 El Paso Electric	SYSTEM PLANNING	Document No.	SOCC-MET--004
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Methodology for Determining System Operating Limits for the Planning Horizon		Document Classification Internal Use	

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## Purpose


NERC requires registered entities to outline and provide its SOL Methodology for the Planning Horizon to its adjacent/neighboring Planning Authorities and the Reliability Coordinator. Additional recipients are to include any Planning Authority who has indicated a reliability need for the methodology, any Transmission Operator who operates any portion of EPE's Planning Authority Area, and any Transmission Planner working within EPE's Planning Authority Area. In response to NERC's governing Reliability Standard, EPE has documented its SOL Methodology for the Planning Horizon for the purposes of providing information to the above listed entities. EPE is registered as a Planning Authority, Transmission Operator and Transmission Planner, and there are no other Planning Authorities, Transmission Operators and/or Transmission Planners operating or working within its Planning Authority Area.

## Scope

This SOL Methodology and/or any updates will be distributed by EPE's System Planning personnel to its System Operations personnel, its adjacent/ neighboring Planning Authorities, and to its Reliability Coordinator.

## Introduction

This document describes EPE's methodology for determining SOLs and the subset of SOLs which qualify as an IROL for its planning horizon as required by the NERC Reliability Standard FAC-010 and WECC's procedures (typically extending beyond one year to a maximum of ten years) within EPE's Planning Authority Area.

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## Methodology for Determining System Operating Limits for the Planning Horizon

EPE determines its SOLs and IROLs utilizing computer simulations of the EPE's Facilities and/or Transmission Paths. In determining its SOLs and IROLs, EPE reviews such simulations, and categorizes operating limits for its Facilities and Transmission Paths based on their potential to serve as "system" operating limits by making the following initial inquiry:

- Does a particular facility or path limit serve as a limit to the EPE system under a specified system configuration, such that it serves as a *system* operating limit, or SOL?
  - If so, the limit is considered an SOL, and a further inquiry is made to determine whether the SOL has the potential to lead to instability, uncontrolled separation or Cascading Outages that adversely impact the reliability of the BES, such that it serves as an IROL.
  - If not, the limit is considered a Facility limit with the potential capability, under the specified system configuration, for the Facility to adversely impact EPE's local distribution of power, but without the potential to adversely affect the transfer of bulk power across the interconnected bulk electric transmission system and the reliability of the BES.

The limits of individual facilities and transmission paths are studied under various system configurations for their impact to the EPE system, the BES, and interconnections with its neighboring entities. When EPE develops system configurations for which it plans to operate under in the planning horizon, it categorizes its limits as (i) regional, (ii) system, or (iii) other/internal, depending upon their potential impacts. Specifically, the category limits are described as (i) limits with the potential to impact the BES on a regional level; (ii) limits with the potential to impact entities immediately adjacent to the EPE system and the transfer of bulk power across the interconnected system; or (iii) internal limits with no potential impact on interconnected entities and no potential to have significant impact on BES reliability and performance. A Facility Rating on an individual facility may be a SOL in the planning horizon under certain system configurations, but not every individual Facility Rating on every individual EPE facility is the most restrictive operating element *of the EPE system* under every system configuration. For purposes of FAC-010, EPE distributes to the RC and its neighboring Planning Authorities the Facility Ratings of EPE's individual facilities without regard to whether the individual facility is categorized within category (i), (ii), or (iii). However, the ability of an individual EPE facility to impact interconnected entities, or to impact the BES beyond EPE's local system, is not present for category (iii).

EPE's SOLs under a specified system configuration may be the result of any one of the following: (i) thermal ratings on individual Facilities; (ii) sag ratings on individual Facilities (iii) system voltage and/or voltage drop (applies to steady state voltage); or (iv) system stability (transient stability, small signal stability (oscillations), or voltage stability). The most restrictive applicable limit of an EPE SOL under a system configuration may be one of the limits listed above. However, EPE plans its system so that as it

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develops system configurations, the system configurations do not call for an individual facility ratings to be exceeded.

