

Project 2015-10 Single Points of Failure

TPL-001

Cost Effectiveness

Known Outages FERC Order No. 786

FERC Order No. 786 Paragraph 40 directs a change to address the concern that the six month threshold could exclude planned maintenance outages of significant facilities from future planning assessments. See paragraphs 33-45 for the discussion on planned maintenance outages.

Overview of Commission Determination (Paragraphs 40-45)

The commission stated in Order No. 786 Paragraph 41:

- For the reasons discussed below, the Commission finds that planned maintenance outages of less than six months in duration may result in relevant impacts during one or both of the seasonal off-peak periods.
- Prudent transmission planning should consider maintenance outages at those load levels when planned outages are performed to allow for a single element to be taken out of service for maintenance without compromising the ability of the system to meet demand without loss of load.
- We agree with commenters such as MISO and ATCLLC that certain elements may be so critical that, when taken out of service for system maintenance or to facilitate a new capital project, a subsequent unplanned outage initiated by a single-event could result in the loss of non-consequential load or may have a detrimental impact to the bulk electric system reliability.
- A properly planned transmission system should ensure the known, planned removal of facilities (i.e., generation, transmission or protection system facilities) for maintenance purposes without the loss of non-consequential load or detrimental impacts to system reliability such as cascading, voltage instability or uncontrolled islanding.

The Commission Disagreed with the following:

- Order No. 786 Paragraph 44: The existing TPL-001-4 for Category P3 covers generator maintenance outages, Category P6 covers transmission maintenance outages.
- Order No. 786 Paragraph 45: Planned outages of less than one year in duration should be addressed operationally by determining new operating limits and taking other actions to mitigate the planned outage.
- Order No. 786 Paragraph 45: Planned outages of less than six months is unnecessary since...10 year time frame.

Options Considered By Standard Drafting Team to Satisfy FERC Order

The following options considered by the NERC Standard Drafting Team for Requirement R1 Part 1.1.2 include (refer to SAMS recommendations):

Current Option (Draft 3):

1.1. System models shall represent:

1.1.1. Existing Facilities.

1.1.2. Known outage(s) of generation or Transmission Facility(ies) scheduled in as selected in consultation with the Reliability Coordinator for the Near-Term Transmission Planning Horizon that are selected by the Transmission Planner and Planning Coordinator for analyses pursuant to Requirement R2, Parts 2.1.3 and 2.4.3 only. Selection shall be limited to known outages that meet each of the following:

1.1.2.1. for analyses pursuant to Requirement R2, parts 2.1.3 and 2.4.3 Expected to result in Non-Consequential Load Loss for P1 events in Table 1; and

1.1.2.2. Are not solely based upon the outage duration; and,

1.1.2.3. Are selected according to an established procedure or technical rationale which shall be available as supporting information.

1.1.2.1.1.3. New planned Facilities and changes to existing Facilities.

1.1.3.1.1.4. Real and reactive Load forecasts.

1.1.4.1.1.5. Known commitments for Firm Transmission Service and Interchange.

1.1.5.1.1.6. Resources (supply or demand side) required for Load.

Previous Option Selected (Draft 2):

Requirement R1, Part 1.1.2 Known outages(s) of generation or Transmission Facility(ies) with duration of at least ~~six~~ four months and any other significant planned outages of generation or Transmission Facility(ies) with a duration of less than four months that are expected to produce more severe System impacts on its portion of the BES. These-This outage coordinations are-is required to be performed for the season/load-levels that outages are normally planned at and shall be performed only in the Near-Term Transmission Planning Horizon.

Standard Drafting Team Proposal for Requirement R1 Part 1.1.2

The SDT did not feel like a time duration alone would capture “significant outages”. Additionally, the language allows PC’s to develop a process for selecting “significant outages” to be studied in the Near-Term Transmission Planning Horizon.

Single Point of Failure of the Protection System

Based on Order No. 754 directive of September 15, 2011; NERC informational filing dated March 15, 2012; Section 1600 data request; and the 2nd NERC informational filing dated October 30, 2015, the SPCS/SAMS report to address the concern of Single Point Of Failure of a protection system:

- For Table 1 – Steady State & Stability Performance Planning Events, Category P5:
 - Replace “relay” with “component of a Protection System,” and
 - Add superscript “13” to reference footnote 13 for the replaced term under the “Category” column.
- For Table 1 – Steady State & Stability Performance Extreme Events, under the Stability column, No. 2:
 - Remove the phrase “or a relay failure¹³” from items a, b, c, and d to create distinct events only for stuck breakers.
 - Append four new events for the same items a, b, c, and d in the above bulleted item to create distinct events replacing “a relay failure¹³” with “a component failure of a Protection System¹³.”
- Replace footnote 13 in TPL-001-4 with, “The components from the definition of “Protection System” for the purposes of this standard include (1) protective relays that respond to electrical quantities, (2) single-station DC supply that is not monitored for both low voltage and open circuit, with alarms centrally monitored (i.e., reported within 24 hours of detecting an abnormal condition to a location where corrective action can be initiated), and (3) DC control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.”¹
- Modify TPL-001-4 (Part 4.5) so that extreme event assessments must include evaluation of the three-phase faults with the described component failures of a Protection System¹³ that produce the more severe system impacts. For example, add a new second sentence that reads “[t]he list shall consider each of the extreme events in Table 1 – Steady State & Stability Performance Extreme Events; Stability column item number 2.”

