a test, providing specific guidance on the test, and requiring NERC to either follow the Commission's guidance or propose an "equally efficient and effective" alternative, the Commission has essentially established a rebuttable presumption that its guidance is correct and efficiently and effectively addresses the underlying reliability goal.³² EEI argues that this approach fails to give due weight to the technical expertise of the ERO because it allows the Commission to establish what the content of the Reliability Standard should be and requires that any alternative proposed by the ERO address the Commission's concerns and goals "as efficiently and effectively" as the Commission's proposal. EEI argues that this process is inconsistent with both the language and legislative history of section 215.

³⁰ *Id.*

³¹ *Id.* at 9.

³² EEI at 7.

21. Duke contends that the Commission failed to give “due weight” to NERC. Duke notes that the Commission claimed to provide NERC with flexibility in modifying Reliability Standard PRC-023-1 by directing NERC “to address the underlying issue through the Reliability Standards development process without mandating a specific change to PRC-023-1.” Duke argues, however, that two specific details of the Commission’s guidance belie this assurance of flexibility. First, Duke claims that the Commission explicitly overruled the guidance provided by the NERC System Protection and Control Task Force when it determined that it would identify some, but not all, critical sub-200 kV facilities.³³ Second, Duke maintains that the Commission mandated a specific change to the Reliability Standard by requiring NERC to include the Commission’s definitions of “desirable system performance” for Category B and Category C contingencies as part of the test. Duke requests that the Commission grant rehearing to provide NERC with adequate time to: (1) provide its members with reasonable notice and opportunity to comment on a modified Standard using the Reliability Standards development process; and (2) submit such modified standard to the Commission.³⁴ If the Commission does not adopt these changes on rehearing, Duke argues that the Commission should fully explain how Order No. 733 satisfies the

³³ Duke at 8.

³⁴ *Id.* at 9.

Commission's statutory obligation to give "due weight" to the technical expertise of the ERO.

Commission Determination

22. In the Final Rule, the Commission identified the absence of a test for identifying critical 100 kV – 200 kV facilities as a specific matter that the ERO needed to address through its Reliability Standards development process. As the Commission explained in the Final Rule, its primary reliability concern throughout this proceeding has been that Requirement R3 fails to provide assurance that planning coordinators will identify all facilities that must be identified and made subject to the Reliability Standard if the Standard is to achieve its purpose and prevent a recurrence of the undesirable system performance that occurred during the August 2003 Blackout.³⁵ Consequently, the Commission directed the ERO to develop a test that would identify all such facilities. The Commission further explained that in order to provide the necessary assurance that the Standard would achieve its purpose, the test must include or be consistent with the system simulations and assessments that are already required by the existing TPL Reliability Standards, meet the system performance levels for all Category of Contingencies used in transmission planning, set forth some definition of desirable system performance, and describe the steady state and dynamic base cases that the planning coordinator must use in identifying facilities in the 100 kV to 200 kV range that

³⁵ Order No. 733, 130 FERC ¶ 61,221 at P 49-50, 77-78.

are subject to PRC-023-1.³⁶ It is these elements that constitute the Commission's reliability concern.

23. In addition to setting forth its concern,³⁷ the Commission provided guidance on an acceptable definition of desirable system performance and on the steady state and dynamic base cases that the planning coordinator must use in identifying critical facilities. While this may not have been clear in the underlying order, these discussions were intended as guidance to inform the ERO and industry as to the technical underpinnings of our concerns. As requested by EEI, we clarify that the Commission did not intend to require the ERO to adopt the specific content of the Commission's specific guidance on these matters. We want to make clear on rehearing that the ERO remains free to exercise its technical expertise during the Reliability Standards development process.³⁸

³⁶ *Id.* at 79-80.

³⁷ As discussed previously, the requirements that a test developed by the ERO need to satisfy are: (1) inclusion of, or consistency with the system simulations and assessments that are already required by the existing TPL Reliability Standards; (2) satisfaction of the system performance levels for all Category of Contingencies required by the transmission planning reliability standards; (3) establishment of some definition of desirable system performance; and (4) a description of the steady state and dynamic base cases that the planning coordinator must use in identifying facilities.

³⁸ It is our view that, given the results we understand it has achieved, the methodology PJM Interconnection, L.L.C. (PJM) developed to identify critical facilities could be one form of an equally efficient and effective alternative to the Commission's proposal described in the Final Rule. Subsequent to the issuance of the Final Rule, PJM developed a test to identify PRC-023-1 critical facilities within its footprint including

(continued...)

24. While we clarify the distinction between our reliability concern and our guidance, we disagree with EEI's "rebuttable presumption" argument. EEI maintains that, in directing NERC to develop a test, providing specific guidance on the test, and requiring NERC to either follow the Commission's guidance or propose an "equally efficient and effective" alternative, the Commission has essentially established a rebuttable presumption that its guidance is correct and efficiently and effectively addresses the underlying reliability goal.

25. While EEI focuses on the section 215(d)(2) requirement that the Commission give due weight to the technical expertise of the ERO, its reading of this requirement fails to account for the Commission's authority under section 215(d)(5) to direct the ERO to develop a new or modified standard that addresses a specific matter. As an initial matter, we note that it is a maxim of statutory construction that each part or section of a statute should be construed in connection with every other part or section so as to produce a

transmission assets that PJM is proposing to acquire with the Commission's approval of FirstEnergy's application to leave Midwest Independent System Operator, Inc. and join PJM. PJM describes its critical facilities test under development as a three step process. Step 1 uses an N-2 analysis to identify contingency pairs and the overloaded facility, i.e., an initial contingency, followed by a second contingency without system adjustments. Step 2 applies to an N-3 analysis where an outage is taken of the N-2 contingency pair causing the overload and the overloaded facility identified in Step 1 and the system is monitored for additional overloads. Step 3 is the identification of critical facilities, i.e., any 100 kV – 200 kV facilities that take an outage following the N-2 combination from Step 2 and results in additional overloads. See PJM Planning Committee Report, PRC-023 (Aug. 11, 2010), available at <http://www.pjm.com/~media/committees-groups/committees/pc/20100811/20100811-item-12-prc-023.ashx>

harmonious whole.³⁹ We find no difficulty in reading section 215(d)(2) in harmony with section 215(d)(5). Section 215(d)(2) requires the Commission to give due weight to the technical expertise of the ERO when the Commission reviews a Standard or modification proposed by the ERO. Section 215(d)(5) authorizes the Commission to direct a modification to a Standard if it judges that such a modification is necessary. There is no contradiction in the Commission giving due weight to the technical expertise of the ERO and still finding that there is a “specific matter” that the ERO must address. EEI’s argument tends to diminish the significance of the Commission’s authority to direct modifications under section 215(d)(5) because it fails to recognize that the Commission, and not just the ERO, has the responsibility and authority to identify “specific matters” that it considers appropriate to carry out section 215. Section 215 establishes a paradigm by which both the Commission and the ERO are responsible for identifying reliability gaps—the ERO through its Reliability Standards development process, where it can independently identify areas of concern and develop Standards to address them; and the Commission through its review of proposed Reliability Standards and authority to direct modifications or new Standards that address specific issues necessary to effectuate the purposes of section 215.

³⁹ *Shell Oil Company, et al., In the Matter of the Transportation of Liquid and Liquefiable Hydrocarbons by Natural Gas Pipelines*, 22 FERC ¶ 61,013, at 61,024 (1983).

26. To the extent that EEI claims that the Commission exceeded its statutory authority by providing guidance, we note that the Commission has already rejected this argument. In Order No. 693, the Commission explained that providing the ERO with “useful guidance to assist in the Reliability Standards development process” is consistent with its authority under section 215(d)(5) to direct the ERO to submit a modification that addresses a “specific matter.”⁴⁰ As the Commission elaborated, when the Commission identifies a specific matter to be addressed in a modification, “it is important that the Commission provide sufficient guidance so that the ERO has an understanding of the Commission’s concerns and an appropriate, but not necessarily exclusive, outcome to address those concerns.”⁴¹ Otherwise, a directive to modify a Reliability Standard might be so vague that the ERO would not know how to adequately respond. Thus, to the extent that EEI challenges the Commission’s right to provide guidance that explains its concerns and a potential way to address them, it is actually challenging Order No. 693 and its settled understanding that section 215(d)(5) permits the Commission to provide such guidance.

27. Although it is not clear from its pleading, it appears that EEI is concerned about the prospect of Commission guidance establishing a “rebuttable presumption” because it removes any discretion the ERO has to disagree with the Commission about the

⁴⁰ Order No. 693, FERC Stats. & Regs. ¶ 31,242 at P 186.

⁴¹ *Id.* P 185.

underlying reliability goal or the means to achieve it. To the extent EEI argues that the ERO should be able to use the Standards Development Process to challenge the Commission's identification of a concern or goal, or the assumptions underlying that concern or goal, we reject such arguments. While the ERO and other parties are free to challenge the Commission's reasoning in identifying its concern or goal, EEI is incorrect about the proper venue for these challenges. Should parties disagree with the content or underlying assumptions (technical or otherwise) of the Commission's concern or goal, they are free, as they have in this proceeding, to challenge the Commission's determination through a rehearing and, ultimately, judicial review. In short, we do not agree that it is appropriate to re-litigate in the ERO Standards Development Process the merits of the Commission's reliability concern or goal. To the extent EEI argues that the Commission's detailed guidance on a possible approach to address its underlying concern or goal establishes a "rebuttable presumption" in favor of the Commission's proposed approach, we reiterate that the ERO may develop an alternative approach that is equally efficient and effective at addressing the Commission's underlying reliability concern or goal.

28. Finally, we reject Duke's claim that the Commission overruled the guidance provided by the ERO System Performance and Control Task Force.

29. NERC included in its NOPR comments the System Performance and Control Task Force guidance for identifying operationally significant 100 kV – 200 kV facilities. The Commission did not overrule that guidance but found that it contained a gap. The

Commission stated that the NERC guidance focused primarily on identifying facilities that are operationally significant between regions or between sub-regions and, therefore, would not necessarily identify operationally significant facilities within a sub-region or a single transmission owner or generator owner. The Commission specifically contemplated that the ERO could refine the System Protection and Control Task Force's guidance into an acceptable mandatory test.⁴²

Conflicting Understandings of Conclusions of the Blackout Report

30. As the Commission explained in the Final Rule, PRC-023-001 was developed to implement Recommendation 21A of the Blackout Report. Consequently, in stating its concern that Requirement R3 fails to provide assurance that planning coordinators will identify all facilities that must be identified and made subject to the Standard if the Standard is to achieve its purpose and prevent a recurrence of what occurred during the blackout, the Commission's notion of the universe of relays that should be identified by the test rests on its interpretation of the Blackout Report.

Requests for Rehearing

31. EEI challenges the Commission's interpretation as part of its argument that the Commission and the ERO may have different views on the reliability goal to be achieved. Below, we explain why we disagree with EEI's narrow reading of the Final Blackout Report.

⁴² Order No. 733, 130 FERC ¶ 61,221 at P 76.

32. EEI adds that it may be difficult for the ERO to develop an alternative to the Commission's approach if the ERO and the Commission have different understandings of the reliability goal at issue. EEI states, for example, that NERC and the Commission appear to differ in how they understand certain aspects of the August 2003 Blackout and the subsequent Blackout Report which explains the causes of the blackout and recommendations to minimize the risks of future blackouts. According to EEI, the Blackout Report concluded that: (1) thirteen important 345 kV and 138 kV transmission lines tripped offline during a four minute time span just prior to the rapid and widespread geographic acceleration of the cascading event and the system remained thermally stable during these four minutes; (2) the lines tripped, without time delay, because of relays that operated exactly as programmed, that is, they were not programmed to delay their operation; (3) the relays operated so quickly that they impeded the natural ability of the system to hold together and did not allow for operator intervention; (4) the relay operations were the "common mode of failure" in the acceleration of the cascade; (5) if the lines had not disconnected so quickly and this period of deterioration and overloading under stable conditions had lasted for as little as 15 minutes or as much as an hour, it is possible that problems could have been recognized and action taken; and (6) while relay operations did not cause the cascade, they greatly expanded and accelerated its spread. EEI maintains that NERC developed PRC-023-1 to address these conclusions. Further, while stating that all the facts and analyses of the August 2003 blackout are not publicly available, EEI asserts that "it does appear that if PRC-023-1 had been in place and these

relays had been programmed to delay their operations for even a few minutes, system operators would likely have had time to consider other operational decisions that could have prevented or mitigated the rapid acceleration of the cascade.”⁴³ EEI also asserts that, at times, Order No. 733 characterizes transmission relay loadability as a non-critical issue during the blackout. As examples of the divergence between NERC and the Commission, EEI points to both the Commission’s assertion that tree contact rather than relays precipitated the cascade and its conclusion that the cascade would not have been prevented if PRC-023-1 had been in place prior to the blackout. While conceding that tree contact may have precipitated the blackout, EEI focuses on the Blackout Report’s finding that relay loadability was a critical component in the blackout because their operation “greatly expanded and accelerated the speed of the cascade.”⁴⁴

Commission Determination

33. While the Commission agrees with some of the six findings that EEI generalizes from the Blackout Report, we disagree with others since detailed information that is available from the Blackout Report does not support EEI’s conclusions. First, the thirteen important 345 kV and 138 kV lines tripped offline during a four minute time span while the system remained thermally stable.⁴⁵ The first 345 kV line to trip after the

⁴³ *Id.* at 9.

