

DRAFT

WHITE PAPER

PROPOSED MODIFICATIONS TO MOD-029-1a

Introduction

The purpose of this paper is to analyze negative, unintended consequences identified while performing studies to comply with NERC Standard MOD-029-1a and to propose changes that are needed to correct those portions of the standard creating the unintended consequences, specifically requirement 2.1 (R2.1).

NERC currently has a Waiver/Exception in place for R2.1; the modifications being proposed in this paper are in-line with the premise of the Waiver/Exception.

This paper provides background information that demonstrates the problem with the current R2.1 language, and provides information supporting the proposed modifications.

While this paper is predominantly focused on the Transmission assets contained within the Western Interconnection, the fundamental issue is applicable to the other interconnections as well.

Entities that have experienced issues with the current MOD-029-1a should be able to evaluate the proposed solutions and judge whether existing unintended consequences are mitigated. Entities that currently do not use the MOD-029-1a Rated System Path Methodology, or are not experiencing negative consequences, should be able to judge whether the proposed modifications introduce any new issues.

The successful resolution of the MOD-029-1a issues is dependent on achieving a consensus that a problem exists, and a supportable, defensible, and reliable solution has been proposed.

A draft Standard Authorization Request is being distributed jointly with this paper.

Executive Summary

The majority of entities experiencing problems with MOD-029-1a are related to R2.1 when no reliability limit is achieved through simulation. Throughout MOD-029-1a there is an assumption that a reliability limit is always achievable through simulation.

The proposed modification to R2.1 decouples the determination of TTC from flow for paths where no reliability limit is achieved through simulation. There is no proposed change for paths that do achieve a reliability limit. For those that do not achieve a reliability limit, the proposal is to use the Facility Rating for the determination of TTC. The use of Facility Rating as the basis

for determining TTC for these “flow limited” paths is in-line with the NERC Waiver/Exception, and is how the majority of these paths have been rated historically.

An additional modification is proposed regarding Requirement 2.3. The proposed modification corrects the erroneous assumption that R2.1 achieved a reliability limit through simulation. This minor administrative modification provides no material change to the requirement.

Background

The purpose of the MOD-029-1a Standard states:

To increase consistency and reliability in the development and documentation of transfer capability calculations for short-term use performed by entities using the Rated System Path Methodology to support analysis and system operations.

The genesis of the existing suite of MOD standards was a pair of Standard Authorization Requests finalized February 15, 2006. One SAR was entitled, “Revision to Existing Standard MOD-001-0” and the other, “Revision to Standards MOD 004, MOD005, MOD006, MOD008, and MOD 009”. The end result was significantly different, and resulted in several new standards being created from scratch, and other existing Version Zero standards being retired. The evolution to the current suite of MOD standards changed dramatically in a White Paper published May 25, 2007. That White Paper proposed the creation of the MOD-028, MOD-029, and MOD-030 standards in addition to the modifications of the MOD-001, MOD-004, and MOD-008 Standards. The White Paper also drew conclusions proposing the retirement of numerous other standards, MOD-003, MOD-005, MOD-006, MOD-007, MOD-009, FAC-012, and MOD-013. The final suite of standards are the result of numerous rounds of comments and ballots and were eventually approved by the NERC Board of Trustees in November of 2008 and adopted by FERC as Mandatory and Enforceable in the United States in November of 2009, and were effective as of April 1st 2011.¹ This paper will refer to certain specific comments and conclusions that were drawn during this initial drafting phase of the MOD Standards.

The final implementation of the MOD standards states that an entity will pick one or more of the methodologies used for determination of Total Transfer Capability:

- MOD-028 – Area Interchange Methodology
- MOD-029 – Rated System Path Methodology
- MOD-030 – Flowgate Methodology

The MOD-029-1a Standard is predominantly used in the Western Interconnection. MOD-029-1a was initially based on the methodology used to rate major paths in the Western Interconnection, the WECC Rated System Path Methodology.

Unfortunately, WECC Rated Paths account for a very small percentage of the total ATC Paths posted in the Western Interconnection, and 80 of the 81 WECC Rated Paths are able to achieve a

¹ Note: these dates are somewhat relative for the initial suite of Version One MOD Standards as MOD-001 and MOD-029-1a have each additionally gone through a formal interpretation cycle.