## Determining and Establishing SOLs<sup>1</sup>

### Computer Simulations or Other Limitations

Computer simulations are used to perform planning studies in the planning horizon. Studies will be performed using approved WECC base cases which reflects an anticipated system configuration, generation dispatch, and load level (peak, intermediate and/or off-peak) for seasonal (i.e., winter, spring, summer, and/or fall) system conditions. The results of these studies are dependent upon the specific system conditions modeled in the simulation. SOLs determined in networked systems can be impacted substantially with changed system conditions and modeling in the base cases. Before a study is performed the following listed items are considered: (i) system configuration including expected system conditions, changes in the system topology, facility outages and new facilities; (ii) load level; and (iii) generation dispatch. The results of a study must show that under all lines in service and following contingencies all Facilities are within their Facility Ratings and within thermal, sag and voltage limits and EPE's BES system shall demonstrate transient, dynamic and voltage stability.


### System Performance Requirements

EPE shall establish SOLs consistent with EPE's BES performance for the following:

1. **Pre-Contingency State.** In a pre-contingency state and all Facilities in service the system performance and EPE's BES shall demonstrate voltage stability and all facilities shall be operating within their Normal Facility Ratings.
2. **Post-contingency State.** Following the single Contingencies listed below, the system shall demonstrate: (i) transient, dynamic and voltage stability; (ii) all facilities shall be operating within their Emergency Facility Ratings, and within thermal, sag, voltage and stability limits; and (iii) Cascading or uncontrolled separation shall not occur:
  - a. Most severe single line to ground or three phase fault with Normal Clearing on any Faulted generator, line, transformer or shunt device;
  - b. Loss of any generator, line, transformer, or shunt device without a Fault;
  - c. Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current (DC) system<sup>2</sup>; and
  - d. Other applicable single contingencies.

<sup>1</sup> EPE provides the SOLs it develops to the RC and to its adjacent Planning Authorities. With respect to the Facility Ratings of EPE's individual facilities, those ratings are shared with the RC and adjacent Planning Authorities as part of EPE's power flow case.

<sup>2</sup> EPE does not own/operate a DC system, and the New Mexico transmission system does not contain a DC system.

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3. **Single Contingency System Performance.** In determining the system's response to single Contingencies, the following performance shall include:
  - a. Planned or controlled interruption of service to customers connected to or supplied by the Faulted Facility or by the affected area;
4. **Next Contingency.** To prepare for the next Contingency, system adjustments must be made, including changes to generation, changes to available reactive devices, uses of the transmission system and transmission system topology.
5. **Multiple Facilities Contingencies.** EPE shall evaluate the following multiple Facility Contingencies, as applicable, when establishing SOLs:
  - a. Simultaneous permanent phase to ground faults on different phases of two adjacent transmission circuits on a common structure with Normal Clearing<sup>3</sup>;
  - b. Permanent phase to ground fault of any generator, transmission circuit, transformer or bus section with delayed Fault Clearing;
  - c. Permanent phase to ground fault of any generator, transmission circuit, transformer or bus section with delayed Fault Clearing;
  - d. Simultaneous permanent loss of both poles of a DC bipolar facility without an alternating current Fault;
  - e. Failure of a special protection scheme breaker to operate following a non-fault loss of any element or permanent phase to ground Fault with Normal Clearing;
  - f. Non-three phase fault on common mode contingency of two adjacent circuits on separate structures with Normal Clearing<sup>4</sup>;
  - g. Common mode outage of two generating units connected to the same switchyard; and
  - h. Loss of multiple bus sections as the result of a permanent phase to ground fault and the failure or delayed clearing of bus tie or bus sectionalizing breakers.

SOLs established for Multiple Contingencies (a) through (e) shall demonstrate consistent system performance with the following:

- a. Transient, dynamic and voltage stability;
- b. All facilities shall be operating within their Post-Contingency thermal

<sup>3</sup> Does not apply to station entrance/exit if the circuits don't share more than five structures.