⁴⁴ *Id.* (citing Blackout Report at 82).

⁴⁵ The chronology of the tripping of the thirteen important 345 kV and 138 kV lines that EEI refers to is available at Figure 6.9 in the Blackout Report.

Sammis-Star 345 kV outage was the Galion-Ohio Central-Muskingum 345 kV line that tripped due to a phase-to-ground fault.⁴⁶ Therefore, had PRC-023-1 been in place, the tripping of the Galion-Ohio Central Muskingum 345 kV line would not have been averted because the line tripped due to a phase-to-ground fault, not due to relay loadability.

34. Second, the Blackout Report further concludes that after the Galion-Ohio Central-Muskingum 345 kV line outage and numerous 138-kV line trips in central Ohio, the East Lima-Fostoria Central 345- kV line tripped at 16:09:06 EDT on zone 3 relay operation due to high current and extremely low voltage (80 percent).⁴⁷ Reliability Standard PRC-023-1 requires evaluation of relay loadability at 0.85 per unit voltage (85 percent of rated voltage) – a more favorable voltage than the 80 percent deteriorated voltage that was experienced.⁴⁸ This recorded fact from the Blackout Report fails to support EEI's assertion that tripping of this important 345 kV line would have been avoided had PRC-023-1 been in place.

⁴⁶ Blackout Report at 79. The Galion-Ohio Central-Muskingum 345-kV line tripped first at Muskingum at 16:08:58.5 EDT on a phase-to-ground fault, reclosed and tripped again at 16:08:58.6 at Ohio Central, reclosed and tripped again at Muskingum on a Zone 3 relay, and finally tripped at Galion on a ground fault.

⁴⁷ *Id.*

⁴⁸ PRC-023-1 Requirement R1.12.2 requires transmission owners, generator owners, and distribution providers to evaluate relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees.

35. As the third basis for disagreement with EEI, we refer to our discussion of the cascade of 138 kV lines in the Final Rule. The cascade of 138 kV lines was precipitated by faults caused by tree contact, not protective relays, and would not have been prevented if PRC-023-1 had been in effect before the blackout.⁴⁹

36. We agree with EEI that the 30 degrees evaluation point was not reached. We note however, that at the time the 345 kV Sammis-Star line tripped, the power factor angle was moving from normal values up to around 27 degrees.⁵⁰ Additional changes in other parts of the system were recorded so it is reasonable to conclude that the power factor angle would have continued to increase. In fact, the Blackout Report shows that the voltages in the Akron-Cleveland area were declining with each successive trip of the 345 kV lines into the area. Immediately prior to the 345 kV Sammis-Star line trip, the voltage at the Star substation was declining from just below 90 percent voltage to just above 85 percent at the time of the trip.⁵¹ Since Sammis-Star was one of the two remaining 345 kV lines supplying the Cleveland-Akron area, any further voltage deterioration in the Cleveland-Akron area would have further increased the reactive power consumption and would have increased the reactive power flow on the Sammis-Star line. Therefore, it would be reasonable to conclude that the measured power angle of the line would not

⁴⁹ Final Rule at P 52

⁵⁰ Blackout Report Figure 6.4 at 78.

⁵¹ Blackout Report Figure 5.6 at 57.

have stayed at 27 degrees. Rather, it likely would have continued to increase to either approaching or exceeding the 30 degrees evaluation angle.

37. We also offer several responses to EEI's other assertion that, if PRC-023-1 had been in place and these relays had been programmed to delay their operations for even a few minutes, system operators likely would have had time to consider other operational decisions that could have prevented or mitigated the rapid acceleration of the cascade. First, the Commission understands that most zone 3 relays (or zone 2 relays set to operate like zone 3 relays) that misoperated during the August 2003 Blackout, including those protection relays now covered by Reliability Standard PRC-023-1, have time coordination usually ranging from several milliseconds to several seconds, but rarely several minutes.⁵² Second, the Blackout Report concludes that FirstEnergy had no automatic load-shedding schemes in place, and did not attempt to begin manual load-

⁵² As discussed in the NOPR, zone 3 relays, and zone 2 relays set to operate like zone 3 relays (zone 3/zone 2 relays), provide remote circuit breaker failure and backup protection for remote distance faults on a transmission line. These relays are typically set to reach 100 percent of the protected transmission line with a margin of more than 100 percent of the longest line (including any series elements such as transformers) that emanates from the remote buses. To ensure coordination of protection, zone 3/zone 2 relays are set with a longer time delay than the zone 2 relay. NOPR, FERC Stats. & Regs. ¶ 32,642 at 9. The zone 3/zone 2 relay setting philosophy (reach setting and time delay) can vary among entities. For example, the time delay can typically range from 0.33 seconds to 1 second, to allow for coordination of protection with the zone 1 relay (which is set without an intentional time delay) on the faulted line. *See* Horowitz, Stanley H and Phadke, Arun G., *Power System Relaying*, West Sussex, England, John Wiley & Sons, Ltd., 2008, p. 102 (noting that the time delay can be longer if needed for coordination).

shedding. It further states, as Chapters 4 and 5 have established, that once Sammis-Star tripped, the opportunity of averting the coming cascade by shedding load had passed. Within six minutes of these overloads, extremely low voltages, big power swings and accelerated line tripping would cause separations and blackout within the Eastern Interconnection.⁵³ Without an automatic load shedding scheme in the Akron/Cleveland area, there were no feasible corrective measures for system operators to return the fast deteriorating system conditions to a safe operating state,⁵⁴ notwithstanding the fact that situational awareness was not maintained by these operators. For this reason, it is the Commission's view that recorded facts from the Blackout Report fail to support EEI's assertion that delayed relay programming of several minutes would have been effective in averting the August 2003 Blackout after the 345 kV Sammis-Star outage.

38. In summary, the Commission also does not agree with EEI's assertion that Order No. 733 characterizes transmission relay loadability as a non-critical issue during the blackout. To assert, as Order No. 733 does,⁵⁵ that one cannot definitely conclude on the present record that PRC-023-1 would have prevented the spread of the blackout, or to recount that the tripping of the 138 kV system was precipitated by faults caused by tree

⁵³ Blackout Report at 70.

⁵⁴ *Id.*

⁵⁵ Order No. 733, 130 FERC ¶ 61,221 at P 55.

contact,⁵⁶ by no means is intended to minimize the significance of relay loadability. We simply do not subscribe to the view that PRC-023-1 would have prevented the loss of the Sammis-Star line and the loss of the 13 important 345 kV and 138 kV lines during a four minute time span.

Elements of Test for Identifying Critical Facilities

39. In Order No. 733, the Commission concluded that, to achieve its reliability objective of ensuring that relay settings do not limit transmission loadability, PRC-023-1 must apply to all sub-200 kV facilities that could trip on relay loadability and contribute to a cascading outage. Accordingly, the Commission directed NERC to modify the Standard to include a mandatory test for planning coordinators to apply to identify which sub-200 kV facilities are critical to the reliability of the Bulk-Power System.⁵⁷ In its guidance, the Commission stated that NERC needed to develop a test that (a) defines desirable system performance and (b) describes the steady state and dynamic base cases that the planning coordinator must use as part of its assessments.⁵⁸ Thus, a facility would

⁵⁶ *Id.* P 52.

⁵⁷ *Id.* P 69.

⁵⁸ The requirements of the Transmission Planning Reliability Standards require that entities have studies to show that their portion of the bulk electric system is stable and within voltage and thermal limits for a variety of contingencies and base cases that cover critical system conditions. Those studies include steady-state and dynamic simulations which require specific base cases. Steady-state base cases are used to evaluate whether the Bulk-Power System will remain within specified current and steady-state voltage limits before and after contingencies in all of the base cases. Dynamic refers to the response of the Bulk-Power System following a transient electric system

(continued...)

be deemed operationally significant if, during a simulation with the base cases, its removal from service following an initiating event would prevent desirable system performance.

Desirable System Performance-Related Rehearing Requests

40. The Commission specified that the test for identifying critical facilities between 100 kV and 200 kV must define expectations of desirable system performance for Category B and Category C contingencies.⁵⁹ With respect to Category B contingencies, the Commission stated that NERC's definition of desirable system performance requires: "(1) continuity of all firm load supply, except for supply directly served by the faulted facility, and no cascading outages; (2) maintenance of all facilities within their applicable thermal, voltage, or stability ratings (short time ratings are applicable); and (3) continuance of all firm transfers."⁶⁰ In discussing these requirements, the Commission stated that there should be only loss of consequential load (i.e., load directly

event such as a fault, tripping and reclosing (if applicable) of a Bulk-Power System element, or planned load shedding. Dynamic base cases evaluate, for example, phase angles, currents and voltages before, during, and after the event to determine whether the Bulk-Power System will remain stable.

⁵⁹ Order No. 733, 130 FERC ¶ 61,221 at P 81. Table I of Reliability Standard TPL-002-1 identifies required system performance during various types of events, referred to by "Category." A Category B contingency is an event resulting in the loss of a single element. Category C contingencies are event(s) resulting in the loss of two or more (multiple) elements.

⁶⁰ *Id.* P 84.

served by the element removed from service) for Category B contingencies and noted in a footnote that Table I, footnote b of Reliability Standard TPL-002-0 (footnote b) allows for the interruption of firm load for consequential load loss.⁶¹ The Commission also stated desirable system performance entails continuity of firm transfers:

[W]hile the curtailment of firm transfers is permitted to prepare for the next contingency, it is generally not the desired system performance for single contingencies required by Table I of the TPL Reliability Standards. Thus, continuity of all firm transfers is the third component of desirable system performance.⁶²

41. On rehearing, parties raise several concerns regarding the Order No. 733 discussion of desirable system performance.

Authority to Require the Standard to Define Desirable System Performance

42. Duke argues that the Commission's directive to define "desirable system performance" exceeds the Commission's authority. Duke explains that "desirable system performance" appears to be a criteria for judging the operation of the Bulk-Power System that is different from the statutorily defined standard or criteria of "Reliable Operation."⁶³

⁶¹ *Id.*

⁶² *Id.* P 83.

⁶³ Section 215(a)(3) of the FPA defines a "Reliability Standard" as a requirement to provide for "reliable operation" of the bulk-power system. Section 215(a)(4) defines "Reliable Operation" as:

[O]perating the elements of the bulk-power system within equipment and electric system thermal, voltage, and stability

(continued...)

Duke argues that the Commission may not unilaterally impose a new legal standard or criteria to replace “Reliable Operation.”

43. Duke also argues that the Commission’s expectation of “desirable system performance” for Category B contingencies is more stringent than the statutory standard of “Reliable Operation.” Duke explains that “Reliable Operation” requires entities to operate the Bulk-Power System to avoid: (1) instability; (2) uncontrolled separation; and (3) cascading failure, while the Commission’s definition of “desirable system performance” includes the additional requirement that entities operate the system to avoid the loss of non-consequential load. Duke claims that planning for the loss of non-consequential load is often specifically designed to preclude instability, uncontrolled separation, and cascading failures.

44. Further, EEI and Duke maintain that the Commission’s statements about the requirements of footnote b and the permissibility of non-consequential load loss are inconsistent with footnote b and prejudge the outcome of the proceeding in Docket No. RM06-16-009.

45. EEI explains that, contrary to the Commission’s statements in Order No. 733, Table I, footnote b of TPL-002-0 currently allows for certain non-consequential (i.e.,

limits so that instability, uncontrolled separation, or cascading failures of such system will not occur as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements.

firm) load loss in a local network.⁶⁴ In Docket No. RM06-16-009, the Commission established a deadline of June 30, 2010, which was subsequently extended to March 31, 2011, for NERC to comply with the Commission's directive in Order No. 693 to clarify footnote b.⁶⁵

46. EEI and Duke contend that the Commission's statements in Order No. 733 reflect the Commission's assumption about how the proceeding in Docket No. RM06-16-009 will conclude, even though the Commission has not yet issued a final rule in that proceeding. EEI also maintains that, since the Commission in Order No. 733 effectively prescribed the specific modification to footnote b that NERC must submit in Docket No. RM06-16-009, it deprived NERC of its statutory right to develop the modification.

47. Similarly, EEI argues that rather than specify "continuity of firm transfers" as the third component of desirable system performance, the Commission should have required

⁶⁴ Footnote b of TPL-002-0 states:

Planned or controlled interruption of electric supply to radial customers or some local Network customers, connected to or supplied by the Faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted Firm (non-recallable reserved) electric power Transfers.

