

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.

Standard Drafting Team (SDT) Proposal for Known Outages

The SDT did not feel like a time duration alone would capture “significant outages.” Additionally, the language allows TP’s and PC’s to develop a process for selecting “significant outages” to be studied in the Near-Term Transmission Planning Horizon utilizing their knowledge or other study results to aid in determination of significant outages. The team removed Requirement R1, Part 1.1.2. The team has modified Requirement R2, Parts 2.1.4 and 2.4.4 as show below. Please not that Requirement R2, Parts 2.1.4 and 2.4.4 were respectively, 2.1.3 and 2.1.4. The SDT has re-organized the Requirements to provide a better flow.

Proposed Revisions (Draft 4):

R1. Each Transmission Planner and Planning Coordinator shall maintain System models within its respective area for performing the studies needed to complete its Planning Assessment. The models shall use data consistent with that provided in accordance with the MOD-032 standard, supplemented by other sources as needed, including items represented in the Corrective Action Plan, and shall represent projected System conditions. This establishes Category P0 as the normal System condition in Table 1. [*Violation Risk Factor: High*] [*Time Horizon: Long-term Planning*]

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 the Near-Term Transmission Planning Horizon selected for analyses pursuant to Requirement R2, Parts 2.1.3 and 2.4.3 only. Known outage(s) shall be selected according to an established procedure or technical rationale that, at a minimum:~~

~~1.1.1.1. Includes known outage(s) that are expected to result in Non-Consequential Load Loss for P1 events in Table 1 when concurrent with the selected known outage(s); and~~

~~1.1.1.2. Does not exclude known outage(s) solely based upon the outage duration.~~

~~1.1.3.1.1.2.~~ 1.1.2. New planned Facilities and changes to existing Facilities.

~~1.1.4.1.1.3.~~ 1.1.3. Real and reactive Load forecasts.

~~1.1.5.1.1.4.~~ 1.1.4. Known commitments for Firm Transmission Service and Interchange.

~~1.1.6.1.1.5.~~ 1.1.5. Resources (supply or demand side) required for Load.

Requirement R2, Parts 2.1.4 and 2.4.4 (Draft 4)

2.1.4. When known outage(s) of generation or Transmission Facility(ies) are planned in the Near-Term Planning Horizon, the impact of selected known outages on System performance shall be assessed. These known outage(s) shall be selected for assessment consistent with a documented outage coordination procedure or

technical rationale by the Planning Coordinator or Transmission Planner. Known outage(s) shall not be excluded solely based upon outage duration. The assessment shall be performed for the P0 and P1 categories identified in Table 1 with the System peak or Off-Peak conditions that the System is expected to experience when the known outage(s) are planned. This assessment shall include, at a minimum known outages expected to produce more severe System impacts on the Planning coordinator or Transmission Planners’s portion of the BES. Past or current studies may support the selection of known outage(s), if the study(s) has comparable post-Contingency System conditions and configuration such as those following P3 or P6 category events in Table 1.

2.4.4. When known outage(s) of generation or Transmission Facility(ies) are planned in the Near-Term Planning Horizon, the impact of selected known outages on System performance shall be assessed. These known outage(s) shall be selected for assessment consistent with a documented outage coordination procedure or technical rationale by the Planning Coordinator or Transmission Planner. Known outage(s) shall not be excluded solely based upon outage duration. The assessment shall be performed for the P1 categories identified in Table 1 with the System peak or Off-Peak conditions that the System is expected to experience when the known outage(s) are planned. This assessment shall include, at a minimum, those known outages expected to produce more severe System impacts on the Planning Coordinator or Transmission Planner’s portion of the BES. Past or current studies may support the selection of known outage(s), if the study(s) has comparable post-Contingency System conditions and configuration such as those following P3 or P6 category events in Table 1.

Single Point of Failure of the Protection System (Footnote 13)

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 System Protection and Control Subcommittee (SPCS) and System Analysis and Modeling Subcommittee (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.”

Revisions by the SDT to Satisfy FERC Order

The recommendations from the SPCS and SAMS report were so specific, there were no other options considered. The SDT has made revisions for further clarification based on team discussion and industry comment.

Proposed Revision (Draft 4)

13. For purposes of this standard, non-redundant components of a Protection System to consider are as follows:
- a. 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;
 - b. A single communications system associated with protective functions, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing (except a single communication system that is both ~~which is not~~ monitored ~~or not and~~ reported at a Control Center ~~shall not be considered non-redundant~~);
 - c. A single station dc supply associated with protective functions required for Normal Clearing, ~~and that~~(except a single station dc supply that is ~~not both~~ monitored ~~or not and~~ reported at a Control Center for both low voltage and open circuit ~~shall not be considered non-redundant~~);
 - d. A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices required for Normal Clearing (except a single trip coil that is both monitored and reported at a Control Center shall not be considered non-redundant).

SDT Proposal for Table 1 Footnote 13:

The SDT 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:

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. 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. The SDT decided to make this an Extreme Event if a three-phase fault following by a single points of failure resulted in Cascading or instability following industry comments.