<sup>4</sup> Does not apply if probability of fault is less than one in thirty years.

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- sag, voltage and stability limits;
- c. Cascading does not occur; and
- d. Uncontrolled separation does not occur.

SOLs established for Multiple Contingencies (f) and (h) shall demonstrate consistent system performance with the following with respect to impacts on other systems:


- a. Cascading does not occur.

The contingencies listed and used for transient stability studies is a subset of the contingencies used for thermal, sag and voltage stability studies. They are chosen based on historical system response, previous study results or the judgment of the study engineer.

6. **Multiple Contingencies System Performance.** In determining the system's response to Multiple Contingencies, the following performance shall include:
  - a. Planned or controlled interruption of service to customer(s) (load shedding);
  - b. Planned removal from service of generator(s);
  - c. Curtailment or interruption of firm transfer(s);
  - d. System reconfiguration, topology and/or load, by manual or automatic control;
  - e. System reconfiguration, topology and/or load, by protection actions; and
  - f. System adjustments required to prepare for the next contingency, including generation re-dispatch and adjustments to load, reactive devices and/or transmission system topology.
7. **Remedial Action Schemes.** RAS are modeled if applicable, including:
  - a. Tripping groups of loads in a predetermined priority and grouping under certain double Contingencies. EPE does not have a RAS.
8. **Other Technical Limitations.** In general, planning studies are not performed to determine if an SOL exists for a path consisting of a single transmission system facility (i.e. a line or transformer). If such limits occur, they are determined by the most limiting equipment (terminal device, line conductor, etc.) for that facility.

### **Stability SOLs**

A stability SOL violation can impact the BES much more quickly than a SOL resulting from thermal, sag or steady state voltage violations, and may qualify as an IROL depending on the potential consequences. The Reliability Coordinator and EPE shall collaborate to understand the nature of the stability SOL, the conditions that resulted in the establishment of such stability SOL and determination of BES impact.

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## Availability of SOL Methodology for Comments

EPE shall issue its SOL Methodology for the planning horizon and any changes to that Methodology, to all of the following prior to the effectiveness of the change:

- Each adjacent Planning Authority and each Planning Authority that indicated it has a reliability-related need for the methodology.
- The Reliability Coordinator and any Transmission Operator that operates any portion of EPE's Planning Authority Area. At present, EPE is the only Transmission Operator in its Planning Authority Area.
- Each Transmission Planner that works in the EPE Planning Authority Area. At present, EPE is the only Transmission Planner in the EPE Planning Authority Area.

## Response to Comments on SOL Methodology for the Planning Horizon

If a recipient of the SOL Methodology for the planning horizon provides documented technical comments on the SOL Methodology, EPE shall provide a documented response to that recipient within 45 calendar days of receipt of those comments. The response shall indicate whether a change will be made to the SOL Methodology and, if no change will be made to that SOL Methodology, the reason why. In addition, as EPE considers updates and/or changes to its SOL methodology documentation, it may generate drafts for informal review and comment by third parties. The sharing of drafts with third parties does not trigger a 45 calendar day response clock or a documented response requirement.


## Definitions

The definitions in this section are applicable to this document and are extracted from the NERC Reliability Standards Glossary of Terms:

### ***System Operating Limit***

*The value (such as MW, MVar, Amperes, Frequency or Volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:*

- Facility Ratings (Applicable pre - and post- Contingency equipment or facility ratings)
- Transient Stability Ratings (Applicable pre and post- Contingency Stability Limits)
- Voltage Stability Ratings (Applicable pre - and post - Contingency Voltage Stability)

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•System Voltage Limits (Applicable pre - and post - Contingency Voltage Limits) Interconnection

### **Reliability Interconnection Reliability Operating Limit**

A System Operating Limit that, if violated, could lead to instability, uncontrolled separation or Cascading Outages that adversely impact the reliability of the Bulk Electric System.

