Transfer Capability Methodology for the Near-Term Transmission Planning Horizon

FAC-013-2

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Transfer Capability Methodology for the Near-Term Transmission Planning Horizon

Distribution Restriction: None

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Transfer Capability Methodology for the Near-Term Transmission Planning Horizon

1 Purpose

This document provides California ISO's Transfer Capability Methodology required under NERC Standard FAC-013-2 for performing an annual assessment to identify potential future transmission system weaknesses and limiting facilities that could impact the ability of the Bulk Electric System (BES) to reliably transfer energy in the near-term transmission planning horizon.

2 Definition

Transfer Capability is defined in the *Glossary of Terms Used in NERC Reliability Standards* as follows:

> The measure of the ability of interconnected electric systems to move or transfer power in a reliable manner from one area to another over all transmission lines (or paths) between those areas under specified system conditions. The units of transfer capability are in terms of electric power, generally expressed in megawatts (MW). The transfer capability from "Area A" to "Area B" is *not* generally equal to the transfer capability from "Area B" to "Area A".

3 Applicability

Consistent with the definition of Transfer Capability, this methodology is applicable to single or multiple, parallel transmission facilities, hereafter referred to as "Transfer Paths", that are used to transfer power between the California ISO and adjacent balancing authority areas. For the purposes of this methodology, the ISO may treat interconnections comprised of multiple, parallel facilities as a single Transfer Path when such treatment is appropriate to maintain reliability.

As a Planning Coordinator, the ISO will use this Transfer Capability Methodology to perform an annual assessment of the Transfer Capability of existing and future Transfer Paths in the near-term planning horizon [FAC-013-2 R1]. The methodology applies for assessing any Transfer Path, whether the path is a WECC-defined path or not.

WECC-paths internal to the California ISO balancing authority area are not considered Transfer Paths and hence assessment of their capability is subject to the California ISO SOL Methodology rather than this Transfer Capability Methodology.

This methodology is not applicable for assessment of Transfer Capability in the operations horizon.

4 Transfer Capability Assessment Methodology

During each calendar year, California ISO will assess its Transfer Paths in accordance with this methodology. The annual assessment will involve the following two steps:

- Selecting Transfer Paths for which simulations are to be performed in that calendar year by applying the selection criteria described in the next section, and
- Performing simulations and documenting an assessment based on those simulations during that calendar year in accordance with this methodology for at least one year in the near-term transmission planning horizon. [R4]

4.1 Criteria for Selection of Transfers to be Assessed

In each calendar year, California ISO will assess a Transfer Path using simulations if: [R1.1]

- Planned changes to the Transfer Path or in the BES within the near-term planning horizon are expected to adversely impact the path's transfer capability.
- The Transfer Path is planned to be added or its Transfer Capability increased within the near-term transmission planning horizon.
- California ISO, in its most recent annual transmission planning cycle, or in SOL studies, seasonal or real-time assessments or other studies, identifies potential future transmission system weaknesses and limiting facilities that could adversely impact the path's transfer capability in the near-term planning horizon.

4.2 Study Methodology

Consistent with California ISO planning practices and its SOL Methodology for the planning horizon, evaluation of system performance under normal conditions with all facilities in service, and following applicable single and multiple contingencies is required when assessing transfers. Steady-state power flow, post-transient governor power flow and transient stability studies are used to evaluate system performance. The assessment is performed for at least one year in the near-term planning horizon.

California ISO's SOL Methodology for the planning horizon is consistent with this Transfer Capability Methodology and hence simulations performed for the near-term transmission planning horizon to assess the SOL of a Transfer Path may be used to assess its Transfer Capability for the purposes of this methodology, and vice versa.

All transmission facilities have physical facility ratings. For a Transfer Path consisting of a single transmission facility, the capability of the Transfer Path may be limited below its facility rating when studies indicate applicable normal or post contingency system performance requirements (thermal, voltage, stability) limit the operation of the facility

below its facility rating in the pre-contingency state. For a Transfer Path consisting of multiple parallel transmission facilities, the Transfer Capability for the path must be assessed based on the applicable system performance requirements.

