PacifiCorp NERC Reliability Compliance

Available Transfer Capability Implementation Document

Document Security Category

☐	Confidential
☐	Restricted
☐	Internal
☒	External (Public)
☐	Critical Infrastructure Information (CII)

Author:	Ravi kanth Varanasi
Revised by:	Brian McClelland
Approved by:	
Authoring Department:	
Approved Location:	
File Number-Name:	
Revision Number:	2.3
Revision Date:	November 18, 2017

Contents

1. Purpose 3
2. Types of ATC Values and Frequency of Recalculation 3
3. ATC Methodology 4
3.1 Planning Horizon calculations: 4
3.2 Operating Horizon Calculations (Day Ahead): 6
3.3 Scheduling Horizon calculations (Real-time): 6
3.4 Existing Transmission Commitments (ETC) 6
Appendix A: Definitions 8
Appendix B: Rated System Path Methodology 9
1. Introduction 9
2. Determination of Transfer Capability 9
3. Procedure 10
3.1 Use of WECC Base Cases: 10
3.2 Methodology 10
3.3 Outages 11
4. Calculating Total Transfer Capability (TTC) 12
4.1 Data and Assumptions 12
4.2 Process to Determine TTC 13
4.3 Other Parameters that Impact TTC 13
4.4 Communication to Transmission Service Provider 14
Appendix C: Transmission Reliability Margin 15
Appendix D: Capacity Benefit Margin (CBM) 17

1. Purpose

PacifiCorp, as a Transmission Service Provider and Transmission Operator registered with the North American Electric Reliability Corporation (NERC), must comply with NERC reliability standards applicable to those functions, including MOD-001-1a.

PacifiCorp has selected the Rated System Path Methodology as described in the current version of MOD-029-1a to calculate Total Transfer Capability (TTC) and Available Transfer Capability (ATC) for ATC paths. MOD-001-1a also requires each Transmission Service Provider to prepare and keep current an ATC Implementation Document (ATCID) that includes processes, procedures, and assumptions used in the determination of ATC under the selected methodology. This document serves as PacifiCorp's ATCID and, therefore, documents PacifiCorp's compliance with the requirements of NERC standards MOD-001-1a and MOD-029-1a. This ATCID can be found on the OASIS at the following link (MOD-001-1 R3 and R5):

http://www.oasis.oati.com/woa/docs/PPW/PPWdocs/ATCID_2017_Final.pdf

2. Types of ATC Values and Frequency of Recalculation

(MOD-001-1 R2) Each Transmission Service Provider shall calculate ATC or AFC values as listed below using the methodology or methodologies selected by its Transmission Operator(s)

R2.1 Hourly values for at least the next 48 hours
R2.2 Daily values for at least the next 31 calendar days
R2.3 Monthly values for at least the next 12 months (months 2-13)

(MOD-001-1 R8) Each Transmission Service Provider that calculates ATC shall recalculate ATC at a minimum on the following frequency, unless none of the calculated values identified in the ATC equation have [sic] changed:

R8.1 Hourly values, once per hour.
R8.2 Daily values, once per day
R8.3 Monthly values, once per week

PacifiCorp calculates and posts to its OASIS hourly ATC values once per hour for each ATC path at a minimum for the next 48 hours. The hourly ATC values are determined Day-A-Head and updated for the next operating hour. Transmission outage information is incorporated into the hourly ATC values.

PacifiCorp calculates daily ATC values once per day for each ATC path at a minimum for the next 31 calendar days. The daily ATC value for a particular ATC path will be set to the ATC path's Total Transfer Capability (TTC) calculated for that period less Capacity Benefit Margin, Transmission Reliability Margin and aggregate existing transmission commitments, which is made up of Existing Transmission Contracts and Transmission Ownership Rights.

PacifiCorp calculates monthly ATC for each ATC path at a minimum for the next 12 months in accordance with MOD-001-1. PacifiCorp calculates ATC values with the following frequency, even if calculated ATC values are unchanged (MOD-001-1 R8).

Hourly, at least once per hour
Daily, at least once per day
Monthly, at least once per day

3. ATC Methodology

Available Transfer Capability (ATC): The measure of the transfer capability remaining in the physical transmission network for further commercial activity over and above already committed uses. It is defined as Total Transfer Capability less Capacity Benefit Margin, Transmission Reliability Margin and existing transmission Commitments.