⁶⁵ *Mandatory Reliability Standards for Bulk-Power System*, 131 FERC ¶ 61,231, at P 26 (2010).

that “continuity of all firm transfers be consistent with the TPL Standards.”⁶⁶ EEI explains that while the Commission’s statement that “curtailment of firm transfers is permitted to prepare for the next contingency” is consistent with footnote b, the Commission’s assertion that curtailments are “generally not the desired system performance for single contingencies” and its conclusion that “continuity of firm transfers is the third component of desirable system performance” are not consistent with footnote b because they preclude the interruption of firm transmission service to prepare for the next contingency.

Commission Determination

48. First, as explained above, we want to clarify that our underlying reliability concern is that an entity subject to the test in PRC-023 know what desirable system performance is so that it can identify when it has not met this performance standard. The Commission continues to believe that it is appropriate for NERC to define desirable system performance in reference to compliance with currently effective Reliability Standards. As discussed below, while Order No. 733 provided other specifics on what the Commission intended would include in desirable system performance, these specifics were intended to be guidance and not strict requirements for the test.

⁶⁶ EEI at 11.

49. We disagree with Duke's assertion that the Commission exceeded its authority by imposing a different and more stringent legal standard than Reliable Operation through its definition of desired system performance and deny Duke's request for a rehearing of this matter. In defining desirable system performance, the Commission turned to existing Reliability Standards relating to transmission system planning since they were developed by the ERO specifically to promote the Reliable Operation of the Bulk-Power System.

50. Reliability Standard PRC-023-1 was developed by NERC to avoid the undesirable system performance that Recommendation 21A of the Blackout Report⁶⁷ sought to prevent.⁶⁸ As stated in Order No. 733: "To achieve this goal, the test to determine which sub-200 kV facilities are subject to PRC-023-1 must include or be consistent with the system simulations and assessments that are required by the TPL Reliability Standards...."⁶⁹ Accordingly, the Commission relied on the approved Reliability Standards developed by NERC through its open stakeholder process to determine the

⁶⁷ The Blackout Report Recommendation 21A states:

A. Evaluation of Zone 3 Relays

NERC: Industry is to review zone 3 relays on lines of 230 kV and higher.

Task Force: Recommends that NERC broaden the review to include operationally significant 115 kV and 138 kV lines, e.g., lines that are part of monitored flowgates or interfaces. Transmission owners should also look for zone 2 relays set to operate like zone 3s.

⁶⁸ NERC July 30, 2008 Petition, Docket No. RM08-13-000, at 7.

⁶⁹ Order No. 733, 130 FERC ¶ 61,221 at P 79.

appropriate definition of desirable system performance. Our remaining discussion in Order No. 733 was intended to provide insight as to the TPL Reliability Standard requirements that were relevant to this discussion.⁷⁰

51. Further, we disagree with Duke that the Commission's comments on the terms of a test set a performance standard. Unlike the TPL Reliability Standards themselves, the test contemplated by the Commission's directive in PRC-023-1 serves only to identify existing system elements that could trip on relay loadability and contribute to cascading outages.

52. We disagree with Duke's concerns regarding the dropping of non-consequential load. Duke misunderstands our discussion of this issue. PRC-023-1 does not prohibit the dropping of non-consequential load. When Order No. 733 was issued, the Commission's guidance with respect to desirable system performance was based on the TPL Reliability Standards, subject to the Commission's direction to modify footnote b of TPL Reliability Standards Table I issued in 2007 in Order No. 693.⁷¹ The ERO is currently developing a

⁷⁰ For example, Reliability Standard TPL-002-0 requires each planning authority and transmission planner to "demonstrate through a valid assessment that its portion of the interconnected transmission system is planned such that the Network can be operated to supply projected customer demands and projected Firm (non-recallable reserved) Transmission Services...under the contingency conditions defined in Category B of Table I." Similarly, Reliability Standard TPL-003-0 addresses Category C contingencies. Thus, the Commission drew its definition of desirable system performance from TPL Reliability Standards Table I (Transmission System Standards – Normal and Emergency Conditions).

⁷¹ Order No. 693, FERC Stats. & Regs. ¶ 31,242 at P 1794 (footnotes omitted)
(continued...)

modification to footnote b pursuant to the Commission's directive. To the extent that Order No. 733 can be read as inconsistent with the directive regarding footnote b of TPL Reliability Standards Table I in Order No. 693, the Commission grants limited rehearing to clarify that the test to determine which sub-200 kV are subject to PRC-023-1 should be consistent with the TPL Reliability Standards and the Commission's directive on footnote b of TPL Reliability Standards Table I as set forth in Order No. 693. Once the Commission approves a modified footnote b addressing non-consequential load loss or the continuance of firm transfers, the definition of desirable system performance should be adjusted to be consistent with the modified TPL Reliability Standards.

Base Cases

53. In addition to defining desirable system performance, the Commission required that NERC's test describe the steady state and dynamic base cases that the planning coordinator must use in assessing facilities. In Order No. 733, the Commission stated

states:

Based on the record before us, we believe that the transmission planning Reliability Standard should not allow an entity to plan for the loss of non-consequential load in the event of a single contingency. The Commission directs the ERO to clarify the Reliability Standard. Regarding the comments of Entergy and Northern Indiana that the Reliability Standard should allow entities to plan for the loss of firm service for a single contingency, the Commission finds that their comments may be considered through the Reliability Standards development process. However, we strongly discourage an approach that reflects the lowest common denominator. The Commission also clarifies that an entity may seek a regional difference to the Reliability Standard from the ERO for case-specific circumstances.

that the base cases must “bracket all stable operating conditions,”⁷² represent “all feasible types and locations of faults,”⁷³ and include “all stable operating conditions and allowable topologies.”⁷⁴ The Commission also stated that the test must include “the effects of the failure of a single component within the as designed Protection Systems, consistent with TPL-002-0 Requirement R1.3.10, but with regard to backup and redundant protection systems.”⁷⁵

54. On rehearing, parties raise several concerns regarding the Order No. 733 discussion of base cases to be run as part of the critical facility test.

Inclusion of Dynamic Studies

55. EEI and the Trade Associations challenge the requirement that the test include dynamic studies. EEI states that PRC-023-1 applies only to steady state loadability of

⁷² Order No. 733, 130 FERC ¶ 61,221 at P 79 (emphasis added).

⁷³ *Id.* P 87 (emphasis added).

⁷⁴ *Id.* P 88 (Item 2) (emphasis added).

Include all stable operating conditions and allowable topologies, such as all allowable planned outages. This is consistent with TPL-002-0, Requirement R1.3.12. (which requires that the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) be included at those demand levels for which planned (including maintenance) outages are performed); and TOP-004 Requirement R4 (which requires operating the actual system in a known operating state).

⁷⁵ *Id.* P 88 (Item 4) (emphasis added).

transmission relays, not to dynamic swings that may entail issues regarding relay characteristics. The Trade Associations agree that the Standard is designed for non-fault, non-power swing steady state conditions, and add that its purpose is to prevent relays from prematurely taking transmission elements out of service, which could prevent operators from taking controlled action, when the loss of a parallel element (or elements) causes an overload. The Trade Associations point to the Standard's focus on overloads (i.e., non-fault, non-power swing currents) on parallel elements as evidence that load flow studies, which reflect steady state conditions, are the only studies that need to be included in the test to determine which facilities will be subject to the Standard.

Commission Determination

56. We deny rehearing. By its terms, the purpose of PRC-023-1 is to ensure “[p]rotective relay settings shall not limit transmission loadability; not interfere with system operators’ ability to take remedial action to protect system reliability and; be set to reliably detect all fault conditions and protect the electrical network from these faults.”⁷⁶

57. Since relays will respond to real-time system conditions, PRC-023-1’s purpose is not limited to addressing only steady state loadability conditions. It requires the consideration of dynamic loadability conditions, such as the stable but dynamic power

⁷⁶ Reliability Standard PRC-023-1 (Transmission Relay Loadability) at A.3. Purpose.

swings that occurred during the August 2003 blackout. In Order No. 733, the Commission was persuaded by NERC's request to allow PRC-023-1 to remain focused on steady state relay loadability and allow NERC to address stable power swings in a different Reliability Standard,⁷⁷ but this does not mean that dynamic base cases are unnecessary for purposes of PRC-023-1. Therefore, because we disagree with EEI and the Trade Associations' assertion that PRC-023-1 applies only to steady state loadability, we do not believe the criterion to include dynamic base cases is inconsistent with PRC-023-1.

58. In determining which facilities between 100 and 200 kV are critical to the reliability of the bulk electric system and must be subject to this standard, the planning coordinator must assess all operating conditions. Otherwise there may be a gap in which a facility may be critical under one operating condition, but not subject to the standard because this operating condition was not studied. To this end, the test must be informed by the other mandatory Reliability Standards. PRC-023-1 interacts with Facilities Design, Connections and Maintenance Reliability Standards, Interconnection Reliability Operations and Coordination Reliability Standards, and Transmission Operations Reliability Standards. These interactions require applicable entities to establish limits for all system elements; interconnected systems must be operated within these limits; operators must take immediate action to mitigate operation outside of these limits; and

⁷⁷ Order No. 733, 130 FERC ¶ 61,221 at P 173.

protective relays must refrain from operating until the observed condition on their protected element exceeds these limits.⁷⁸ To ensure that the protective relays set according to PRC-023-1 refrain from operating until the observed condition on their protected elements exceed system operating limits, dynamic conditions need to be studied as part of the required valid assessment required by the TPL Reliability Standards.

59. The following provides the Commission's guidance as to how the ERO could implement the requirement to study dynamic states. To perform a valid assessment as required by the TPL Reliability Standards, a planning authority or transmission planner must demonstrate that its network can be operated to supply projected customer demand and projected firm transmission service, at all demand levels, over the range of forecast system demands, and under the contingency conditions defined in Table I.⁷⁹ The valid assessment includes the performance of the system for all stable operating conditions: steady state and dynamic. Because NERC developed PRC-023-1 to address the inadvertent tripping of facilities due to loadability that occurred during the August 2003 Blackout, the test to identify applicable critical facilities must also consider the dynamic conditions that resulted in such inadvertent tripping. As previously mentioned, dynamic base cases are used to evaluate, for example, phase angles, currents and voltages before, during and after contingencies to determine whether the Bulk-Power System will remain

⁷⁸ *Id.* P 164.

⁷⁹ *Id.* P 85.

stable in all of the base cases. Steady state load flow analysis will capture only one aspect of the system response characteristics.

60. Studying steady states alone will not be adequate to ensure that all protection relays critical to the reliability of the system will be captured under PRC-023. Only a valid assessment that includes the use of steady state load flow and transient stability analyses representing the system conditions before and after contingencies will ascertain whether the protection relays will not misoperate during the transient or dynamic phase during and immediately after a disturbance, or after the system has settled to another steady state once the faulted element is removed and should be required to comply with PRC-023-1. For this reason, dynamic base cases are not only appropriate, but consistent with the study tools and practices utilized by planners, in coordination with protection engineers, in accordance with the TPL Reliability Standards. To ignore protection relay performance during dynamic conditions, such as those that occurred during the August 2003 Blackout, would not be consistent with PRC-023-1 which is intended to ensure that relays operate reliably for faults but do not limit transmission loadability.

Requirement to Include All Stable Operating Conditions

61. EEI and the Trade Associations challenge the requirement that base cases must “bracket all stable operating conditions,” represent “all feasible types and locations of faults,” and include “all stable operating conditions and allowable topologies.” EEI and the Trade Associations argue that these expectations are impractical, unduly burdensome, practically impossible, and technically unreasonable.

62. EEI also claims that the Commission provided contradictory guidance; EEI explains that while the Commission indicated that every possible condition and topology needs to be studied, some of its statements appear to suggest otherwise. EEI points specifically to the Commission's clarification that it was not requiring planning coordinators to use Category D contingencies to determine whether a facility is subject to PRC-023-1, and to the Commission's acknowledgement that "relay settings can not be determined with great certainty for extreme multi-contingency conditions," which are the types of conditions consistent with Category D contingencies.⁸⁰ EEI further observes that the Commission acknowledged a second time that "relays cannot be set reliably under extreme multi-contingency conditions" and specifically recognized that "it is not realistic to expect the ERO to develop Reliability Standards that anticipate every conceivable critical operating condition applicable to unknown future configurations for regions with various configurations and operating characteristics."⁸¹ EEI argues that the Commission should drop the requirement that base cases include all stable operating conditions and allowable topologies or, at a minimum, make the requirement consistent with the TPL Reliability Standards, which require planning coordinators to "cover critical system conditions and study years as deemed appropriate by the responsible entity."

⁸⁰ *Id.* P 95.

⁸¹ *Id.* P 168.