During simulations, transfer on a path under study may be increased or decreased by adjusting generation and, if appropriate, load in the source and sink areas. An increase in transfer, for example, may be achieved by increasing generation and/or decreasing load within the source area and decreasing generation and/or increasing load within the sink area. [R1.5]

When assessing an existing or known Transfer Capability in the near-term planning horizon, simulations are performed with the transfer path modeled at the existing or known maximum transfer level — plus the applicable reliability margin if the transfer is voltage stability limited. If the results of the simulations indicate that the BES does not meet applicable performance requirements at that transfer level, a new Transfer Capability will be established for the path. The new Transfer Capability is established by decreasing the pre-contingency power transfer on the path until the maximum safe transfer level that results in acceptable system performance for all applicable contingencies is reached.

In cases where a Transfer Path is desired to have a target Transfer Capability, the assessment is performed with the path modeled at the desired transfer level — plus the applicable reliability margin if the transfer is voltage stability limited — and system enhancements or operational measures, if any, that are necessary to achieve the desired Transfer Capability are identified.

The assessment shall respect known System Operating Limits (SOL) [R1.2]. Assumptions and criteria used to perform Transfer Capability assessment are consistent with California ISO's planning practices [R1.3].

Applicable facility normal ratings shall be applied in the pre-contingency state, and emergency ratings shall be applied following contingencies. Applicable emergency ratings are those that are valid for a duration of at least 30 minutes. Facility voltages, and voltage deviation limits shall be applied in accordance with the California ISO Planning Standards and WECC regional criteria.

The following sections provide additional criteria and assumptions to be used in performing the assessments. [1.4]

4.3 Study Models

Study models used in the assessment must include at least the ISO Planning Coordinator area as well as the modeling details from the adjacent Planning Coordinator area that would impact the transfers under study. California ISO uses study models that are based on recent

WECC base cases which include the entire Western Interconnection. Study models are updated to include expected material changes in transmission system topology and ratings, generation and system demand in the study area for the study time period as further described below.

4.3.1 Generation Dispatch

Study models are updated to include expected material changes in generation including, but not limited to, long-term planned generation outages, additions and retirements. Generation units are dispatched to simulate the maximum flow on the Transfer Path under study. Generation is dispatched consistent with the system conditions and the time period being simulated. [R1.4.1]

4.3.2 Transmission System Topology

Study models are updated to reflect expected material changes in transmission system topology including, but not limited to, long-term transmission planned outages, additions and retirements. [R1.4.2]

4.3.3 System Demand

Demand levels modeled in the base cases are coordinated through the base case development process. Depending on the Transfer Path being studied, demand levels may be representative of peak, off-peak or shoulder, or light demand conditions. Peak demand for the California ISO Balancing Authority area is based on California Energy Commission's (CEC) load forecast. [R1.4.3]

4.3.4 Current Approved and Projected Transmission Uses

Relevant currently approved and projected transmission uses are to be modeled in the study cases. [R1.4.4]

4.3.5 Parallel Path (Loop Flow) Adjustments

Parallel path flows will be considered when assessing transfers. Parallel flows may result in transmission limitations in systems other than the transacting areas. In such cases, transfers between the two transacting areas may be limited due to the impact of parallel flows. The assessment must be sufficient in scope to ensure that limitations throughout the interconnected network are addressed. [R1.4.5]

4.3.6 Contingencies

All applicable single and multiple contingencies associated with or that could limit the transfer under study, including those outside the ISO Planning Coordinator Area, should be studied. Contingencies may be selected based on previous studies, established knowledge of the system in the study area or contingency screening studies. A description of the

contingencies studied along with the rationale for selecting the contingencies should be documented. [R1.4.6]

4.3.7 Monitored Facilities

All facilities in the study area that could be adversely impacted by transfers on the path under study, including those that are outside the ISO Planning Coordinator Area, should be monitored. A description of the monitored facilities along with the rationale for selection should be documented. [R1.4.7]

4.4 Applicable System Performance Requirements

Operation within Transfer limits must, starting with all facilities in service and following applicable single and multiple contingencies, result in the thermal loading, voltage, stability and reliability of service performance of the BES consistent with applicable NERC standards, WECC criteria, and California ISO Planning Standards and planning practices.

4.5 Power Flow Analysis

Power flow analysis is used to evaluate system performance under normal and applicable single and multiple contingency conditions to identify facilities, if any, whose thermal or voltage (including voltage stability) limits may be violated. Contingencies that result in divergence or excessive voltage deviation are further evaluated using post-transient and transient analysis tools as appropriate.