All ATC calculation methodologies derive ATC by first determining TTC, expressed in terms of contract paths, and reducing that figure by a margin that recognizes uncertainties with transfer capability (i.e., TRM), a margin that allows for meeting generation reliability criteria (i.e., CBM) and existing transmission commitments (i.e., ETC).

All counterflow resulting from firm and non-firm Transmission schedules are added back to ATC_{NF} in both the scheduling and operating horizons (MOD-001-1 R3.2). In PacifiCorp's ATC_{NF} calculations, $Counterflows_{NF}$ are the sum of schedules flowing in the direction counter to the rated direction of the ATC Path. PacifiCorp establishes TTC values on a directional basis for its paths and due to variability in reservations vs schedules, PacifiCorp does not account for counterflows in determining firm ATC, as accounting for counterflows for firm ATC can create an oversubscribed condition.

3.1 Planning Horizon calculations:

When determining TTC for a path, PacifiCorp first checks to see if the path is a WECC rated path. If it is, the WECC path rating is used. If no WECC rating exists and no action has been taken to have the path rated using a different method, then the path TTC, adjusted for seasonal variance, is set at the previously established amount, known and used in operation since January 1, 1994.

In Summary, PacifiCorp conducts extensive power flow studies that model as a minimum:

- Forecasted system loads, seasonal, and day-a-head.
- Transmission including series capacitors, phase shifting transformers, generators, transfers on ATC paths.
- Planned outages from (COMPASS) PacifiCorp's outage management system.

PacifiCorp also conducts seasonal assessment studies of the transmission system which may require adjustment to the path TTC creating a seasonal System Operating Limit (SOL). System Operating Limit studies screen for system performance based on planning criteria[1]. Loadings on transmission facilities are evaluated along with established voltage performance. Transient stability studies are conducted to ensure adequate margins in the system and some of the more important margins are related to current overloads, stability performance, system damping, post-transient voltage, reactive support, etc. The complete details of the type of models and studies conducted can be found in Appendix B: Rated System Path Methodology.

To determine firm and non-firm ATC, the Transmission Provider uses the following algorithms for the Scheduling, Operating and Planning Horizons:

$$\textbf{Firm ATC } (ATC_F) = TTC - ETC_F - CBM - TRM + Postbacks_F + Counterflows_F$$

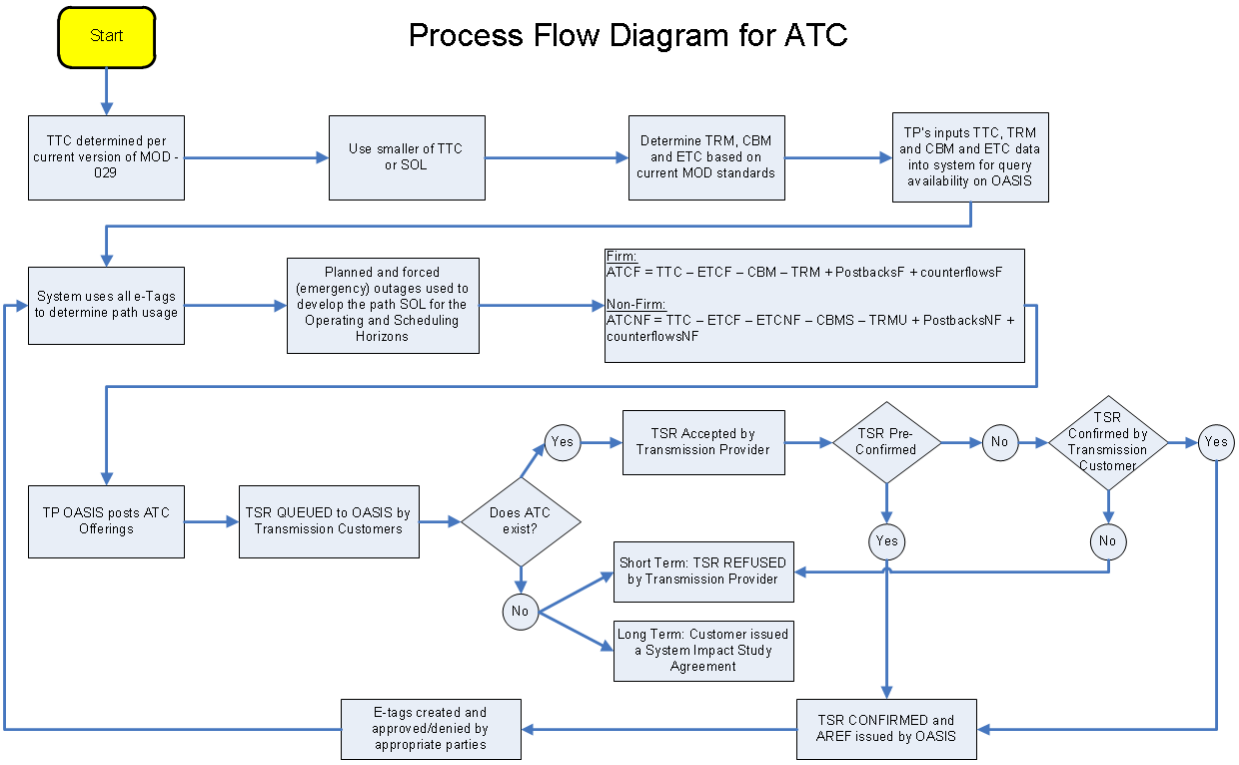
[1] Reliability Criteria for System Planning.