Reliability Limit, while only 1 is “flow limited”. This dichotomy is fundamental to the flaws inherent in the current MOD-029-1a Standard. Below is a review of the facts associated with the Transmission System in the Western Interconnection:

- Western Interconnection is primarily dominated by sparse load pockets and long EHV lines
- WECC load is approximately 18% of the total U.S. summer demand
- WECC miles of ≥ 230 kV transmission is approximately 36% of U.S. total
- WECC miles of high voltage transmission per MW of demand is about 3 times that of FRCC, RFC, or SERC
- Historically the Western Interconnection operated on a contract path approach
- Major generation & transmission facilities typically owned by multiple entities
- Utility interconnections primarily at EHV level
- The various transmission entities cooperate on many levels
 - WECC wide
 - Sub regions (WestConnect, Columbia Grid, Northern Tier)
 - Subgroups & workgroups (SWAT, CCPG, SSPG, etc.)
- Significant focus on reliable operations
- Currently 81 WECC Rated Paths
 - Only 1 has a rating based on “flow”
 - Remaining are based on “reliability” limits
- WECC rating methodology is applicable to long EHV lines not a dense network
- WECC Path Rating is for a “path” not individual elements
 - Typically a WECC rated path is multiple lines in parallel
- Numerous operational procedures developed to ensure system reliability
- Entities recognize that contract path & actual flows may not align

In early 2010, Western Interconnection entities began performing analysis of TTC necessary to meet the MOD-029-1a Requirements. It was immediately discovered that something was very wrong. The “unintended consequences” of MOD-029-1a became a regular agenda item on WestConnect monthly Steering Committee Meetings. In October of 2010, Western Area Power Administration formally contacted WECC, asking for guidance on MOD-029-1a and for WECC to interface with NERC and FERC to resolve the detrimental consequences of the Reliability Standards before the forthcoming April 1, 2011 compliance deadline. WECC’s response did not provide guidance that would eliminate the concerns expressed about the standard. APS, SRP and Western met with FERC Staff in November of 2010 to outline the results of MOD-029-1a studies, results which pointed to significant reductions in TTC when no reliability limits were found. Follow-up web meetings with both FERC and NERC participation were conducted to further describe the “unintended consequences” of being compliant with MOD-029. Ultimately in late December of 2010, WestConnect Utilities filed a request for extension with FERC for the implementation of the MOD standards, to afford time to 1) get proper guidance on the intended application of these standards, or 2) provide for the time needed to move to MOD-030, if necessary. FERC ultimately rejected the request and directed entities needing more time to request the extension through NERC.

The WestConnect entities followed the FERC directive and filed a request for extension directly to NERC. This led to what was termed the MOD-029-1a Deep Dive, to investigate the issues, and propose solutions to mitigate the “unintended consequences”. The Deep Dive meeting was held in February of 2011, and had participation by FERC, NERC, and WECC, and utilities from the Western and Eastern Interconnection. The Deep Dive provided an overview of the problems being experienced by entities in the Western Interconnection. Detailed examples of the problems were demonstrated, along with the consequences, i.e TTC reductions resulting in loss of capability to serve native load etc. The Deep Dive participants including FERC, NERC, and WECC agreed that a problem exists. The Deep Dive participants then discussed possible short-term solutions to remedy these problems, and the process necessary to achieve the remedy. The process was initially envisioned to be the submission of an Urgent Action Standards Authorization Request (UASAR). It was also envisioned that NERC would be the author and initiator of the UASAR. The methodologies currently practiced to determine TTC on these paths was discussed, the most common being the use of Facility Ratings when no Reliability Limit is achieved in system studies.

Shortly after the Deep Dive Meeting, NERC issued the Waiver/Exception for R2.1. The Waiver/Exception allows entities, for paths that do not achieve a Reliability Limit, to determine TTC the way they have done it historically, including setting TTC to the path thermal rating.

The specific relief granted in the Waiver/Exception is:

In the interim, NERC suggests (but does not require) that entities calculate the TTC of “Flow Limited” paths consistent with practices used in the past (such as using the path thermal rating).