Available SPS or automatic remedial measures which affect steady-state system response may be applied. These remedial measures may include generation and load dropping and automatic series and shunt capacitor switching. Manual remedial measures may not be applied except following the initial outage when simulating overlapping outages such as TPL-001-4 Category P6 contingencies.

4.6 Post-Transient Analysis

Post-transient governor power flow analysis is used as required to evaluate system performance under normal and following critical single and multiple contingencies to identify facilities, if any, whose thermal, voltage, or voltage stability limits may be violated. Post-transient analysis is particularly utilized to further evaluate a limited number of critical contingencies where the results may benefit from the more detailed representation of the contingencies or a more accurate system response.

Either a standard post-transient analysis with the path transfer under study increased by the applicable margins or a P-V analysis should be performed as required to ensure the Transfer Capability meets applicable voltage stability margin requirements. For contingencies that

cause simulations to diverge — which signals voltage instability — post-transient voltage stability analysis may be performed using the P-V method to determine a valid transfer level.

Available SPS or automatic remedial measures which affect post-transient system response may be applied. These remedial measures may include automatic series and shunt capacitor switching, generation and load dropping. Manual remedial measures should not be applied except following the initial outage when simulating overlapping outages such as TPL-001-4 Category P6 contingencies. Transmission voltage regulating transformers, shunt capacitors and reactors, and phase shifting transformers should be fixed at their pre-contingency state except where there is specific information to do otherwise.

4.7 Transient Stability Analysis

Transient stability studies should be performed as needed to assess the impact of transfers on system stability. A simulation result is considered to demonstrate stability if machines in the system remain in synchronism and post disturbance oscillations exhibit positive damping. Duration of a stability simulation run should be ten seconds unless a longer time is required to ascertain stability.

Relay action and fault clearing time should be represented in simulations according to the expected operation of the system. System disturbances for stability studies should be simulated at locations that result in maximum stress on the system. Available SPS or automatic remedial measures which affect transient response should be modeled. These remedial measures may include high speed series and shunt capacitor switching, generation and load dropping. Manual remedial measures should not be applied except following the initial outage when simulating overlapping outages such as TPL-001-4 Category P6 contingencies.

5 Applicable Study Processes

This section describes the various study processes that California ISO may use for assessing transfers in the near-term transmission planning horizon to meet the requirements of FAC-013-2 R4. These study processes include:

- The WECC Path Rating Process
- The California ISO annual Transmission Planning Process (TPP)
- Other qualified studies, including Transfer Capability studies, SOL studies and Path-rating studies performed jointly or individually by California ISO, Participating Transmission Owners (PTO) or adjacent Planning Coordinators that are consistent with NERC Standard FAC-013-2 and this Transfer Capability methodology.

5.1 WECC Path Rating Process

The determination of Path Ratings for WECC paths follows the rigorous and collaborative WECC Path Rating Process detailed in Section 4 of the WECC document entitled Project Coordination, Path Rating and Progress Report Processes. Section 4 of the document, titled Path Rating Process, requires members of the Western Interconnection to perform path rating studies, which are typically performed for the near-term planning horizon, in a way that conforms to the requirements, methodology, and processes contained therein. Facilities are granted an "Accepted Rating" by WECC at the conclusion of the review process. Path Ratings are subject to the review process based on the criteria specified in the document.

Ratings of WECC Transfer Paths are officially documented in the WECC Path Rating Catalog which is typically updated annually. For each Path, the Catalog includes a map of the Path, description of the Path, its Transfer Limit or Rating, and check boxes to identify whether the rating is an "Accepted Rating", "Existing Rating" or "Other Rating".

California ISO deems Accepted WECC Ratings of Transfer Paths to be their Transfer Capabilities for the near-term transmission planning horizon provided the ISO does not identify future transmission system weaknesses that limit transfers on the path below its WECC rating in its annual transmission planning process or other relevant studies.

5.2 Annual ISO Transmission Planning Process

California ISO may perform simulations of some or all of the transfers selected in accordance with Section 4.1 of this methodology in any given calendar year as part of its annual Transmission Planning Process (TPP) to identify weaknesses and limiting facilities that could impact the ability to reliably transfer energy in the near-term transmission planning horizon. In the cases where limitations are identified on the capability of a Transfer Path and mitigation is not proposed to address the limitations, the ISO will perform supplemental simulations in accordance with this methodology and document an assessment based on those simulations.