Where:
ATC_F is the firm Available Transfer Capability for the ATC Path for that period.
TTC is the Total Transfer Capability of the ATC Path for that period.
ETC_F is the sum of existing firm commitments for the ATC Path during that period.
CBM is the Capacity Benefit Margin for the ATC Path during that period.
TRM is the Transmission Reliability Margin for the ATC Path during that period.
$Postbacks_F$ are changes to firm ATC due to a change in the use of transmission Service for that period.
$Counterflows_F$ are adjustments to firm ATC as determined by the transmission Provider.

Non-Firm ATC (ATC_{NF}) =

$$TTC - ETC_F - ETC_{NF} - CBM_S - TRM_U + Postbacks_{NF} + Counterflows_{NF}$$

ATC_{NF} is the non-firm Available Transfer Capability for the ATC Path for that period.
TTC is the Total Transfer Capability of the ATC Path for that period.
ETC_F is the sum of existing firm commitments for the ATC Path during that period.
ETC_{NF} is the sum of existing non-firm commitments for the ATC Path during that period.
CBM_S is the Capacity Benefit Margin for the ATC Path that has been scheduled during that period.
TRM_U is the Transmission Reliability Margin for the ATC Path that has not been released for sale (unreleased) as non-firm capacity by the Transmission Service Provider during that period.
$Postbacks_{NF}$ are changes to non-firm ATC due to a change in the use of Transmission Service for that period.
$Counterflows_{NF}$ are adjustments to non-firm ATC as determined by the Transmission Provider.



3.2 Operating Horizon Calculations (Day Ahead):

PacifiCorp recalculates TTC in the operating horizon based on the system operating conditions, primarily planned and forced outages that may cause a system to deviate from the system normal condition and TTC. The posted TTC becomes a system operating limit (SOL). Planned outages are modeled by PacifiCorp grid operations engineers by means of power flow simulations and the impacted path's TTC is adjusted to the effective SOL for the duration of the outage.

PacifiCorp's OASIS calculates ATC as e-Tags are approved throughout the pre-schedule day and runs to the end of the pre-schedule day(s) per the Western Electricity Coordinating Council (WECC) pre-schedule calendar. PacifiCorp's OASIS recalculates ATC continuously during the Operating and Scheduling Horizons as new transmission service requests (TSRs) are confirmed and as soon as schedules are received and approved for existing reservations.

Operating Horizon Formulas:

$$\textbf{Firm ATC } (ATC_F) = TTC - ETC_F - CBM - TRM + Postbacks_F + Counterflows_F$$

$$\textbf{Non-Firm ATC } (ATC_{NF}) = TTC - ETC_F - ETC_{NF} - CBM_S - TRM_U + Postbacks_{NF} + Counterflows_{NF}$$

3.3 Scheduling Horizon calculations (Real-time):

PacifiCorp's OASIS recalculates ATC continuously during the Operating Horizons and the adjusted TTC becomes the SOL. Under unplanned outage conditions (emergency), TTC on OASIS is decremented automatically whenever a new outage is delivered to OASIS from COMPASS.