Commission Determination

63. We deny rehearing, but will clarify our determination. Our primary concern in requiring the planning coordinators to create base cases is to ensure that the study is robust enough to capture all facilities between 100 and 200 kV that are critical to the operation of the bulk electric system. Protective relays covered by PRC-023-1 are expected to operate correctly (i.e., for fault conditions and not due to system or transmission loadability) for all stable operating conditions and allowable topologies for all feasible types and locations of faults.⁸² As the Commission stated in Order No. 693, the performance of the Bulk-Power System is assessed for a “range of operating conditions and contingencies [and] determining those operating conditions and contingencies that have an undesirable reliability impact.”⁸³ This is consistent with the development of the valid transmission assessment required by TPL Reliability Standards. We therefore grant EEI’s request for clarification that the base cases should be consistent with those studied under the TPL series of standards.

64. We intended our statements requiring the test to include a study of all stable operating conditions to be consistent with the studies currently carried out pursuant to

⁸² *Id.* P 87; Reliability Standard PRC-023-1 A.3.

⁸³ Order No. 693, FERC Stats. & Regs. ¶ 31,242 at P 1683.

currently effective Reliability Standards TPL-002-0 and TPL-003-0.⁸⁴ Much of the rest of our discussion in Order No. 733 was intended to provide insight as to the TPL Reliability Standard requirements that were relevant to this issue. We note that, if in the discretion of the ERO it believes it is more efficient, the identification of operationally significant 100 kV – 200 kV facilities could also be identified as part of the assessments currently performed by transmission planners based on the performance of the system to their operation.

65. Contrary to what petitioners assert, the Commission did not conclude that the applicability of PRC-023-1 should be determined based on Category D contingencies. In the Final Rule, the Commission acknowledged that Reliability Standard TPL-004-0 does not require corrective plans such that the Bulk-Power System would avoid cascading or instability for such contingencies but only requires that the transmission planner has evaluated its system for such extreme events.⁸⁵ For purposes of clarity, the Commission affirms that its guidance regarding base cases did not intend to include Category D events. Rather, the base cases are meant to be tested for all feasible types and locations of faults and include all stable operating conditions and allowable topologies when tested

⁸⁴ Reliability Standard TPL-002-0 (System Performance Following Loss of a Single Bulk Electric System Element (Category B)), at Requirement R1; Reliability Standard TPL-003-0 (System Performance Following Loss of Two or More Bulk Electric System Elements (Category C)), at Requirement R1.

⁸⁵ Order No. 733, 130 FERC ¶ 61,221 at P 95.

against, consistent with the requirements for studying Category B and Category C contingencies.

TPL-002, Requirement R1.3.10

66. On March 18, 2010, the Commission issued a Notice of Proposed Rulemaking in Docket No. RM10-6-000 proposing to reject NERC's interpretation of Reliability Standard TPL-002-0, Requirement R1.3.10. NERC's proposed interpretation would consider protection failure to be studied only as part of Category C contingencies addressed in TPL-003-0. Taking a different tack, the Commission proposed to interpret Requirement R1.3.10 of TPL-002-0 as requiring assessments that study non-operation of primary protection system devices to assess how the backup or redundant protection system or device maintains system performance. The Commission's interpretation indicated that non-operation of a primary protection system is not a contingency,⁸⁶ but one of the base cases.⁸⁷

⁸⁶ *Interpretation of Transmission Planning Reliability Standard*, Notice of Proposed Rulemaking, FERC Stats. & Regs. ¶ 32,655, at P 21 (2010) ("The Commission proposes to interpret that the non-operation of a non-redundant primary protection system is not a contingency and Requirement R1.3.10 requires that the planner model, as a condition in the base case, the non-operation of the primary protection system, accounting for operation of the redundant protection system or, alternatively, the fact that the protection system is not redundant, as appropriate").

⁸⁷ *Id.* P 10 ("Requirement R1.3 defines the criteria for the 'base cases' that must be included in the studies to support the assessment. Requirement R1.3.10 provides as a base case criteria that the studies must include the effects of existing and planned protection systems, including any backup or redundant systems").

Requests for Rehearing

67. Duke and the Trade Associations argue that the Commission's expectation that base case studies include the effects of the failure of a single component within the as designed Protection Systems, "consistent with TPL-002-0 Requirement R1.3.10" prejudices the outcome of the proceeding in Docket No. RM10-6-000. In that docket, the Commission proposed to reject NERC's interpretation of TPL-002-0 Requirement R1.3.10 and to adopt an alternative interpretation. Duke and the Trade Associations maintain that the Commission should not apply an interpretation in this proceeding that is the subject of a proposed rulemaking in another proceeding. The Trade Associations argue that if the Commission insists on this requirement, it should make it subject to the outcome of the proceeding in Docket No. RM10-6-000.

68. EEI argues that TPL-002-0 does not address system protection failures, as the Commission stated when it required that base cases "include the effects of a *failure* of a single component within the as designed Protection Systems, consistent with TPL-002-0 Requirement R1.3.10." EEI states that TPL-003-0 and TPL-004-0 address protection system failures.

Commission Determination

69. The Commission grants rehearing of our statements regarding TPL-002-0 Requirement R1.3.10. As stated above, the Commission believes the test to determine which sub-200 kV facilities are subject to PRC-023-1 should be consistent with the system simulations and assessments that are required by the TPL Reliability Standards.

Consequently, we grant rehearing to the extent that our guidance in Order No. 733 differs from the currently effective language of TPL-002-0 Requirement R1.3.10. Until the Commission issues an order approving an interpretation of Requirement R1.3.10 in Docket No. RM10-6-000, NERC may use its own interpretation of the Reliability Standard as written to formulate the test. And once the Commission approves an interpretation of Requirement R1.3.10, the base cases component of the critical facilities test should be made consistent with that interpretation.

Other Test Criteria

70. Petitioners raise several additional concerns about the clarity and consistency of the Commission's guidance on the test for identifying critical facilities. Both the Trade Associations and EEI refer to the Commission's discussion concerning validating relay settings on system conditions that the relays could experience, including acceptable margins applied to minimum voltages and power factor angles, as ambiguous and incorrect.⁸⁸ It is the Trade Associations' view that the Commission misinterprets the NERC System Protections and Control Task Force as assuming that relay settings are to be validated by operators to reflect changing system conditions. Rather, the Trade Associations assert, what the System Protections and Control Task Force contemplated, and what PRC-023-1 provides, is the establishment of reasonable margins (e.g., the 115

⁸⁸ Trade Associations at 7 n.3; EEI at 13 (citing Order No. 733, 130 FERC ¶ 61,221 at P 56).

percent and 150 percent requirements set forth in Requirement R1.10) to encompass the system conditions that relays could experience.

71. EEI asserts the Commission's statement that radial transmission facilities serving load with only one transmission source are not included in NERC's definition of "bulk electric system" conflicts with Requirement R1.10, which applies to transmission lines terminated only with a transformer.⁸⁹ EEI similarly argues that the Commission's statement that the "test set forth above is best implemented uniformly across all regions" is inconsistent with the Commission's acknowledgement that some issues may not affect some utilities as a result of physical differences in network design and performance.⁹⁰

Commission Determination

72. We deny rehearing and provide the following clarification. First, we clarify in this order that our discussion of test criteria other than those incorporating concepts required in currently effective Reliability Standards was intended to be guidance for the ERO to consider in developing a test to identify the facilities subject to the Standard. While we believe including these items identified in Order No. 733 is one way to accomplish the goal of identifying the appropriate facilities, we want to make clear that the ERO can develop an alternative proposal for addressing the Commission's concerns with the understanding that any such alternative must be as effective as, or more effective than,

⁸⁹ EEI at 14 (citing Order No. 733, 130 FERC ¶ 61,221 at P 94).

⁹⁰ *Id.* (citing Order No. 733, 130 FERC ¶ 61,221 at P 92).

the Commission's proposed approach in addressing the identified technical and other concerns. However, to clarify our intention in incorporating these items into our guidance in Order No. 733, we will provide some additional discussion in response to the rehearing requests.

73. EEI and the Trade Associations misunderstand Order No. 733 statements regarding validating relay settings. By its own terms, Reliability Standard PRC-023-1 applies only to load-responsive phase protection relays—one of the several types of protection relays. The Standard, therefore, cannot be applied in a vacuum; other Reliability Standards must be taken into account to ensure that settings contemplated in PRC-023-1 do not preclude compliance with other Reliability Standards. In Order No. 733, the Commission quotes approvingly from the NERC System Protection and Control Task Force to reinforce the point that relay engineers need to ensure that all relay settings provide appropriate margin with respect to both the particular equipment and the system as a whole.

74. In response to EEI's concern regarding radial facilities, we believe that EEI misunderstood our intention and do not believe that our discussion of radial facilities in Order No. 733 is inconsistent with Reliability Standard PRC-023-1 Requirement R1.10.⁹¹

⁹¹ By the terms of Reliability Standard PRC-023-1, the requirement applies to transformers with low side voltages equal to or above 200 kV and, if identified by the planning coordinator, transformers with low side voltages equal to or above 100 kV. These are not the type of transformer used to supply load with one radial transmission line.

In the paragraph petitioners point to, the Commission addressed arguments that Reliability Standard PRC-023-1 should not apply to radial transmission lines by referring to NERC's definition of bulk electric system.⁹² NERC's definition of "Bulk Electric System" states that "[r]adial transmission facilities serving only load with one transmission source are generally not included in [the definition of Bulk Electric System.]"⁹³ Requirement R1.10 of PRC-023-1 was created by the NERC Reliability Standard development process and submitted to us for approval. However, we did not read it as being at odds with NERC's definition of the bulk electric system because, by its terms, it only applies to transformers with low voltage terminals of 100 kV or greater. Few lines that terminate at such a transformer are radial transmission facilities serving only load with one transmission source. As mentioned below, Requirement R1.10 can apply to autotransformers between different Bulk-Power System voltages. Accordingly, we do not understand our statements regarding the NERC Statement of Criteria Registry to be at odds with PRC-023-1 Requirement R1.10.

75. Lastly, on the advice of the ERO that the effects of Reliability Standard PRC-023-1 are not constrained to regional boundaries, the Commission stated in Order No. 733 that any test to identify critical facilities must be consistent across regions so that the effects

⁹² Order No. 733, 130 FERC ¶ 61,221 at P 94.

⁹³ *Glossary of Terms Used in Reliability Standards*, (Feb. 2008), available at http://www.nerc.com/files/Glossary_12Feb08.pdf.

of protection relay operation are consistent.⁹⁴ The Commission has acknowledged that the goal of greater uniformity does not mean that regional differences cannot exist,⁹⁵ but we also believe that uniformity of Reliability Standards should be the goal and the practice, the rule rather than the exception.⁹⁶ Accordingly, we do not consider it to be inconsistent to acknowledge in Order No. 733 that some issues may not affect some utilities as a result of physical differences in network design and performance, but nevertheless direct a uniform approach be taken in testing for critical facilities.

Deadline to File Test

Rehearing Request

76. The Commission directed NERC to develop the test, apply it to a representative sample of utilities from each of the three Interconnections, and file the test and the results from the representative sample no later than March 18, 2011, one year from the date of Order No. 733. NERC requests that the Commission extend the deadline for filing the test to 24 months from the date the Commission issues an order on rehearing in this proceeding. NERC argues that an extension of time is necessary to guarantee that it has

⁹⁴ Order No. 733, 130 FERC ¶ 61,221 at P 92.

⁹⁵ Order No. 672, FERC Stats. & Regs. ¶ 31,204 at P 291.

⁹⁶ *Id.* P 290.

sufficient time to develop the test through the Reliability Standards development process.⁹⁷

77. NERC explains that if it follows the Commission's suggestion and bases the test on the voluntary guidelines previously developed by the NERC System Protection and Control Task Force, it could use existing study regimes as part of the Reliability Standard development process and meet the Commission's deadline; however, if industry determines that the voluntary NERC guidelines are insufficient and that a different, more technical analysis is warranted, NERC would have to consult a wide array of industry experts and NERC technical committees, and require new studies beyond those currently conducted by Planning Coordinators and Transmission Owners.⁹⁸ NERC adds that the test would then need to be vetted through the Reliability Standards development process and field tested on a representative sample of utilities. NERC does not believe that it would be possible to perform all of these tasks within the one-year timeframe established by the Commission in Order No. 733.

Commission Determination

78. We grant NERC's request that the deadline for filing the test and the results from a representative sample of utilities in each of the three Interconnections be extended to twenty-four months from the date of this order. The Commission believes the ERO

⁹⁷ NERC at 5.

⁹⁸ *Id.*

should have sufficient time to utilize its Reliability Standards development process and consult with technical experts and its technical committees. We note in the meantime, however, entities must comply with the Standard as approved in Order No. 733.