The Joint Initiatives MOD Strike Team has maintained communication with NERC through the intervening months, and has received guidance that NERC expects that the entities in the Western Interconnection will propose modifications to MOD-029-1a sufficient to remove the need for the NERC Waiver/Exception. The proposed change is consistent with NERC’s desire to eliminate the need for the Waiver/Exception currently granted by NERC for R2.1. These changes are intended to be applicable to all entities utilizing the MOD-029-1a standard, and are not expected to have adverse impact on existing TTC.

Detailed Analysis and Proposed Mitigation

This section provides a basic structure identifying an issue by making a Problem Statement, followed by examples of how that particular problem manifests, finally followed by proposed modifications to the current MOD-029-1a.

The majority of entities that have problems with MOD-029-1a are predominantly finding that requirement 2.1 creates the negative, unintended consequences. At the heart of the problem with R2.1 is the fundamental dichotomy of setting TTC to the “flow”, whether “flow limited” or “reliability limited”, considering that the Contract Path implementation of Transmission allocation in the West does not lend itself to this “flow” limit.

Not all entities implementing MOD-029-1a are experiencing these problems. Entities that internalize paths as flowbased and only post constrained interfaces, i.e BA to BA paths, do not appear to be significantly impacted by the flaws of MOD-029. Additionally, entities that are able to actually achieve a “reliability limit” are not impacted as significantly as entities that are unable to achieve a “reliability limit” on their ATC Paths. Paths rated using the WECC Path Rating Methodology are not impacted by the existing language, and will not be further impacted by the proposed modifications.

The requirement R2.1 problem statement will focus on mitigating the “flow limited” concern.

As stated in the opening, the successful resolution of the MOD-029-1a issues is dependent on achieving a consensus opinion that a problem exists and a supportable, defensible, and reliable solution has been proposed that can eventually be included in a Standard Authorization Request.

Current MOD-029-1a requirement 2.1:

R2.1. Except where otherwise specified within MOD-029-1, adjust base case generation and Load levels within the updated power flow model to determine the TTC (maximum flow or reliability limit) that can be simulated on the ATC Path while at the same time satisfying all planning criteria contingencies as follows:

R2.1.1. When modeling normal conditions, all Transmission Elements will be modeled at or below 100% of their continuous rating.

R2.1.2. When modeling contingencies the system shall demonstrate transient, dynamic and voltage stability, with no Transmission Element modeled above its Emergency Rating.

R2.1.3. Uncontrolled separation shall not occur.

Many entities have struggled to understand what this requirement is really saying, especially with the parenthetical “(maximum flow or reliability limit)” embedded in the middle of the requirement.

Most entities have interpreted the words to state that you must:

- 1) Determine TTC through simulation
- 2) Adjust base case generation and Load levels without introducing “fictitious” generation or load
- 3) If you achieve a Reliability Limit, then the TTC is the “flow”
- 4) If you cannot achieve a Reliability Limit and are therefore “flow limited” set the TTC to the “flow”

It is argued by entities that support this White Paper, that setting TTC to the “flow”, in both the “reliability limited” case and the “flow limited” case is not appropriate for the Contract Path world in which we conduct transmission operations in the Western Interconnection.

There are numerous issues that are raised by setting the TTC to the flow.

- 1) ATC that has been historically been available in the Contract Path world is eliminated or significantly reduced.