OASIS calculates the ATC after the Operating Horizon closes, typically at 3:05 PM Pacific time the day before transactions are scheduled to occur. In addition, PacifiCorp's OASIS recalculates ATC continuously during the Operating and Scheduling Horizons as new TSRs are confirmed and as soon as schedules via e-Tags are received and approved for existing reservations. ATC is also recalculated whenever new e-Tags are received that impact either firm or non-firm ATC. To determine firm and non-firm ATC, the Transmission Provider uses the following algorithms for the Scheduling Horizon:

Scheduling Horizon Formulas:

$$\textbf{Firm ATC } (ATC_F) = TTC - ETC_F - CBM - TRM + Postbacks_F + Counterflows_F$$

$$\textbf{Non-Firm ATC } (ATC_{NF}) = TTC - ETC_F - ETC_{NF} - CBM_S - TRM_U + Postbacks_{NF} + Counterflows_{NF}$$

3.4 Existing Transmission Commitments (ETC)

ETCs are committed uses of the Transmission Provider's system considered when determining ATC. The commitments include capacity set aside for the following:

- Serving native peak load along with losses, if not counted in TRM or CBM (**NL**)
- Network Integration Transmission Service along with losses, if not counted in TRM or CBM (**NITS**)
- Grandfathered transmission service (**GF**)
- Confirmed Point-To-Point transmission service (**PTP**)
- Roll-Over-Rights, when customers' transmission service has renewal rights(**ROR**)
- Firm capacity reserved for other purposes not listed above (**OS**)

Firm ETC is calculated using the formula:

$$ETC_F = NL_F + NITS_F + GF_F + PTP_F + ROR_F + OS_F$$

Non-Firm ETC is calculated using the formula:

$$ETC_{NF} = NITS_{NF} + GF_{NF} + PTP_{NF} + OS_{NF}$$

PacifiCorp does not set aside or reserve either:
(1) non-firm capacity for grandfathered transmission service and contracts for energy and/or transmission service executed prior to the effective date of PacifiCorp's OATT, or
(2) non-firm capacity for any other service, contract, or agreement otherwise not specified, and so both of these values will be zero.

Native and Network Load requirements are modeled using Transmission Customers' annual Load and Resources (L&R) submittals. Network service allocations are studied and adjusted annually based upon Transmission Customers' L&R submittals. For the Planning Horizon, network service allocations on posted path(s) are used to represent forecasted annual growth of Native Load and Network Load over the Planning Horizon. The methodology used to determine the capacity set aside for Native and Network Loads is a spreadsheet analysis.

Existing, confirmed requests for Point-to-Point transmission service are modeled in the Planning Horizon using the specified megawatt quantity, Point(s) of Receipt, and Point(s) of Delivery.

PacifiCorp, in the absence of Transmission Customer notice to terminate rights, assumes that a Transmission Customer will exercise rollover rights for existing long-term transmission. To account for this assumption, transmission in the amount of the confirmed TSR is set aside. If a Transmission Customer does not exercise its rollover right, that amount may be removed from the ETC.

Transmission reservations that are not scheduled will be made available and posted on OASIS as Non-Firm ATC. Non-firm ATC on each posted path is continuously recalculated to include any unscheduled firm ATC for such path and posted on PacifiCorp's OASIS. PacifiCorp's OASIS system automatically updates ATC on a path as e-Tags are received and approved from both firm and non-firm Transmission Customers. The OASIS adjusts ATC continuously in both the Scheduling and Operating Horizons.

Appendix A: Definitions

Available Transfer Capability (ATC): The measure of the transfer capability remaining in the physical transmission network for further commercial activity over and above already committed uses. It is defined as Total Transfer Capability less existing transmission Commitments (including retail customer service), less a Capacity Benefit Margin, less a Transmission Reliability Margin.

ATC Path: Any combination of Point of Receipt and Point of Delivery for which ATC is calculated.

Existing Transmission Commitments (ETC): Committed uses of a Transmission Provider's transmission System considered when determining ATC.

Capacity Benefit Margin (CBM): The amount of firm transmission transfer capability preserved by the transmission provider for load–serving entities (LSEs), whose loads are located on that Transmission Service Provider's system, to enable access by the LSEs to generation from interconnected systems to meet generation reliability requirements. Preservation of CBM for a LSE allows that entity to reduce its installed generating capacity below that which may otherwise have been necessary without interconnections to meet its generation reliability requirements. The transmission transfer capability preserved as CBM is intended to be used by the LSE only in times of emergency generation deficiencies.

Operating Horizon: The pre-schedule/day ahead period of time that begins at the end of the Scheduling Horizon and extends through the end of the last day that has been or is being prescheduled.

Planning Horizon: The period of time that begins at the end of the Operating Horizon and extends to 10 years from the current day.

Scheduling Horizon: The real-time period that begins with the current hour and extends through the current day, up to 24 hours from the current hour.