Revision By Standard Drafting Team to Satisfy FERC Order

Since some of the recommendations from the SPCS and SAMS report were so specific, there were no other options considered for the following:

- For Table 1 – Steady State & Stability Performance Planning Events, Category P5:
 - Replace “relay” with “component of a Protection System,” and
 - Add superscript “13” to reference footnote 13 for the replaced term under the “Category” column.
- For Table 1 – Steady State & Stability Performance Extreme Events, under the Stability column, No. 2:
 - Remove the phrase “or a relay failure” from items a, b, c, and d to create distinct events only for stuck breakers.

- Append four new events for the same items a, b, c, and d in the above bulleted item to create distinct events replacing “a relay failure” with “a component failure of a Protection System.”

Different options were considered for footnote 13 language.

Current Option Footnote 13 (Draft 3)

1. For purposes of this standard, non-redundant components of a Protection System to consider are as follows:
 - A single protective relay which responds to electrical quantities, without an alternative (which may or may not respond to electrical quantities) that provides comparable Normal Clearing times, ~~e.g. sudden pressure relaying~~;
 - A single communications system, necessary for correct operation of a communication-aided ed protection scheme required for Normal Clearing, which is not monitored or not reported at a Control Center;
 - A single station dc supply associated with protective functions required for Normal Clearing, and that single station dc supply is not monitored or not reported at a Control Center for both low voltage and open circuit;
 - A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions through and including the trip coil(s) of the circuit breakers or other interrupting devices required for Normal Clearing.

Previous Option Footnote 13 (Draft 2)

The previous option was to have footnote 13 list four of the five components of a protection system but limit “communications systems” to only those that are not monitored or alarmed. The following is language for Footnote 13¹:

13. For the purposes of P5 of this standard, components of a Protection System include the following:
 - a. A single protective relay which responds to electrical quantities, without an alternative that provides comparable Normal Clearing times, e.g. sudden pressure relaying;
 - b. A single communications system, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing, which is not monitored or not reported;
 - c. A single dc supply associated with protective functions, and that single station dc supply is not monitored or not reported for both low voltage and open circuit;
 - a-d. A single control circuitry associated with protective functions including the trip coil(s) of the circuit breakers or other interrupting devices.

Standard Drafting Team Proposal for Table 1 Footnote 13:

¹ Failure of voltage and current sensing device would result in a breaker operation without a fault which was considered not a reliability risk to the BES.

The Standard Drafting Team added clarifications to the previous draft option which expands Protection System components to be considered to determine the impact to the BES if that component failed when a fault occurs.

Extreme Events and P8 Category:

The SPCS and SAMS report for Order No. 754 recommended that three phase faults involving single points of failure of a protection system be addressed. Additionally, the standard drafting team recognized that the Order No. 754 data requirement collected data for a three-phase fault and not a single-line-ground fault. The Order No. 754, Section 1600 data collection and report indicated a risk to the BES for three phase faults followed by single points of failure of a protection system. Therefore, the SDT decided to make Category P8 planning event if a three-phase fault following by a single points of failure resulted in Cascading or instability.

Revision By Standard Drafting Team to Satisfy FERC Order

Current Option (Draft 3):

~~4.2. Studies shall be performed to assess the impact of the extreme events which are identified by the list created in Requirement R4, Part 4.5. If the analysis concludes there is Cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event (s) shall be conducted. Table 1 Addition Category P8: "Interruption of Firm Transmission Serviced Allowed for EHV and HV, however a CAP is required if Cascading or instability occurs.~~

~~4.2.1. If the analysis concludes there is Cascading caused by the occurrence of extreme events, excluding extreme events 2e-2h in the stability column, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event(s) shall be conducted.~~

~~4.2.2. If the analysis concludes there is Cascading caused by the occurrence of extreme events 2e-2h in the stability column, an evaluation of possible actions designed to prevent the System from Cascading shall:~~

~~4.2.2.1. List System deficiencies, the associated actions needed to prevent the System from Cascading, and the associated timetable for implementation List System deficiencies, the associated actions, and an associated timetable for implementation needed to prevent the System from Cascading.~~

~~4.2.2.2. Be reviewed in subsequent annual Planning Assessments for continued validity and implementation status.~~

Previous Option (Draft 2):

4.2. Studies shall be performed to assess the impact of the extreme events which are identified by the list created in Requirement R4, Part 4.5.

- 4.2.1. If the analysis concludes there is Cascading caused by the occurrence of extreme events, excluding extreme events 2e-2h in the stability column, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences of the event(s) shall be conducted.
- 4.2.2. If the analysis concludes there is Cascading caused by the occurrence of extreme events 2e-2h in the stability column, an evaluation of possible actions designed to prevent the System from Cascading shall:
 - 4.2.2.1. List System deficiencies, the associated actions needed to prevent the System from Cascading, and the associated timetable for implementation~~List System deficiencies, the associated actions, and an associated timetable for implementation needed to prevent the System from Cascading.~~
 - 4.2.2.2. Be reviewed in subsequent annual Planning Assessments for continued validity and implementation status.

Standard Drafting Team Proposal

The standard drafting team feels that there is a reliability risk to the BES if Cascading or instability results in a three-phase fault followed by single point of failure of a protection system. There was confusion in the industry with the language that was similar to a CAP but not exactly a CAP. Therefore, the standard drafting team decided to create a P8 planning event which required a CAP if Cascading or instability occurs.