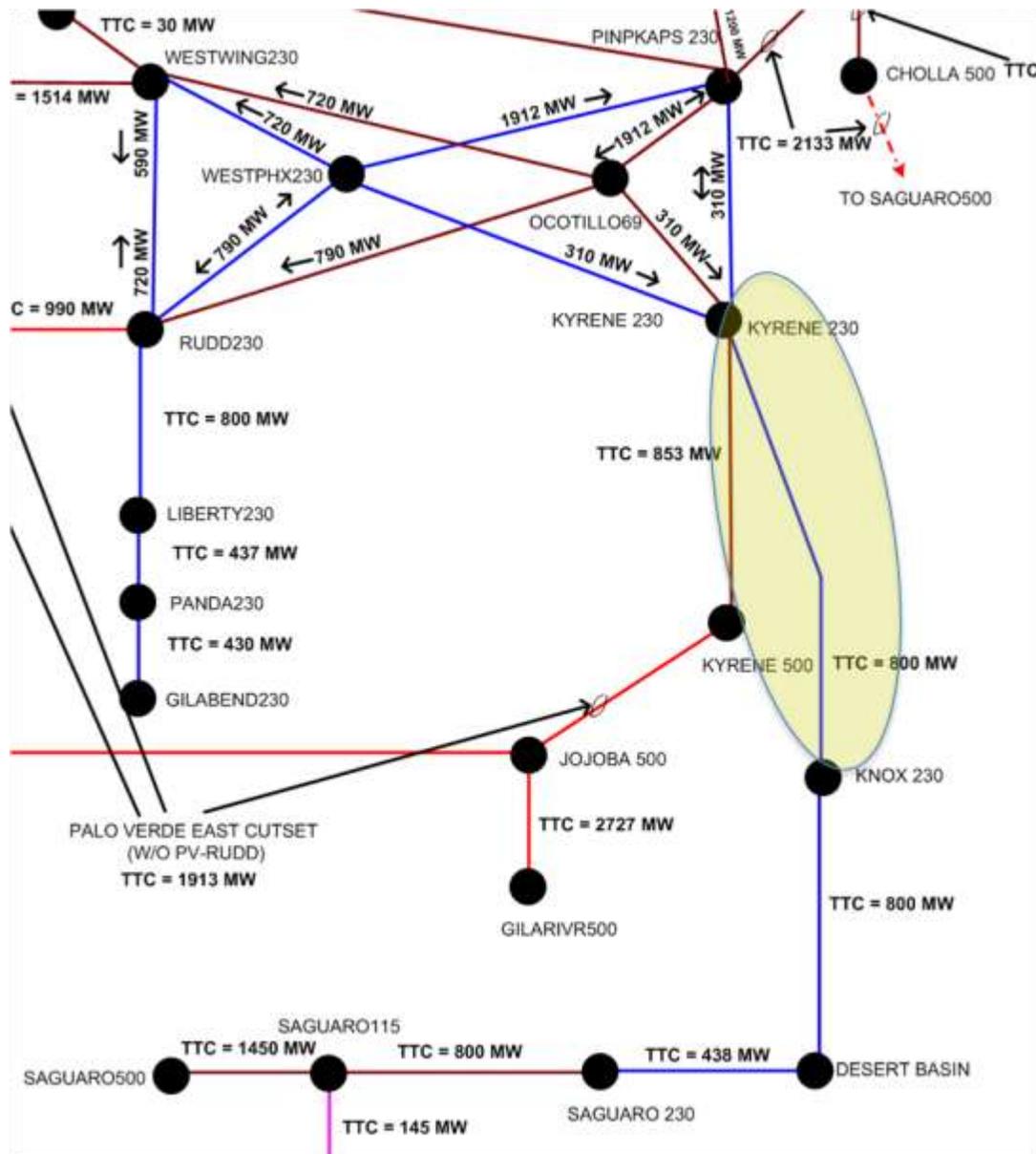
- 2) Reliability is not served by setting TTC on a Transmission Path that is “capable” of supporting much higher levels of transfer without impacting reliability.
- 3) TTC on paths with multiple owners that have very low net flows are reduced significantly by requiring the TTC to be set at the maximum simulated flow. The flows in a power flow do not account for this scenario.
- 4) Issues arise where native load cannot be served
- 5) Issues arise where system upgrades need to be built to maximize flow, which can result in situations where the only way to get additional flow is to “hijack” another entities flow.
- 6) Issues arise when a path that has historically “flowed” is no longer capable of achieving the historical levels do the upgrades in the Transmission system. These transmission system upgrades could be the result of an 3rd party entity building a parallel line, and results in what the authors term “stranded transmission capacity”, which is similar to scenarios that were created with FERC Order 888 that resulted in “stranded generation” or “stranded load”. But in the case of MOD-029, there is no relief in the form of grandfathering the “stranded transmission capacity”, one is just out of luck if the same level of power can no longer flow.
- 7) Issues arise where revenue to repay investment in the transmission system are significantly impacted, which in turn can result in upward pressure on transmission rates.