System Operating Limit (SOL): An adjustment to the TTC of a posted transmission path during the Scheduling and Operating Horizons for seasonal system performance and power flows and or variations in dispatch and load patterns, as well as when the system is in an abnormal operating state, such as during forced or planned line outages. During periods when an SOL value is required, the transmission path scheduling limit will be the SOL instead of the TTC. SOL represents the reliability limit of a transmission path at the point in time and for the duration of the system abnormality.

Non-Simultaneous Transfer Capability (or Limit): The capability or capacity of a transmission circuit or path, in megawatts, to transfer power reliably and in accordance with prescribed reliability criteria independent of concurrent flows on other circuits or paths. Non-Simultaneous Transfer Capability is normally determined with all potentially interacting circuits or paths loaded below the levels at which limitations are observed.

Simultaneous Transfer Capability (or Limit): The capability or capacity of a transmission circuit or path, in megawatts, to transfer power reliably and in accordance with prescribed reliability criteria in concert with other interacting paths, circuits, or generators. Simultaneous Transfer Capability is the interactive relationship with the flows on other transfer paths or circuits or the outputs of generators and is typically defined in the form of nomograms (parametric functions).

Transmission Reliability Margin (TRM): The amount of transmission transfer capability necessary to provide reasonable assurance that the interconnected transmission network will be secure. TRM accounts for the inherent uncertainty in system conditions and the need for operating flexibility to ensure reliable system operation as system conditions change.

Appendix B: Rated System Path Methodology

1. Introduction

Transfer capability is the measure of the ability of the interconnected electric system to reliably transfer power 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)

Total Transfer Capability (TTC) is defined as the amount of electric power that can be moved or transferred reliably from one area to another area of the interconnected transmission system by way of all transmission lines (or paths) between those areas under specific system conditions.

Transmission Capacity: The ability of a single transmission line to transfer electric power, when operated as part of the interconnected network, is a function of the physical relationship of that line to the other elements of the transmission network.

Transmission Capability: The transmission transfer limit to maintain the reliability of the interconnected transmission network. These transfer values are called "capabilities" because they are highly dependent on the generation, customer demand, and transmission system conditions assumed during the analyzed time-period.

All transfer capabilities are developed to ensure that power flows are within their respective operating limits, both pre-contingency and post-contingency. Operating limits are developed based on thermal, voltage and stability concerns according to industry reliability criteria (WECC/NERC) for transmission paths. The Western Electricity Coordinating Council (WECC) refers to Transfer Capability across an inter- area path as the System Operating Limit (SOL).

PacifiCorp maintains Transmission Reliability Margin (TRM) as described in NERC standard MOD-008-1 in its ATC calculation for all the ATC paths posted. A description of the methodology used to calculate TRM can be found in the Transmission Reliability Margin Implementation Document (TRMID). More details regarding the same can be found at the end of this appendix.

2. Determination of Transfer Capability

The calculation of transfer capability is generally based on power flow simulations that model the power system under a specific set of assumed conditions. Based on the assumptions made, the power flow models are viewed as reasonable indicators of network performance and available transfer capability.

- System Limits – The transfer capability of the transmission line or a path may be limited by thermal, voltage, and stability consideration. Once the critical contingencies are identified, their impact on the network must be evaluated to determine the most restrictive of those limitations. Therefore, the Total Transfer Capability (TTC) becomes:

TTC = lesser of {Thermal Limit, Voltage Limit, Stability Limit} following worst contingency

In some cases, the parallel path flows may result in transmission limitations in systems other than the transacting systems, which can limit the transfer capability between the two contracting areas.

3. Procedure

This section describes the various power flow studies along with data modeling and assumptions used to determine the TTC of ATC paths.

3.1 Use of WECC Base Cases:

The Western Electricity Coordinating Council (WECC) is the NERC-certified Regional Entity responsible for coordinating bulk electric system (BES) reliability in the Western Interconnection. The Western Interconnection covers all or parts of the 14 western United States, the Canadian provinces of British Columbia and Alberta, and a portion of Baja California Norte, Mexico.

WECC's Studies Subcommittee (StS) and its workgroups, under the direction of the WECC Reliability Assessment Committee (RAC), are responsible for performing studies and maintaining data files, among other responsibilities. The Data Subcommitte (DS) is responsible for preparing and maintaining base case data. WECC's members, including PacifiCorp, submit operating and planning data, including Load and generation forecasts, as well as generation and transmission additions and retirements, to WECC's staff. WECC's staff then prepares the operating and planning power flow base cases on which PacifiCorp and its adjacent BAs rely for the power flow base cases that are the foundation of all Western Interconnection generation and transmission planning and operating studies. The transmission and power system data each WECC member is required to provide is detailed in the WECC Data Preparation Manual[2].