Applicability to Below 100 kV Facilities

Order No. 733

79. As approved by the Commission, PRC-023-1 does not apply to any sub-100 kV facility. The Commission determined that the failure to apply the Reliability Standard to operationally critical facilities, regardless of their size constituted a gap in the enhanced reliability program created by PRC-023-1. Order No. 733 stated that facilities such as auxiliary power facilities for nuclear plants and the “cranking path” from black start generators to the Bulk-Power System are facilities that may have sub-100 kV elements, and so would be omitted from the requirements of the Reliability Standard. The order found that the loss of such facilities can affect the reliability of the Bulk-Power System. Because the ERO had already recognized that sub-100 kV facilities can play a significant role in the Reliable Operation of an Interconnection, the Commission directed the ERO to modify the Standard to apply to sub-100 kV facilities but sought to limit its application to facilities that are: (1) owned or operated by a currently Registered Entity or an entity that becomes a Registered Entity in the future; (2) associated with a facility that is included on a critical facilities list defined by the Regional Entity; (3) employing load-responsive

phase protection relays in its protection system(s); and (4) identified by the critical facilities test that the Commission required NERC to develop.⁹⁹

80. In response to NOPR comments questioning the technical basis for applying the Standard to sub-100 kV facilities, the Commission explained that such facilities should be subject to the Standard because their loss can affect the reliability of the Bulk-Power System.¹⁰⁰

81. The Commission also rejected NOPR comments arguing that it was required to give “due weight” to NERC’s exclusion of sub-100 kV facilities from the Standard.¹⁰¹

The Commission explained that NERC failed to provide a sufficient technical justification for the initial exclusion and offered no technical argument against the Commission’s proposal; noting that, in its NOPR comments, NERC stated that applying the Standard to sub-100 kV facilities “may have merit” and “would require further study.”¹⁰² The Commission cited these comments as an indication that NERC did not affirmatively consider applying the Standard to sub-100 kV facilities and then reject the idea on the basis of its technical expertise.

⁹⁹ Order No. 733, 130 FERC ¶ 61,221 at P 62.

¹⁰⁰ *Id.* P 67.

¹⁰¹ *Id.*

¹⁰² *Id.* (citing NERC comments at 18).

82. Finally, with respect to comments arguing that any expansion of the Standard must be developed through the Reliability Standards development process, the Commission clarified it did not prescribe this specific change as an exclusive solution to its reliability concerns regarding sub-100 kV facilities. As with its other directives, the Commission stated the ERO could propose an alternative solution that it believes is an equally effective and efficient approach to addressing the Commission's reliability concerns about the absence of sub-100 kV facilities from the Standard. Moreover, while the Commission stated that it expected planning coordinators to use the same test to identify critical sub-100 kV facilities as they use to identify critical 100 kV-200 kV facilities, it clarified that the ERO could, pursuant to Order No. 693, propose a modified Standard that contains a different test for sub-100 kV facilities, provided that the test represents an "equivalent alternative approach."

Rehearing Request

83. EEI and the Trade Associations request rehearing of the Commission's directive to make PRC-023-1 applicable to sub-100 kV facilities. They note that the Blackout Report provides no evidence to support extending the Reliability Standard to sub-100 kV facilities. EEI further asserts that the failure of the Commission to give a reasoned explanation for the extension renders its directive arbitrary and capricious. Additionally, EEI notes that the Commission's failure to identify a specific concern with the failure to

extend the Standard to sub-100 kV facilities means the ERO is unable to develop an alternative but equally efficacious approach to addressing the directive.¹⁰³

84. The Trade Associations argue that NERC's failure to study the appropriateness of extending the Standard to sub-100 kV facilities does not justify subjecting each such registered facility to the Standard's operational significance tests, but merely supports directing NERC to study the matter. The Trade Associations also make the "indirect due weight" argument stating that while NERC may be free to develop an alternative approach to the directive, NERC appears to be denied the ability now to study the matter and determine that the extension of PRC-023-1 is not necessary or appropriate to achieve reliability of the Bulk-Power System.¹⁰⁴

85. The Trade Associations' request that the Commission direct NERC to study whether there is merit to extending PRC-023-1 to facilities below 100 kV and, if so, whether already registered sub-100 kV facilities should be evaluated for operational significance under the same tests as applied to 100 kV to 200 kV facilities.¹⁰⁵

Commission Determination

86. We deny rehearing. Critical assets are defined by NERC as facilities, systems, and equipment that, if rendered unavailable, would affect the reliability or operability of the

¹⁰³ EEI at 15-16.

¹⁰⁴ Trade Associations at 14-15.

¹⁰⁵ *Id.* at 15.

bulk electric system.¹⁰⁶ The Commission believes that there may be critical facilities below 100 kV that are also critical to the reliability of the bulk power system under PRC-023-1. In order to address what it perceived as a gap in the applicability of PRC-023-1, the Commission directed the ERO to modify the Reliability Standard to apply to sub-100kV facilities that are associated with a facility that is included on a critical facilities list defined by a Regional Entity. We want to emphasize that this determination will likely have narrow applicability, but where it applies it will be critical to the reliability of the bulk electric system. A sub-100 kV facility will only be subject to PRC-023-1 if it both meets the NERC general test for critical assets, and is therefore already registered, and is identified as operationally critical in the test directed to be created by Order No. 733. Because the application was narrowly tailored to demonstrably critical assets, the Commission justified the applicability of the Reliability Standard to sub-100 kV facilities by stating that “[r]elay settings on such facilities should be subject to PRC-023-1 because their loss can also affect the reliability of the Bulk-Power System.”¹⁰⁷

87. The Trade Associations argue that the Commission should have directed no more than that NERC study the appropriateness of extending the Standard to sub-100 kV facilities and that, in making the directive that it did, the Commission denied NERC the

¹⁰⁶ *Glossary of Terms Used in Reliability Standards* (Feb. 2008), available at http://www.nerc.com/files/Glossary_12Feb08.pdf.

¹⁰⁷ Order No. 733, 130 FERC ¶ 61,221 at P 67.

ability to conclude such application of PRC-023-1 is not necessary or appropriate to achieve reliability. As we stated above, when the Commission identifies a specific matter to be addressed, and gives guidance explaining its concern, it is acting within its statutory authority. The Commission's obligation to give "due weight" to the technical expertise of the ERO does not conflict with this authority. As section 215(d)(2) of the FPA makes clear, the obligation to give "due weight" arises in the context of a "proposed reliability standard or modification to a standard," in other words, when the Commission reviews an ERO proposal. The Commission can give "due weight" to the technical expertise of the ERO when reviewing a Standard and nonetheless identify a specific matter to be addressed without contradiction.

88. The Commission directed the ERO to develop a modification that would make PRC-023-1 applicable to only those sub-100 kV facilities that are operationally critical. While the Commission attempted to tailor the modification so that only critical sub-100 kV facilities are subject to the Reliability Standard, the ERO is free to comply by developing an equally effective and efficient response that addresses the concern or goal underlying the directive, namely the detriment to reliability inherent in a failure to apply Reliability Standard PRC-023-1 to relay protection systems associated with facilities critical to the operation and reliability of the Bulk-Power System. In developing such a modification, the ERO Reliability Standards development process allows for such study and field tests as are necessary to develop the modification. If the Trade Associations' position is that, in studying this matter, NERC may determine that no operationally

critical sub-100 kV facilities currently exist, NERC is to develop a modification that will capture such facilities should they occur in the future, but NERC must be able to show its response is no less effective and efficient than the test we proposed in Order No. 733.

Generator Step-Up Transformer Relays as Back-Up Protection

Order No. 733

89. In Order No. 733, the Commission distinguished between two roles for protection relays physically located at the generator terminal on the low-voltage side of a generator step-up transformer. Such relays can provide backup protection for a Bulk-Power System element such as a transmission line outside of the generator zone of protection, or might provide backup protection for the generator and step-up transformer. In Order No. 733, the Commission found that the requirements of PRC-023-1 apply to all protection systems as described in Attachment A that are intended to provide protection to the facilities defined in section 4.1.1 through 4.1.4 of the Reliability Standard, regardless of whether the protection systems provide primary or backup protection and regardless of their physical location. The Commission stated that those relays that are applied to provide backup protection to Bulk-Power System elements sense increased current flow due to a fault and, therefore, are subject to Reliability Standard PRC-023-1.

Rehearing Request

90. Petitioners disagree with the distinction in purpose and seek rehearing or clarification that generator step-up transformer relay loadability shall be addressed in a Reliability Standard development process that is separate from PRC-023-1. NERC and

EEI argue that whether a relay is subject to PRC-023-1 or a new Reliability Standard should be determined by its location, not its purpose or functionality, because a low-side relay will always sense a fault on the transmission side. In addition, the Trade Associations note that fault conditions are not the purpose of PRC-023-1, so the Commission's concern with fault conditions is misplaced. The Trade Associations further assert the Reliability Standard was designed to prevent over-tripping of parallel paths, and because of their radial nature, overloading from parallel flows is not an issue with regard to generator equipment. Moreover, generators and their transformers need to be able to assist in transient stability and voltage stability events.

91. Though the Commission stated that the Reliability Standard would apply only to those relays providing backup protection to Bulk-Power System elements, NERC and EEI state the purpose of backup distance protection relays applied at a generator's terminals is to provide thermal protection for the generator and backup protection for the generator step-up transformer, not for the transmission lines. NERC asserts that PRC-023-1 settings are inadequate for thermal protection of the generator and raises technical arguments that distinguish generator loadability relay challenges from those challenges addressed by PRC-023-1.

92. EEI asserts the Final Rule is confusing in that in one place the Commission allows NERC to address generator step-up and auxiliary transformer loadability in a different Reliability Standard, but then clarifies later that PRC-023-1 does apply to relays on the low-side of a generator step-up transformer that are applied to provide backup protection

to Bulk-Power System elements.¹⁰⁸ NERC and the Trade Associations raise the issue of whether the Commission gave appropriate weight to NERC's work on this matter.

Commission Determination

93. We deny rehearing and clarify that the Commission does not intend the Reliability Standard to apply to back-up protective relays connected to current transformers at the neutral end of the generator, as illustrated in Appendix 1. We disagree with NERC and the Trade Associations that the location of the relay should govern whether or not PRC-023-1 applies to a particular relay. There is nothing in the current Standard to support that interpretation. In its Applicability section, PRC-023-1 states that it applies to, among others, generation owners with load-responsive phase protection systems described in the Standard's Attachment A and applied to certain facilities.¹⁰⁹ Attachment A specifically excludes certain protection systems from the requirements of the Standard. One of these exclusions is for "[g]enerator protection relays that are susceptible to load." Attachment A does not exclude any other type of relay physically located at the generator terminal on the low-voltage side of a generator step-up transformer. Thus, by the Standard's terms it

¹⁰⁸ EEI at 5 (citing Order No. 733, 130 FERC ¶ 61,221 at P 104, 113).

¹⁰⁹ These facilities are: (1) Transmission lines operated at 200 kV or above (2) transmission lines operated at 200 kV or above as designated by the Planning Coordinator as critical to the reliability of the Bulk Electric System, (3) Transformers with low voltage terminals connected at 200 kV and above, or (4) Transformers with low voltage terminals connected at 100 kV to 200 kV as designated by the Planning Coordinator as critical to the reliability of the Bulk Electric System.

must apply to generator protection backup relays located at the generator step-up transformer.

94. Petitioners disagree with the Commission's position described in Order No. 733 that backup relays located at the generator can be used to protect transmission elements.¹¹⁰ They argue that the primary function of all backup distance protection applied at the terminals of a generator is to provide thermal protection for the generator and backup protection for the generator step-up transformer, and not the connected transmission line. As discussed in Order No. 733, however, as drafted, PRC-023-1 applies to the relays intended to provide either primary or backup protection to transmission elements.¹¹¹ The relays that the Commission described as being subject to Reliability Standard PRC-023-1, while they may be connected to current transformers located at the generator terminal or on the low-voltage side of the generator step-up transformer, are set to provide backup protection for Bulk-Power System elements.¹¹² In such instances, the sensing of the relay will be solely in the direction of the Bulk-Power System, and such relays should be set in accordance with PRC-023-1. Backup

¹¹⁰ Order No. 733, 130 FERC ¶ 61,221 at P 113.

¹¹¹ For example, the relays can be connected in two ways: (1) connected to current transformers at the neutral end of the generator or (2) connected to current transformers at the generator terminal or on the low-voltage side of the generator step-up transformer. We agree that commenters' arguments may be appropriate for the former connection.

¹¹² Donald Reimert, *Protective Relaying for Power Generation Systems* 77 (2005).

protection, however, can also be connected to current transformers located at the neutral end of the generator, and such relays will sense in the direction of the generator and the Bulk-Power System.¹¹³ Relays in this second location may operate for faults on the generator or the Bulk-Power System, and Order No. 733 does not purport to make such protection relays subject to PRC-023-1. With this clarification, the Commission believes that it resolves the apparent conflict in Order No. 733 identified by EEI.