Examples detailing the nature of the R2.1 problem

Knox 230kV – Kyrene 230kV

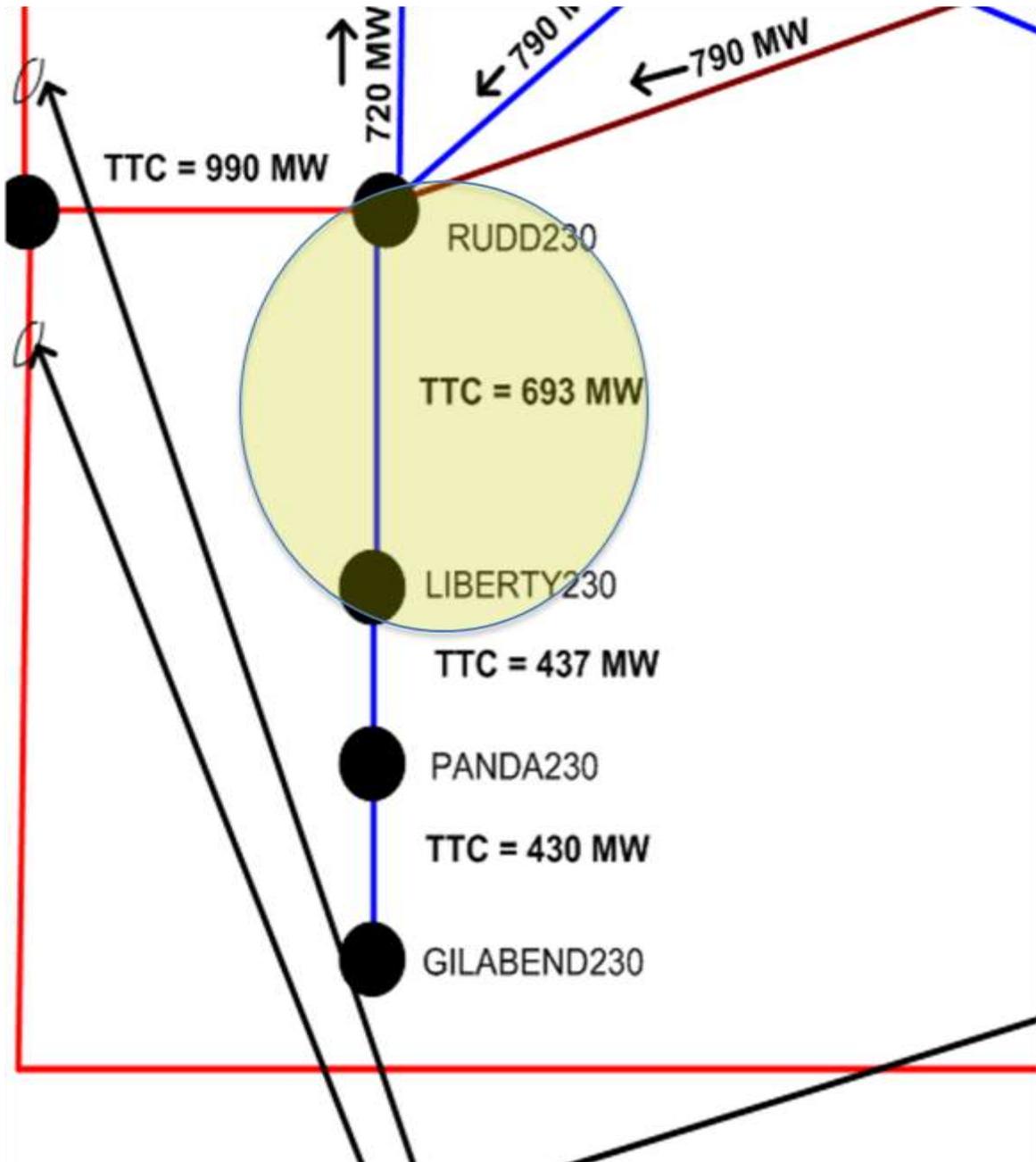
Current TTC: 800 MW (Facility Rating)