PacifiCorp uses these same WECC base cases as the starting point for all its studies in support of its Total Transfer Capability (TTC) calculations. PacifiCorp uses the WECC base cases that represent generation and Transmission for an operating season to perform its TTC analysis for its Transmission system as defined in the WECC Data Preparation Manual.

As a minimum the following changes are made to the basecases:

- Update recent Transmission Network Changes and Updates
- Model the Overlapping Scheduled and Forced Outages
- Update Load Levels based on a recent forecast
- Modify WECC Path Flows as deemed appropriate
- Update Generation levels based on season
- Maintain Network Voltage Levels

The basecase configuration of the interconnected systems shall represent the simulated conditions, including any expected facility outages. The activation of any operating procedure actions, such as RAS/SPS normally expected to be in effect, are also included in the base-case simulations.

3.2 Methodology

System Operating Limits (SOLs) developed for transmission grid operations are used in determining the TTC for ATC purposes. When calculating TTC, PacifiCorp uses assumptions that are no more

[2] WECC Data Preparation Manual for Power Flow Base Cases and Dynamics Stability Data

limiting than those used in its planning of operations for the corresponding time period, when such planning of operations has been performed for that time period (MOD-001-1 R6).

When determining TTC for a path, PacifiCorp first checks to see if the path is a WECC rated path. If yes, the WECC rating is used. If no WECC rating exists, then for ATC Paths whose path rating, adjusted for seasonal variance, was established, known and used in operation since January 1, 1994, and no action has been taken to have the path rated using a different method, the TTC is set at that previously established amount.

When calculating ATC, PacifiCorp subtracts its Existing Transmission Commitments (ETC) from the TTC set from the SOL developed for its planning of operations. No additional studies beyond those developed to determine SOLs used in calculating TTCs are performed to calculate ATC. Therefore there are no assumptions used to calculate ATC to compare to assumptions used in PacifiCorp planning of operations (MOD-001-1 R7).

3.3 Outages

PacifiCorp participates in a regional process which requires all participants to enter proposed significant outage plans for facilities they own into the WECC Coordinated Outage System (COS)[3] as soon as they are known. Generally for transmission outages that impact WECC rated paths the outages are posted at least 45 days prior to the month in which the proposed outage is to occur. The details regarding the outages are also notified to the affected parties via email.

PacifiCorp maintains internally a coordinated outage management system (COMPASS) for planned and unplanned outages. The COMPASS program is designed to post an outage and update the Available Transmission Capacity (ATC) in the PacifiCorp/DG&T Open Access Same-Time Information System (OASIS) based on outage path constraint information for OASIS paths. Should the PacifiCorp Operator establish a lesser SOL for an ATC path, the lower value is posted on OASIS via COMPASS. Refer to Transmission Grid Operations Operating Procedure No. PCC-806 for a detailed description of the coordination of outages.

Information on the proposed outages is accessible from the OASIS of PacifiCorp and to the public via WECC's COS to allow for customer comment. The draft outage plans are continuously updated based on information posted to WECC's COS.

PacifiCorp participates in a regional Northwest Operations Planning Study Group (NOPSG) where seasonal SOL limits are verified and discussed along with any major outages. The outage limits associated with ATC paths internal to PacifiCorp's system are shared via OASIS and COMPASS.

Outage Criteria for TTC Calculations
The duration of a given outage is one of the criteria by which PacifiCorp determines which outages to incorporate in its daily and seasonal TTC calculations. PacifiCorp considers generation and Transmission outages (discussed above as a part of COMPASS) in TTC calculations.

[3] https://cos.weccrc.org/cos/

PacifiCorp calculates new SOLs when changes to system conditions will significantly impact the limits and uses those new SOLs to determine new TTC values. The change in SOL values is based on the time period being calculated and the reason for the change. This new SOL is then used to set the TTC.