95. The Commission agrees with the Trade Associations that backup relays set according to PRC-023-1 should be coordinated with other protection systems to ensure that systems protecting the generator and generator step-up transformer operate before protection systems that provide backup protection for the Bulk-Power System. We do not, however, agree with their assertion that this means that the current PRC-023-1 should be read not to apply to the loadability of generator step-up transformers because of such coordination. As discussed in Order No. 733, the Commission expects that the ERO will develop the Reliability Standard addressing generator loadability as a new Reliability Standard with its own individual timeline, and not as a revision to an existing Standard.¹¹⁴

96. The Commission does not accept the Trade Associations' assertion that the Reliability Standard was designed to prevent over-tripping of parallel paths and therefore

¹¹³ *Id.*

¹¹⁴ Order No. 733, 130 FERC ¶ 61,221 at P 106.

has no applicability to generator equipment and auxiliaries. While we do not argue that our directive was intended to address anything beyond relays providing backup protection for elements of the Bulk-Power System, nothing in PRC-023-1 limits applicability to parallel paths or thermal cascading outages. The Standard is general and covers all possible topologies for Reliable Operations in real time.

97. We do agree that generators and their transformers assist in transient stability and voltage stability events. In the context of Reliability Standard PRC-023-1, load-responsive phase relays must not trip due to transient stability and voltage events in order to allow operators to take remedial action. Moreover, the assistance provided by generators and their transformers, until addressed in other standard development activities, is presently addressed by PRC-001-1 and requires coordination of generation and transmission protection systems.

98. We agree with NERC that a generator's higher loading angle and dynamic response to local disturbances are not addressed by PRC-023-1 and that the requirements of PRC-023-1 are insufficient to provide for secure operation of generator backup protection. We also agree with NERC that load-responsive relays applied at the terminal of a generator will respond to a maximum load and the resultant apparent impedance independent of whether it is set with a shorter reach to protect the generator and the generator step-up transformer or with a longer reach to additionally provide backup protection from transmission system faults. Our decision in the Final Rule is consistent with each of NERC's assertions. As we discussed previously, the relays at issue, while

they may be connected to current transformers located at the generator terminal or on the low-side of the generator step-up transformer, are set to provide backup protection for Bulk-Power System elements; not backup protection for the generator. For this reason, while the assertions NERC makes are appropriate, they are relevant to considerations and relays that do not fall within the scope of PRC-023-1. In addition, NERC makes the case that relays governed by PRC-023-1 on most generators or on transmission lines supplied totally or partially from generators will not be able to coordinate since they will not operate appropriately. Such observations underscore the need for generator and transmission protective systems to be coordinated as recommended in the Blackout Report.¹¹⁵ In sum, entities must first pick a relay that coordinates with their system. Having selected their protection relays, if load-responsive phase protection relays are used to provide backup protection to elements of the Bulk-Power System, then those relays should be set in accordance with PRC-023-1.

99. We know from event analysis that entities use load-responsive phase protection relays at the low-side of generator step-up transformers to provide backup protection to Bulk-Power System elements one or more buses away from the generator and that such relays have misoperated. It is not our intention to mandate a specific protection system,

¹¹⁵ See Blackout Report at 73, “[T]he evidence collected indicates that the relay protection settings for the transmission lines, generators and under-frequency load-shedding in the northeast may not be coordinated and integrated...;” and at 159, Recommendation No. 21 “establish an integrated approach to relay protection for generation and transmission lines....”

but we have determined that where an entity selects a phase protection relay to provide backup support to Bulk-Power System elements, such relay should be set in accordance with PRC-023-1. To do otherwise creates a gap in ensuring the reliability PRC-023-1 is intended to establish. If the ERO wishes to address such a gap by another means, we will accept an alternative method, provided that the ERO demonstrates that the alternative will adequately address the Commission's underlying goal as efficiently and effectively as the Commission's proposal.

Power Swings

Order No. 733

100. During the August 2003 Blackout, certain relays were unable to distinguish between an actual fault and a dynamic, but stable power swing. In keeping with their settings and specifications, the relays operated in response to non-fault power swings and thereby accelerated the cascade. Reliability Standard PRC-023-1 applies to steady state relay loadability without regard to dynamic conditions or stable power swings. Rather than order the ERO to modify PRC-023-1 to address stable power swings, in Order No. 733, the Commission directed the ERO to develop a new Reliability Standard that requires the use of protective relay systems that can differentiate between faults and stable power swings and, when necessary, phase-out relays that cannot meet this requirement.

Rehearing Request

101. EEI states that the directive to develop a Reliability Standard to prevent protection relays from operating unnecessarily due to stable power swings is inconsistent and ambiguous because relays cannot distinguish between actual faults and stable power swings. At best, some relays are less susceptible to dynamic power swings, so such a standard cannot be developed at this time. NERC asks for clarification between the unambiguous mandate in Order No. 733 that the new standard is to require the use of protective relays that can differentiate between faults and stable power swings¹¹⁶ and the statement that the Commission recognizes that because of the characteristics of impedance relays, the relay may potentially operate regardless of whether a power swing is stable or unstable.¹¹⁷ EEI also comments that there is no record in the docket nor in the Blackout Report to support the need for such a Reliability Standard and, accordingly, the directive is arbitrary and capricious.

102. Both the Trade Associations and NERC caution that the use of protection systems that differentiate between faults and stable swings may result in less stability as a result of a decreased ability to identify unstable swings. The Trade Associations seek clarification that the Commission is not directing the phase-out of all protection equipment that cannot differentiate between faults and stable power swings. NERC seeks clarification that it can use its industry technical experts to address the issue appropriately

¹¹⁶ NERC at 10 (citing Order No. 733, 130 FERC ¶ 61,221 at P 150, 173).

¹¹⁷ *Id.* at 11 (citing Order No. 733, 130 FERC ¶ 61,221 at P 168).

and asks for clarity as to whether the directive was intended to create an absolute requirement to highlight a concern that other approaches might satisfy. Together NERC, EEI, and the Trade Associations assert more deference was due to NERC to determine the nature of the problem and the appropriate solution.

103. Dominion comments that the Commission did not give the ERO sufficient guidance concerning the timing of any phase-out of protection relay systems.¹¹⁸ It asserts that the Commission considered only the cost of replacing such relay elements in rejecting the arguments that they not be replaced. Dominion believes that the Commission and the ERO must also consider the complexity of the replacement process and the potential impact on system reliability in establishing a timetable for a phase-out.

Commission Determination

104. We deny rehearing and provide the following clarification. We continue to believe that not addressing stable power swings constitutes a gap in the current Reliability Standards and must be addressed. Therefore, we retain the directive, pursuant to section 215(d)(5) to direct the ERO to develop a Reliability Standard addressing stable power swings.

105. The Commission, agreeing with commenters on the NOPR, recognized in Order No. 733 that addressing stable power swings is a complex issue.¹¹⁹ But entities must plan

¹¹⁸ Dominion at 4.

¹¹⁹ Order No. 733, 130 FERC ¶ 61,221 at P 153.

and operate their systems taking into account real time operating conditions. If their portion of the power system, with the existing protection systems, cannot achieve the performance identified in various Reliability Standards, such as the TPL Reliability Standards, a corrective action plan is required. Because PRC-023-1 is silent with respect to relays operating unnecessarily because of stable power swings, we expressed concern in the Final Rule that relays set according to the Reliability Standard remain susceptible to tripping unnecessarily for expected non-fault loading conditions like those that occurred during the August 2003 Blackout. Without specifying the terms of the directive, we directed the ERO to develop a new Reliability Standard that requires the use of protective relay systems that can differentiate between faults and stable power swings and, when necessary, phase-out relays that cannot meet this requirement.

106. A power swing is described as “stable” if after a sudden change in power or a disturbance on the electric system, (e.g., a fault or loss of generation or transmission or load, etc.) generators remain in synchronism and the system returns to an acceptable and stable operating condition. As discussed in Order No. 733, zone 3/zone 2 relays¹²⁰ operated during the August 2003 Blackout according to their settings, but it was the

¹²⁰ Multiple impedance relays are installed at each end of a transmission line, with each used to protect a certain percentage, or zone, of the local line and remote lines. Zone 3 relays and zone 2 relays set to operate like zone 3 relays (zone 3/zone 2 relays) are relays typically set to reach 100 percent of the protected transmission line and more than 100 percent of the longest line (including any series elements such as transformers) that emanates from the remote buses.

inability of these relays to distinguish between a dynamic, but stable, power swing and an actual fault that contributed to the cascade.¹²¹ Unlike a stable power swing, an unstable power swing indicates a sudden change in power on the electric system to such a degree that generators may go out of synchronism, preventing the electric system from returning to an acceptable and stable operating condition.

107. To be clear, we do not direct the development of a Reliability Standard containing an absolute obligation to prevent protection relays from operating unnecessarily during stable power swings. Many, but not all, zone 3 or zone 2 relays with inappropriate settings did operate unnecessarily during the stable power swings portion of the August 2003 Blackout, which led to propagating the geographic spread of the cascade. We note that the Blackout Report highlighted the adverse reliability impact of zone 3 relays and explained why application of zone 3 relays on 230 kV and greater lines have been proactively eliminated in many regions to avoid such relay misoperation. We are not requiring such across-the-board elimination of all zone 3 relays but only the creation of a Reliability Standard that addresses protection systems vulnerable to stable power swings (resulting from Category B and Category C contingencies) that will result in inappropriate tripping.

108. NERC seeks assurance that it can use its industry technical experts and apply its judgment to address this matter appropriately for the various circumstances existing

¹²¹ Order No. 733, 130 FERC ¶ 61,221 at P 152.

across the Bulk-Power System and, with the Trade Associations, expresses concern that the Commission's directive will reduce reliability. In Order No. 693, the Commission stated that "Commission directives are not intended to usurp or supplant the Reliability Standard development procedure."¹²² The ERO's process allows a full vetting of suggestions raised for the first time during the NOPR process and also encourages interested entities to participate in developing Reliability Standards and modifications. We reaffirm the ERO can use its industry technical experts to address the directive as it deems appropriate consistent with its Reliability Standard development process, and we will consider properly supported approaches to addressing our directive provided that the ERO demonstrates that the alternative will address the Commission's concern as efficiently and effectively as the Commission's proposal. Through application of its technical expertise, and the balancing of stakeholder interests, the ERO's Reliability Standard development process is the appropriate forum to discover and address any unintended consequences arising from the use of protective relay systems. Accordingly, we believe a new Reliability Standard can be developed to address stable power swings.

109. With regard to the Trade Associations' request for clarification concerning which relays the Commission's directive are to apply to and which non-differentiating relays must be phased out, we leave this to the discretion of the ERO and will evaluate the Reliability Standard at the time it is filed. As stated in Order No. 733, the ERO has the

¹²² Order No. 693, FERC Stats. & Regs. ¶ 31,242 at P 187.

flexibility to propose an alternative solution. Specifically, we stated that “while we direct the ERO to develop a Reliability Standard that phases out such relays where necessary if they do not meet the reliability goal, the ERO is free to develop an alternative solution to our reliability concerns regarding undesirable relay operation due to stable power swings, provided that it is an equally effective and efficient approach.”¹²³ Such flexibility also applies to the class of protection systems subject to the new standard: “We leave it to the ERO to determine the appropriate protection systems to be discussed in the new Reliability Standard through application of its technical expertise.”¹²⁴ It is our view that these statements provide the clarification that Trade Associations requests.

110. As reported in the Blackout Report and discussed in the NOPR, despite the loss of fourteen key transmission lines, the Task Force found that during the August 2003 Blackout, the system did not become dynamically unstable until at least the Thetford Jewell 345 kV line tripped at 16:10:38 EDT.¹²⁵ Up until this point during the 2003 blackout, with each dynamic, but stable, power swing, the transmission system recovered and appeared to stabilize. As the power swings and oscillations increased in magnitude, however, zone 3/zone 2 and other relays reacted as though there was a fault in their protective zone even though there was no fault. These relays were not able to

¹²³ Order No. 733, 130 FERC ¶ 61,221 at P 169.

¹²⁴ *Id.* P 167.

¹²⁵ Blackout Report at 82-83.

differentiate the levels of currents and voltages that the relays measured, because of their settings, and consequently operated unnecessarily.

111. The Commission's directive pertains to conditions in which relays misoperate due to stable power swings that were identified as propagating the cascade during the August 2003 Blackout. In light of this, we do not agree with EEI's assertion that the Commission's position to address stable power swings is not supported by findings from the Blackout Report.

112. We also believe that EEI's claim that relays cannot distinguish between actual faults and stable power swings appears to ignore the fact that there are protection system applications currently in use for such purposes, i.e., "power swing block" applications that are applied to block tripping of distance relay elements during stable power swings.¹²⁶ Therefore, with existing technologies and appropriate applications of protective systems, relays can be set to avoid tripping during the predictable, stable power swings such as can occur as a result of Category B and Category C events.¹²⁷

113. Dominion raises a technical and implementation concern regarding a standard that is not yet developed. In the Final Rule, the Commission directed NERC, Dominion, and

¹²⁶ Report to the Power System Relaying Committee of the IEEE Power Engineering Society, IEEE PSRC WG D6, *Power Swing and Out-of-Step Considerations on Transmission Lines* (2005), available at [http://www.pes-psrc.org/Reports/Power %20Swing%20and%20OOS%20Considerations%20on%20Transmission%20Lines%20F..pdf](http://www.pes-psrc.org/Reports/Power%20Swing%20and%20OOS%20Considerations%20on%20Transmission%20Lines%20F..pdf).