5.3 Other Qualified Studies

California ISO may perform stand-alone simulations of the remainder of the transfers selected under Section 4.1, in any given calendar year, or use simulations performed by, or in collaboration with, other appropriate functional entities, and document an assessment based on those simulations. Applicable studies include Transfer Capability studies, SOL studies and Path-rating studies performed jointly or individually by the ISO, Participating Transmission Owners or adjacent Planning Coordinators that are consistent with NERC Standard FAC-013-2 and this Transfer Capability Methodology.

6 Distribution Requirements

6.1 Transfer Capability Methodology

California ISO will issue its Transfer Capability Methodology and any revisions to the Transfer Capability Methodology, to the following entities subject to the following: [R2]

- Distribute to the following prior to the effectiveness of such revisions [R2.1]:
  - Each Planning Coordinator adjacent to the California ISO Planning Coordinator area or overlapping the California ISO Planning Coordinator area. [R2.1.1]
  - Each Transmission Planner within the California ISO Planning Coordinator area. [R2.1.2]
- Distribute to each functional entity that has a reliability-related need for the Transfer Capability Methodology and submits a request for that methodology within 30 calendar days of receiving that written request. [R2.2]

Comments, questions or concerns on this Transfer Capability Methodology are to be submitted to Charles Cheung (ccheung@caiso.com) and RegionalTransmission@caiso.com.

6.2 Annual Transfer Capability Assessments

During each calendar year, California ISO will make the documented Transfer Capability assessment results available within 45 calendar days of the completion of the assessment to the recipients of its Transfer Capability Methodology pursuant to the requirements of Section 6.1. However, if a functional entity that has a reliability-related need for the results of the annual assessment of the Transfer Capabilities makes a written request for such an assessment after the completion of the assessment, California ISO will make the documented Transfer Capability assessment results available to that entity within 45 calendar days of receipt of the request. [R5]

If a recipient of a documented Transfer Capability assessment requests data to support the assessment results, California ISO will provide such data to that entity within 45 calendar days of receipt of the request. The provision of such data will be subject to the legal and regulatory obligations of the ISO regarding the disclosure of confidential and/or sensitive information. [R6]

7 Supporting Information

7.1 Document Owner

California ISO - TIP	California ISO Transmission Infrastructure Planning (TIP)

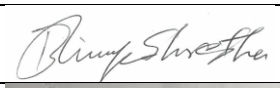
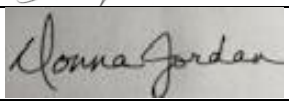
7.2 References

NERC Reliability Standards	FAC-013-2: Assessment of Transfer Capability for the Near-Term Transmission Planning Horizon
	TPL-001-4: Transmission System Planning Performance Requirements (P1-P7); TPL-001-5 (with a 7/1/2023 Enforcement Date)
	MOD-029-1a: Rated System Path Methodology
WECC	Project Coordination, Path Rating and Progress Report Processes
	WECC 2020 Path Rating Catalog
	TPL-001-WECC- CRT-3.2: System Performance Regional Criteria
California ISO	Business Practice Manual (BPM) for the Transmission Planning Process
	California ISO Planning Standards
	System Operating Limits (SOL) Methodology for the Planning Horizon

7.3 Version History

Version	Change	By	Date
1.0	New methodology for FAC-013-2	Nebiyu Yimer, Joseph Meier	3/29/2013
2.0	Reviewed and updated the FAC-013-2 Transfer Capability Methodology, and included references to the new NERC TPL-001-4 standard	Charles Cheung	6/30/2015
2.1	Updated references to the TPL-001-WECC- CRT-3 standard	Charles Cheung	6/30/2017
2.2	Updated references to the TPL-001-WECC- CRT-3.1 standard and other references	Charles Cheung	6/30/2018
2.3	Updated references to the WECC Path Rating Catalog	Charles Cheung	6/30/2019
2.4	Updated references to the TPL-001-WECC- CRT-3.2 standard and WECC Path Rating Catalog	Charles Cheung	6/30/2020

8 Technical Review

Reviewed By	Name	Signature	Date
Senior Manager, Regional Transmission – South	Robert Sparks		7/27/2020
Manager, Regional Transmission – North	Binaya Shrestha		7/27/2020
Market & Infrastructure Compliance Manager	Donna Jordan		7/27/2020

9 Approval

Approved By	Name	Signature	Date
Director, Transmission Infrastructure Planning	Jeffrey Billinton		**2020/07/29**