4. Calculating Total Transfer Capability (TTC)

4.1 Data and Assumptions

When calculating TTC for its ATC Paths, PacifiCorp uses WECC base cases that utilize data and assumptions consistent with the time period being studied. (MOD-029 R1.1) In addition to PacifiCorp's TOP area, the WECC base cases model the entire Western Interconnection. Hence, the WECC base cases include all TOP areas contiguous to PacifiCorp's TOP area (MOD-029 R1.1.1.2). There are no other TOP areas that are linked to PacifiCorp's TOP area by joint operating Agreement (MOD-029 R1.1.1.3).

PacifiCorp models all existing System Elements in their normal operating condition for the assumed initial conditions, up to the time horizon in which PacifiCorp begins modeling outages (refer to outage section). Most System Elements normally operate as in service; however, some system elements normally operate in an open position (MOD-029 R1.1.2).

The WECC base cases include generators that meet the guidelines set out in the WECC Data Preparation Manual. PacifiCorp models the phase shifters in non-regulating mode during outage studies and in regulating mode to set a desired flow during normal operating conditions studies. (MOD-029 R1.1.4, Refer to TPL methodology)

PacifiCorp uses the seasonal load forecasts contained in the WECC base cases for each BA other than PacifiCorp. PacifiCorp updates the loads in the WECC cases with its own seasonal forecast (MOD-029 R1.1.5). Generation and Transmission Facility additions and retirements within the WECC footprint are included in the WECC seasonal operating base cases for the season in which they are energized/de-energized, respectively. PacifiCorp transmission planners modify the WECC base cases to reflect the actual in-service or retirement dates (MOD-029 R1.1.6, R1.1.7).

For the seasons or time periods in which the seasonal studies have not been completed, the last year's seasonal study results will be used for setting the TTC for the relevant Path. PacifiCorp uses the minimum SOL from the relevant seasonal studies to set the TTC of the Path for the study periods. For periods within the operating horizon, when there are no studied outages, PacifiCorp uses the maximum SOL from the relevant seasonal studies to set the TTC of the Path (MOD-029 R1.1, R1.2, MOD-029 R2.1).

PacifiCorp establishes its TTC limits based on studies that also model special protection system settings that currently exist or are projected for implementation within the studied time horizon. The PacifiCorp Wide Area Protection Scheme (WAPS), PacifiCorp Local Area Protection Scheme (LAPS), and PacifiCorp Safety Net (SN) Summary Spreadsheet lists the available RAS modeled during system studies (MOD-029 R1.1.8).

The WECC base cases include all series compensation for each line at the expected operating level. PacifiCorp has Transmission lines with series compensation. (MOD-029 R1.1.9) PacifiCorp uses no

other modeling requirements for calculating TTC in addition to those specified in this document (MOD-029 R1.1.10).

4.2 Process to Determine TTC

PacifiCorp adjusts generation and load levels within the WECC power-flow base cases to determine the TTC that can be simulated for each of its ATC Paths, while at the same time satisfying all planning criteria contingencies, as follows:

- When modeling normal conditions, PacifiCorp models all Transmission Elements in the BA at or below 100 percent of their continuous Rating (MOD-029 R1.2 and R2.1.1). PacifiCorp internally maintains numerous databases which list the generator, transmission ratings. An example of such a database is the weak link database[4].
- When modeling contingencies within PacifiCorp's Balancing Authority (BA), the loadings on PacifiCorp transmission facilities shall be within all WECC performance criteria in WECC's TPL-001-WECC-CRT-3.1 Regional Criterion document, including transient, dynamic and voltage Stability, with no transmission element modeled above its emergency rating. Refer to PacifiCorp Grid Operations System Operating Limits Methodology for the Operations Horizon (SOL Methodology) and Transmission Grid Operations Operating Procedure No. PCC-806 for a detailed description of how PacifiCorp determines SOLs used to set TTCs. (MOD-029 R2.1.2 and R.3)
- By meeting the above criteria, PacifiCorp ensures that uncontrolled separation would not occur (MOD-029 R2.1.3). If PacifiCorp can simulate a reliability-based flow in the direction counter to prevailing flows on an ATC path, PacifiCorp calculates a reliability-based TTC for that ATC Path. (MOD-029 R2.2)

4.3 Other Parameters that Impact TTC

Described in the sections above, the TTC on an ATC path is primarily determined by a power flow studies. This TTC value represents a reliability based limit and the following are other factors that further impact the TTC.