¹²⁷ *Id.*

other affected stakeholders to work together towards a solution to this issue and submit it for review by the Commission,¹²⁸ and we will review the matter at that time.

Requirement R1.10

Order No. 733

114. Sub-requirement R1.10 of PRC-023-1, as approved by the Commission, addresses transformer fault protection relays and transmission line relays on transmission lines that terminate in a transformer. It requires that the transformer fault protection relays and transmission line relays do not operate at or below the greater of 150 percent of the applicable maximum transformer name-plate rating, including the forced cooled ratings corresponding to all installed supplemental cooling equipment, or 115 percent of the highest owner-established emergency transformer rating. Such protection relay settings would allow the transformer to be subjected to overloads higher than its established ratings for unspecified periods. For this reason, the Commission directed the ERO to modify sub-Requirement R1.10 so that it requires entities to verify that the limiting piece of equipment is capable of sustaining the anticipated overload for the longest clearing time associated with the fault.

Rehearing Request

115. EEI argues that requiring companies to verify that equipment is capable of withstanding an anticipated overload for the longest clearing time associated with that

¹²⁸ *Id.* P 150.

overload suggests both safety and liability issues rather than a reliability issue, and as such, is beyond the Commission's authority.¹²⁹ It also notes that the Commission offers no technical analysis or evidence to support its statement that failure to apply the system protections it proposes will result in a degradation of reliability.¹³⁰ EEI finds the terms of the directive to be susceptible to various understandings and hence ambiguous. It requests clarification that mitigation of thermal overload is beyond the scope of PRC-023-1.

116. The Trade Associations comment that it is in the TPL Reliability Standards where comparisons of facility ratings to reasonable worst case system conditions are made.¹³¹ For this reason, they request that the Commission withdraw its directive, or at least relax it so that it can be satisfied through the TPL Reliability Standards, not PRC-023-1. The Trade Associations also assert that, instead of deferring to the ERO's technical expertise, the Commission substituted its own judgment and in so doing, reveals flawed analysis. For instance, in denying the adequacy of IEEE standards, the Commission offers the example of faults on the low side of a transformer in instances where there is no breaker on the high side of the transformer. The Trade Associations assert that such a relay, in most cases, will be protecting the distribution system, not the Bulk-Power System. In the

¹²⁹ EEI at 19.

¹³⁰ *Id.* at 20.

¹³¹ Trade Associations at 25.

few instances where the relay is not protecting the distribution system, there will be a transfer trip scheme in place obviating the need for a modification required by Order No. 733.¹³² Lastly, the Trade Associations assert that “the longest clearing time associated with the fault” may not be the worst case. The worst case is usually the highest fault current which has the fastest clearing time.¹³³

Commission Determination

117. We deny rehearing and provide the following clarification. Sub-requirement R1.10 applies to the topology where there is no breaker installed on the high-voltage side of the transformer. Because of this configuration, faults within the transformer or at the low-voltage side of the transformer are cleared by tripping the remote breaker on the transmission line and the transformer low-voltage breaker. Faults on the low-voltage side of the transformer will generally be lower in magnitude as measured at the remote breaker due to the large impedance of the transformer. Fault protection relays set at 150 percent of the transformer nameplate rating or 115 percent of the highest operator established emergency transformer rating may be set too high to operate for faults on the low-voltage side of the transformer. Consequently, delayed clearing of faults (i.e., the longest clearing time associated with the faults) from the high-voltage side of the transformer may occur and subject the transformer to through-currents higher than the

¹³² *Id.* at 24.

¹³³ *Id.* at 25.

transformer's rating. Overcurrent relays used for transformer protection have a limited ability to detect these types of faults because they are set above the maximum load current for entities that set these relays following the IEEE Standards.¹³⁴

118. EEI's assertion that the Commission's directive was motivated by safety and liability concerns rather than by reliability issues was explicitly rejected in Order No. 733.¹³⁵ The Commission's concern was not to guard against the thermal overload of transmission facilities. Rather, the reliability concern is ensuring that the longest clearing time associated with the protection systems respects the facility's operating limits in order to assure that a contingency could not result in additional facilities failing. As discussed in the Final Rule, protection systems that do not respect the actual or verified capability of the limiting facility will result in a degradation of system reliability. In this instance, applying sub-Requirement R1.10 without regard to the topology and capability of each transformer could cause the transformer to fail. Failure of the transformer may not be limited to only the affected transformer, but may also affect other Bulk-Power Systems elements in its vicinity, further degrading the reliability of the Bulk-Power System.¹³⁶ The Commission's directive seeks to efficiently ensure that elements of the Bulk-Power System are operated within their appropriate capabilities.

¹³⁴ Order No. 733, 130 FERC ¶ 61,221 at P 206.

¹³⁵ *Id.* P 204.

¹³⁶ *Id.* P 210.

119. The Commission also rejects EEI's assertion that the Final Rule provides no support for its statement that failure to follow the Commission's directive will result in the degradation of reliability. As discussed in the Final Rule, Requirement R1.10 is applicable to a system configuration with no breaker installed on the high-voltage side of the transformer.¹³⁷ Transformers subject to PRC-023-1 in this configuration would not typically include a step-down transformer since the majority of distribution systems are not in excess of 100 kV, and the Standard is applicable to transformers with low voltage terminals connected at 100 kV to 200 kV if designated by the planning coordinator. With the exception of local distribution systems in excess of 100 kV, the applicable transformers are autotransformers between different Bulk-Power System voltages, with many being rated at 300 MVA or larger. Faults within the autotransformer, or at the low-voltage side of the autotransformer, are cleared by tripping the remote breaker on the transmission line and the transformer lower-voltage breaker.¹³⁸ Order No. 733 also explained that because faults on the lower-voltage side of the transformer will generally be lower in magnitude as measured at the remote breaker due to the large impedance of the transformer, fault protection relays set applying Requirement R1.10 may be set too low to operate for faults on the low-voltage side of the transformer. Consequently,

¹³⁷ *Id.* P 206.

¹³⁸ *Id.*

delayed clearing of faults from the high-voltage side of the transformer may occur and subject the transformer to overloads higher than the transformer's rating.

120. In Order No. 733, the Commission stated that “[f]ailure of the transformer may not be limited to only the affected transformer, but may also affect other Bulk-Power System elements in its vicinity, further degrading the reliability of the Bulk-Power System” as would be expected with a failure of a large autotransformer between different Bulk-Power System voltages.¹³⁹ In addition, the replacement due to a failure of such a transformer could require a long lead-time, prolonging the Bulk-Power System's return to the level of reliability that preceded the failure.

121. With regard to EEI's claim that the terms “verify” and “longest clearing time associated with a fault” are ambiguous, we understand that protection systems are designed to remove faults quickly. However, the Commission's use of the phrase “longest clearing time” is in the context of the design and coordination of protection systems, where the “longest clearing time” refers to the longest time that a fault could remain on the Bulk-Power System before it is cleared by a protection system. This context is not the same as that of a “worst case” that the Trade Associations discuss in their argument. Because the directive is in the context of coordination of protection systems, the Commission expects the verification to be undertaken in the same context. That is to say, the verification that the longest clearing time associated with the protection

¹³⁹ *Id.* P 210.

system respects the facility's operating limits must be done in the context of the design and coordination of protection systems.

122. The Commission addressed its concerns regarding the gaps in reliability created by over-reliance on the IEEE Standard C37.91-2008, IEEE Guide for Protecting Power Transformers, in the Final Rule.¹⁴⁰ The Trade Associations challenge one of the Commission's reservations regarding those standards by asserting that in the very few cases where such relays are not protecting the distribution system, there will be a transfer trip scheme in place to address the Commission's concern. We are not persuaded. There are no specific requirements for a transfer trip scheme in this or other Reliability Standards. The Trade Associations' assertion also assumes that all entities have communications systems installed and are using them for this protection scheme, which may not be the case, nor is it a specific requirement of the Reliability Standards.

123. Order No. 733 does not, as the Trade Associations argue, require the development of facility ratings; facility ratings are established in the Facilities Design, Connections,

¹⁴⁰ *Id.* P 206, 208-209. For example, (1) delayed clearing of faults (i.e., the longest clearing time associated with the faults) from the high-voltage side of the transformer may occur and subject the transformer to overloads, (2) an entity could provide a facility rating that was just within the voluntary requirements in the IEEE standards, however, when setting protection relays according to sub-Requirement R1.1, the transformer could be subject to currents above its capability as previously described, (3) the IEEE Standards may not apply to transformers manufactured before 1993 because the guidelines established in C57.109-1993 do not apply to transformers manufactured before 1993, and (4) a setting of 150 percent of the transformer nameplate rating or 115 percent of the highest operator established emergency rating may not always be less than 200 percent of the transformer forced-cooled nameplate rating.

and Maintenance (FAC) Reliability Standards. Order No. 733 also does not require the comparison of facility ratings that the Trade Associations also claim is covered by the TPL Reliability Standards. Order No. 733 requires that the longest clearing time associated with the protection systems applied to protect the transmission facility respects that facility's operating limits.¹⁴¹ For example, if the facility has an appropriate duration short time rating, that rating could provide the operating limit.

124. In our review of Reliability Standard PRC-023-1, we identified that sub-Requirement R1.10 raised the concern that overloading facilities at any time, but especially during system faults, could lower reliability.¹⁴² To address that gap in the standard, the Commission directed the ERO to modify the sub-requirement so that it requires entities to verify that the limiting piece of equipment is capable of sustaining the anticipated overload for the longest clearing time associated with the fault. We believe this to be a reasonable way to address the perceived gap in the Reliability Standard's goal of enhancing reliability. But, as it did here, whenever the Commission directs the ERO to modify PRC-023-1 in a specific manner, we will accept an alternative method that addresses the concern identified by the Commission provided that the ERO demonstrates that the alternative will adequately address the Commission's underlying concern or goal as efficiently and effectively as our own proposal.

¹⁴¹ *Id.* P 203.

¹⁴² *Id.* P 191.

Attachment A Section 3.1**Order No. 733**

125. Attachment A of PRC-023-1 specifies which protection systems are subject to, and which are excluded from, the Standard's Requirements. Section 3 of the Attachment expressly excludes systems specified in sections 3.1 through 3.9, and specifically excludes relay elements that are only enabled when other relays or associated systems fail. In Order No. 733, the Commission directed the ERO to remove the exclusion of these supervisory relays from section 3 and to revise section 1 of Attachment A to include supervisory relay elements on the list of relays and protection systems that are specifically subject to PRC-023-1. A supervisory relay acts as a check on the supervised protection system because both must operate to trip a facility. The Commission is concerned that if supervisory relays are not subject to the Reliability Standard, then they may be set below the rating of the protected element. If that were to happen, high loading conditions can cause such relays to be continuously energized and ready to operate, and the supervisory relays will no longer act as a check on the protection systems they are supervising. This threat to reliability underlies our directive on this matter.

Rehearing Request

126. Petitioners argue that the Commission's directive to subject all supervisory relays to PRC-023-1 is overly broad. The Trade Associations comment that no purpose is served by including supervisory relays if the supervised protection system already meets

PRC-023-1 loadability requirements.¹⁴³ They assert the example given by the Commission is inappropriate and explain that as long as either the tripping relay or the supervisory relay meets PRC-023-1, then the protection system as a whole will meet the Standard. The Trade Associations request clarification to allow NERC to add supervisory relay elements to section 1 with a caveat that supervisory relay elements only need to meet the loadability requirements if the protection system they are supervising is responsive to load and does not meet the loadability requirement.

127. EEI argues that the Commission's directive would be detrimental to reliability because increases to dependability take place largely at the expense of security since relays will trip more often.¹⁴⁴ As an example, EEI poses the need for an operational decision to open breakers for loss of potential, as opposed to the operator likely leaving the element in service with fast tripping enabled for a fault as could be the case if section 3.1 of Attachment A continues to be exempted from Reliability Standard PRC-023-1. In complex protective schemes dependability and security tend to be mutually exclusive, so EEI requests clarification of the Commission's statement in Order No. 733 that protective relays must be dependable and secure.¹⁴⁵ It points out that engineers have been biased

¹⁴³ Trade Associations at 26.

¹⁴⁴ EEI at 21.

¹⁴⁵ *Id.* (citing Order No. 733, 130 FERC ¶ 61,221 at P 269).

toward dependability to ensure the safety of people and equipment and that the exclusions in section 3.1 of Attachment A appropriately reflect that bias.

128. Dominion comments that the Commission's requirement would include some supervisory relay functions for which allowance of the full emergency line loading limit is not practical or, in many cases, even attainable.¹⁴⁶ It further asserts the application of the Reliability Standard to supervisory relays is too complex for a rulemaking proceeding by the Commission, and instead the ERO should be directed to consider which supervisory relays should be covered by the Standard and to explain the basis for excluding any relays from that coverage.