### **Bulk Electric System**

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

#### **Inclusions:**


- **I1** - Transformers with the primary terminal and at least one secondary terminal operated at 100 kV or higher unless excluded by application of Exclusion E1 or E3.
- **I2** – Generating resource(s) including the generator terminals through the high- side of the step-up transformer(s) connected at a voltage of 100 kV or above with:
  - a. Gross individual nameplate rating greater than 20 MVA. Or,
  - b. Gross plant/facility aggregate nameplate rating greater than 75 MVA.
- **I3** - Blackstart Resources identified in the Transmission Operator’s restoration plan.
- **I4** - Dispersed power producing resources that aggregate to a total capacity greater than 75 MVA (gross nameplate rating), and that are connected through a system designed primarily for delivering such capacity to a common point of connection at a voltage of 100 kV or above.

Thus, the facilities designated as BES are:

- a. The individual resources, and
- b. The system designed primarily for delivering capacity from the point where those resources aggregate to greater than 75 MVA to a common point of connection at a voltage of 100 kV or above.
- **I5** –Static or dynamic devices (excluding generators) dedicated to supplying or absorbing Reactive Power that are connected at 100 kV or higher, or through a dedicated transformer with a high-side voltage of 100 kV or higher, or through a transformer that is designated in Inclusion I1 unless excluded by application of Exclusion E4.

#### **Exclusions:**

- **E1** - Radial systems: A group of contiguous transmission Elements that emanates from a single point of connection of 100 kV or higher and:
  - a. Only serves Load. Or,
  - b. Only includes generation resources, not identified in Inclusions I2, I3, or I4, with an aggregate capacity less than or equal to 75 MVA (gross nameplate rating). Or,

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- c. Where the radial system serves Load and includes generation resources, not identified in Inclusions I2, I3 or I4, with an aggregate capacity of non- retail generation less than or equal to 75 MVA (gross nameplate rating).

Note 1 – A normally open switching device between radial systems, as depicted on prints or one-line diagrams for example, does not affect this exclusion.

Note 2 – The presence of a contiguous loop, operated at a voltage level of 50 kV or less, between configurations being considered as radial systems, does not affect this exclusion.

- **E2** - A generating unit or multiple generating units on the customer's side of the retail meter that serve all or part of the retail Load with electric energy if: (i) the net capacity provided to the BES does not exceed 75 MVA, and (ii) standby, back-up, and maintenance power services are provided to the generating unit or multiple generating units or to the retail Load by a Balancing Authority, or provided pursuant to a binding obligation with a Generator Owner or Generator Operator, or under terms approved by the applicable regulatory authority.
- **E3** - Local networks (LN): A group of contiguous transmission Elements operated at less than 300 kV that distribute power to Load rather than transfer bulk power across the interconnected system. LN's emanate from multiple points of connection at 100 kV or higher to improve the level of service to retail customers and not to accommodate bulk power transfer across the interconnected system. The LN is characterized by all of the following:
  - a) Limits on connected generation: The LN and its underlying Elements do not include generation resources identified in Inclusions I2, I3, or I4 and do not have an aggregate capacity of non-retail;
  - b) Real Power flows only into the LN and the LN does not transfer energy originating outside the LN for delivery through the LN; and
  - c) Not part of a Flowgate or transfer path: The LN does not contain any part of a permanent Flowgate in the Eastern Interconnection, a major transfer path within the Western Interconnection, or a comparable monitored Facility in the ERCOT or Quebec Interconnections, and is not a monitored Facility included in an Interconnection Reliability Operating Limit.
- **E4** – Reactive Power devices installed for the sole benefit of a retail customer(s).

Note - Elements may be included or excluded on a case-by-case basis through the Rules of Procedure exception process.

The definition of SOL lists units of measurement (MW, MVar, Amperes, Frequency or Volts). EPE typically expresses SOLs in MW.

## Acronyms

BES – Bulk Electric System

EPE – El Paso Electric Company

IROL – Interconnection Reliability Operating Limits