- For ATC paths whose capacity is limited by contract, the TTC on the ATC path is the minimum of the allowable contract capacity or the reliability based TTC (MOD-029 R2.3).
- Sometimes it is impossible to simulate a flow on ATC path in the non-prevailing direction due to system topology, loads and generation etc. The TTC on this ATC path in the non prevailing direction is equal to the TTC in the prevailing direction. If the TTC in the prevailing direction is limited by an SPS, the TTC in the non-prevailing direction is equal to the TTC in the non-prevailing direction without the use of the SPS (MOD-029 R2.2).
- PacifiCorp has ATC paths that have interactions with other ATC paths and these system interactions are described by using a nomogram. The TTC of these ATC are posted in PacifiCorp OASIS along with the nomograms (MOD-029 R2.4).
- PacifiCorp grid operations conducts daily and seasonal studies to determine the TTC on ATC paths by conducting power flow simulations. Any simultaneous interactions of a TTC on an ATC path with TTC on another path is studied by making adjustment to the power flow cases in order

[4] Weak Link Databases

to simulate the flow on the paths at the TTC levels. System reliability is evaluated on this case and any findings are documented along with a resolution (MOD-029 R2.5).

- PacifiCorp has paths that have multiple ownerships and TTC on these ATC paths is posted in accordance to the contractual agreement made by all the owners (MOD-029 R2.6)
- PacifiCorp has ATC paths that have been established and operated prior to January 1, 1994. All paths that have been established prior to January 1, 1994 are referenced in the System Electric Data document. The TTC on these paths is set to the prior operated value (MOD-029 R2.7).

4.4 Communication to Transmission Service Provider

- Within seven days of completion of report, the Transmission Operator shall make available to the Transmission Service Provider of the ATC Path, the most current value for TTC and the TTC study report documenting the assumptions used and steps taken in determining the current value for TTC for that ATC Path.

Appendix C: Transmission Reliability Margin

TRM is reliability based quantity that is deducted from the previously established TTC to derive ATC on a path. TRM defines the amount of transmission transfer capability on an ATC path that takes into account the uncertainties of the following:

- Load forecast and load distribution error,
- Variations in facility loadings,
- Uncertainty in transmission system topology,
- Loop flow impact,
- Variations in generation dispatch,
- Automatic sharing of reserves,
- Nomograms,
- Reactive power flows,
- Other uncertainties as identified through the NERC reliability standards development process.

PacifiCorp uses at least two of the above-listed criteria in its calculation of TRM:
1) Allowances for unscheduled flow (loop flow), and 2) Allowances for simultaneous path interactions (nomograms).

TRM is calculated pursuant to the requirements of the currently effective version of NERC Reliability Standard MOD-008 ("TRM Calculation Methodology").

Allowances for unscheduled flow or parallel path impacts (loop flow) are accounted for in TRM by PacifiCorp as follows:

- Planning Horizon:
  TRM may be assigned in the Planning Horizon when studies show simulated flows that exceed ETC values. TRM is assigned to the maximum flow identified above existing ETC requirements for paths that exhibit this characteristic.

- Operating Horizon:
  TRM may be assigned when actual flows in the Operating Horizon are observed to exceed the maximum ETC on a path without phase shifter control devices, and more than one time in any operating season.

Under such circumstances, a TRM value equal to the maximum flow above the ETC up to the path TTC is established and posted.

2) Simultaneous limitations associated with operation under a nomogram.

Allowances for simultaneous path interactions (associated with operation under a nomogram) are accounted for in TRM as follows:

- Planning Horizon:

When a transmission path has a nomogram relationship with another path, the Non-Simultaneous and Simultaneous Transfer Capabilities are first determined from studies using the methods described previously in this document. The difference between the Non Simultaneous and Simultaneous Transfer Capability is then considered to determine TRM and is posted on the impacted path/s.

- Operating Horizon:
  Posted TRM derived in the Planning Horizon is released for non-firm use in the Operating and Scheduling Horizons. The full list of TRM reserved on posted paths may be found as System Data (ATC information) and can be viewed on the PacifiCorp OASIS.

Appendix D: Capacity Benefit Margin (CBM)

CBM is also a reliability based quantity and some amount of the TTC calculated previously is preserved by the Transmission Provider for load–serving entities, whose loads are located on PacifiCorp's transmission system.

In order for the load-serving entities to enable access to generation from interconnected systems to meet generation reliability requirements, some amount of TTC is preserved as CBM.

PacifiCorp does not reserve CBM on its own behalf or for other Transmission Customers without a specific request for CBM. PacifiCorp's Capacity Benefit Margin Implementation Document (CBMID) is posted on OASIS as required by currently effective NERC Reliability Standard MOD-004 ("Capacity Benefit Margin").