Commission Determination

129. We deny the Trade Associations' request for clarification and disagree with their statement that no purpose is served by including supervisory relays if the supervised protection system already meets PRC-023-1 loadability requirements. The Commission is concerned that reliability is compromised by excluding supervisory relays from the requirements of PRC-023-1 as the exclusion can result in supervisory relays set below the rating of the protected element. This can result in a relay being energized and ready to operate upon high loading conditions and thus no longer serving as a check on the other protection system.¹⁴⁷ The failure of a communication element during a period of high

¹⁴⁶ Dominion at 5.

¹⁴⁷ Order No. 733, 130 FERC ¶ 61,221 at P 150.

loadability can result in the protected facility tripping, even when the line continues to carry its normal load current. For example, a pilot wire current differential scheme that measures the difference of the current entering and exiting a line would not be subject to the loadability issues addressed by PRC-023-1 as long as the communications facilities are available and operate as designed. However, if the communications facilities fail to operate, normal load current would result in the tripping of the current differential scheme if the supervisory relays are not set to consider loadability, contrary to the Trade Associations' assertion that, as long as either the tripping relay or the supervisory relay meets PRC-023-1, the protection system as a whole will meet the Standard.

130. We also disagree with EEI that the Commission's directive would be detrimental to reliability. We understand that "dependability" and "security" are not additive features of protection relaying, and due considerations are given to both aspects by protection engineers in coming up with protection systems without biasing or sacrificing one aspect over the other. EEI argues, however, that factors of ensuring the safety of people and equipment are biased towards ensuring dependability (i.e., circuits will trip even when no fault has occurred) and hence the exclusions in section 3.1 of Attachment A. The Commission does not believe there is a need to make a compromise in this instance between reliability and the safety of people and equipment. The Commission expects the performance of the protection system necessary to achieve Reliable Operation of the Bulk-Power System to be accomplished with the operation of the backup protection system. Reliable Operation may not be achieved if facilities trip out for a failure of a

communication channel or switching or potential sources supplying protection systems. When the Commission used the terms “dependable” and “secure” in the Final Rule, we used them in the same context as those terms are used in the industry;¹⁴⁸ not as absolutes. Rather than a protection system that is 100 percent secure and 100 percent dependable, the Commission intended to convey a protection system that has a measure of dependability and security that collectively ensure reliability.

131. EEI also argues that because the loss of voltage input or a failed communication channel is rare, it would be better to trip for these non-fault conditions rather than risk not tripping for another condition because certain elements of the protection system are set according to the requirements of PRC-023-1. We disagree. Communication channel interruptions can be expected, and such an interruption in communications has resulted in multiple outages due to supervisory relays set too low, i.e., not set to consider transmission loadability.¹⁴⁹ As discussed in Order No. 733, a protection relay, as an integral part of the Bulk-Power System, must not operate during non-fault conditions, regardless of how few times the relay may actually operate.¹⁵⁰

132. Dominion’s concern with load-responsive phase protective and supervisory relays is specific to one of the thirteen criteria established under Requirement R1, specifically

¹⁴⁸ *Id.* P 269 n.186.

¹⁴⁹ *Id.* P 268.

¹⁵⁰ *Id.* P 269.

Requirement R1.5. This Requirement establishes relay setting requirements for the system configuration for “relays applied on weak source systems so they do not operate at or below 170 percent of the maximum end-of-line three phase fault magnitude (expressed in amperes).” Dominion identifies, in some parts of its system, the system configuration described by Requirement R1.5, i.e., where Dominion has weak sources where the range of possible fault currents is close to or below the emergency line loading value. While, in general, the Commission’s discussion in the Final Rule referred to relay setting criteria as described in Requirement R1.1 (highest seasonal Facility Ratings) and Requirement R1.2 (15-minute Facility Rating) the Commission’s use of the phrase “rating of the line” is in the context of the specific criteria established in each of the requirements and not the “emergency loading limit” of the line as Dominion asserted.¹⁵¹ As identified by the Commission and stated by Dominion, to achieve Reliable Operation, it is essential to have workable settings with both the phase relays and the supervisory relays such that they operate as desired, i.e., tripping for faults but not on loadability. Therefore, we clarify that the desired performance, as reflected in the setting of the supervisory relay, is dependent upon which criteria under Requirement R1 is applicable to the specific topology.

133. Dominion further argues that setting the supervisory overcurrent relay over the emergency rating of the line is not necessary because the impedance relay with which it

¹⁵¹ Dominion, Attachment A, at 3.

works will permit such emergency loading, i.e., not operate and trip the transmission line. As discussed in Order No. 733, and previously in this section, the Commission is concerned with supervisory relays set below the rating of the line being continuously energized and thus no longer able to act as a check on the protection system the relays are supervising. The ERO proposed, and the Commission approved, subjecting overcurrent relays to the requirements of PRC-023-1. Each of Dominion's arguments raised here can be addressed through the ERO's Reliability Standards development process. It is our expectation that such technical disagreements will either be resolved through that process.

134. The ERO did not provide any technical rationale for excluding any load-responsive phase protection systems from the requirements of PRC-023-1. Having directed the ERO to modify PRC-023-1 in a specific manner, we will accept an alternative method that addresses the Commission's concern provided such alternative is demonstrably adequate in addressing the Commission's underlying concern as efficiently and effectively as the Commission's proposal.

Regulatory Flexibility Act of 1980**Order No. 733**

135. The Regulatory Flexibility Act of 1980 (RFA)¹⁵² generally requires a description and analysis of final rules that will have significant economic impact on a substantial number of small entities. The RFA mandates consideration of regulatory alternatives that accomplish the stated objectives of a proposed rule and that minimize any significant economic impact on a substantial number of small entities. The Small Business Administration's (SBA) Office of Size Standards develops the numerical definition of a small business.¹⁵³ The SBA has established a size standard for electrical utilities, stating that a firm is small if, including its affiliates, it is primarily engaged in the transmission, generation and/or distribution of electric energy for sale and its total electric output for the preceding twelve months did not exceed four million megawatt hours.¹⁵⁴

136. In Order No. 733, the Commission departed from the "rule-out" approach proposed in the NOPR to determine the 100 kV to 200 kV facilities that would be subject to the Standard in favor of an "add-in" approach.¹⁵⁵ To address comments regarding the number of small entities affected by PRC-023-1, the Commission stated that, as of the

¹⁵² 5 U.S.C. §§ 601-612 (2006).

¹⁵³ 13 C.F.R. § 121.101 (2010).

¹⁵⁴ 13 C.F.R. § 121.201, Sector 22 Utilities & n.1 (2010).

¹⁵⁵ Order No. 733, 130 FERC ¶ 61,221 at P 340.

November 30, 2009 NERC Compliance Registry, 1,301 registered entities perform activities subject to PRC-023-1.¹⁵⁶ Of the 1,301 entities, only 80 qualify as “small entities.”¹⁵⁷ The Commission concluded that the final rule would not have a “significant impact on a substantial number of small entities.”¹⁵⁸

Rehearing Requests

137. EEI asserts that the Commission erred in certifying that Order No. 733 will not have a significant economic impact on a substantial number of small entities.¹⁵⁹ The Reliability Standard, EEI argues, will force a substantial number of small entities to employ engineers and make capital expenditures, resulting in significant costs to small entities. EEI supports its assertion with estimates of the personnel and capital costs that it believes will be incurred. It believes that approximately 200 planning and relay engineers will be required to perform studies and tests to make determinations regarding the applicability of PRC-023-1. It quotes a cost of approximately \$33 million for these engineering personnel alone, and adds to that another \$33 million for expenditures such as office space, technical equipment, and supporting personnel.

¹⁵⁶ *Id.* P 341.

¹⁵⁷ *Id.* P 343.

¹⁵⁸ *Id.* P 344.

¹⁵⁹ EEI at 22.

138. The Trade Associations also take issue with the Commission's conclusion regarding the applicability of the RFA.¹⁶⁰ First, the Trade Associations argue that the Commission erred in excluding entities that owned only generation facilities from the pool of entities that may be subject to PRC-023-1. They argue that the Commission has failed to account for its directive to NERC to develop a new loadability standard for generator step-up transformers. Second, the Trade Associations assert that approximately 253 small entities are subject to PRC-023-1, in lieu of the 80 as described in the Final Rule. In providing the quantity of 253, they did not name the specific entities included in this figure.

Commission Determination

139. The Commission rejects the estimates, alleged by EEI, of resources and personnel required to comply with PRC-023-1. First, as presented in the Final Rule, only 12 percent of those entities estimated to be subject to PRC-023-1 are small entities. Second, the estimated number of technicians, their salaries, and miscellaneous support costs like office space alleged by EEI are, as EEI states, "based upon the collective experience and engineering expertise of EEI's membership," but EEI fails to provide any specific or generally accepted source for this information. Accordingly, EEI has provided no basis for us to reconsider our estimates.

¹⁶⁰ Trade Associations at 28.

140. The Commission also rejects the argument made by the Trade Associations that the add-in approach will cause a substantial number of small entities to be affected by PRC-023-1. The Trade Associations allege that the Commission cannot state that a substantial number of small entities will not be affected by PRC-023-1 because “nearly all 100+ kV facilities will be deemed operationally significant under appropriate tests.” The Trade Associations appear to misunderstand the applicability of the RFA. The RFA concerns itself with small entities as that term is defined in the Regulatory Flexibility Act,¹⁶¹ not with individual Bulk-Power System facilities. Because the Trade Associations are focusing on the size of the Bulk-Power System facility, and not the actual entity, we deny the Trade Associations’ request for rehearing on this issue.

141. Additionally, the Trade Associations argue that the Commission erred when it stated that entities that own only generation would not be subject to PRC-023-1. The Commission stands by its statement, as found in the Final Rule, that “no generator owner that is not also a transmission owner and/or a distribution provider will be subject to PRC-023-1.” Accordingly, the Commission was correct in limiting the number of entities that could be subject to PRC-023-1.

¹⁶¹ See Small Business Administration, *A Guide for Government Agencies, How to Comply with the Regulatory Flexibility Act 1* (Jun. 2010) (“The RFA applies to a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions”).

142. Finally, the Trade Associations allege that the Commission erred in stating that a maximum of 80 small entities are listed on the NERC Compliance Registry. The Trade Associations, in their comments, provided a figure of 253 small electric utilities. As previously explained in the Final Rule, to arrive at the Commission's quantity of 80, it compared the number of electric utility companies that qualify as small electric utilities (as found on the EIA-861 Database Year 2007) to the companies listed on the NERC Compliance Registry. This comparison revealed that only 80 entities that qualified as small entities were found on both lists. Although the Trade Association references EIA data, it is unclear which entities it includes in its 253 figure, and, without more information, the two numbers cannot be rectified. The Trade Associations have not provided a basis for us to reconsider our determination that the relevant number of entities is 80.

143. In conclusion, the Commission reaffirms its Final Rule determination that PRC-023-1 will not have a significant economic impact on a substantial number of small entities.

The Commission orders:

(A) The requests for rehearing are hereby granted, in part, and denied, in part, as discussed in the body of this order.

(B) The requests for clarification are hereby granted, as discussed in the body of this order.

(C) The request for an extension of time is hereby granted, as discussed in the body of this order.

By the Commission.

(S E A L)

Nathaniel J. Davis, Sr.,
Deputy Secretary.

Appendix 1

Generator Step-up and Auxiliary Transformers and Applicability to Backup Protection Systems

The following diagrams¹⁶² illustrate the two types of connections discussed in Order No. 733. Commenters' arguments are in reference to the connection depicted in Figure 1. The Commission's directive is in reference to the connection depicted in Figure 2.

Figure 1

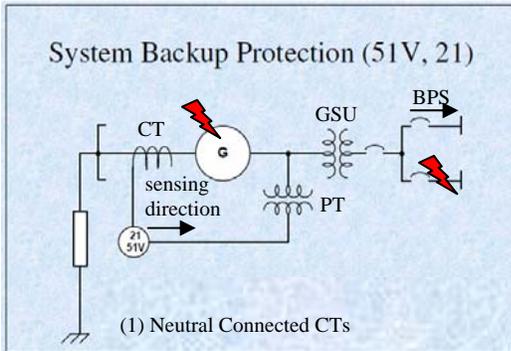
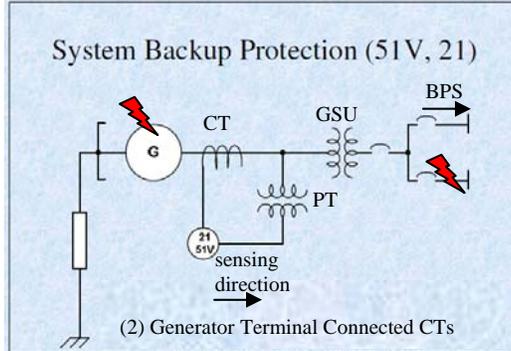


Figure 2



¹⁶² *Generator Control and Protection*, presented at Southern Illinois University Edwardsville, available at <http://www.ee.siu.edu/~smuren/ECE%20545%20Notes/Ch%2011%20-%20Generator%20Protection.pdf>