- MOD 29 TTC (w/o Waiver/Exception: 183 MW (Flow limited))
- Path consists of 230kV circuit internal to Phoenix Network
- APS owns 100%
- SRP schedules Desert Basin Generation (600 MW). APS uses the remaining for load serving and to bring Saguaro generation resources to Phoenix.
- Maximum real flow for 2010: 100 MW



The Knox 230kV to Kyrene 230kV APS posted path is impacted by the implementation of MOD-029-01a. This path historically has an 800 MW TTC value, which was based on the Facility Rating of the facilities on the path. Under MOD-029-1a (no Waiver/Exception) the Knox to Kyrene path is studied, a reliability limit is not found and a maximum flow of 183 MW is achieved. With TTC equal to flow, the MOD-029-1a (no Waiver/Exception) TTC value on the Knox-Kyrene path is 183MW. There have been long term contracts of 600 MW, and 200 MW of APS load serving historically scheduled on this path, with no reliability issues.

Liberty 230kV – Rudd 230kV



- Current TTC: 693 MW (Facility Rating)
- MOD-029-1a (no Waiver/Exception) TTC: 185 MW (Flow limited)
- Path consists of 230kV circuit internal to Phoenix Metro 230kV system.
- APS owns 100%
- The path is primarily used for load serving and brings Gila River Generation to load.
- APS Long Term Schedule: 617 MW

The Liberty 230kV to Rudd 230kV APS posted path is impacted by the implementation of MOD-029. This path historically has a 693 MW TTC value, which was based on the Facility Rating of the facilities on the path. Under MOD-029-1a (no Waiver/Exception) the Liberty to Rudd path is studied, no reliability limit is found and a maximum flow of 185 MW is. With TTC equal to flow, the MOD-029-1a (no Waiver/Exception) TTC value on the Liberty to Rudd path is 185MW. There have been long term load serving commitments of 617 MW with no reliability issues.

Proposed Modifications for R2.1

R2.1. Except where otherwise specified within MOD-029-1, adjust base case generation and Load levels within the updated power flow model to determine the maximum flow/TTC (~~maximum flow or reliability limit~~) that can be simulated on the ATC Path. If a reliability limit is achieved, set the TTC to the simulated flow resulting in the reliability limit. If maximum simulated flow does not result in achieving a reliability limit, set the TTC to the Facility Rating of the ATC Path. A reliability limit for the ATC Path is achieved if any of the following criteria are not satisfied: ~~while at the same time satisfying all planning criteria contingencies as follows:~~

R2.1.1. When modeling normal conditions, all Transmission Elements will be modeled at or below 100% of their continuous rating.

R2.1.2. When modeling contingencies the system shall demonstrate transient, dynamic and voltage stability, with no Transmission Element modeled above its Emergency Rating.

R2.1.3. Uncontrolled separation shall not occur.

Basis for Proposed Modification to R2.1

The proposed modification is consistent with NERC's desire to eliminate the need for the Waiver/Exception currently granted by NERC for R2.1. The Waiver/Exception allows entities, for paths that do not achieve a Reliability Limit, to determine TTC the way they have done it historically including setting TTC to the Thermal Limit.

The specific relief granted in the Waiver/Exception is:

In the interim, NERC suggests (but does not require) that entities calculate the TTC of "Flow Limited" paths consistent with practices used in the past (such as using the path thermal rating).

The proposed modification is consistent with the language in the Waiver/Exception. This change is intended to be applicable to all entities utilizing the MOD-029-1a standard, and is not expected to have adverse impact on existing TTC.

Determination of TTC in the Western Interconnection has historically been done in two different fashions. 81 paths have been rated using the WECC Path Rating Methodology. Typically, the paths rated using the WECC Path Rating Methodology are EHV paths connecting multiple BAs using transmission from multiple Transmission Owners. WECC Rated Paths are typically reliability limited paths, and the proposed revisions do not have any impact on the TTC associated with these paths.

Paths that do not use the WECC Path Rating Methodology are typically internal to a BA and may or may not be reliability limited. The proposed changes do not impact the reliability limited paths.

The proposed modification specifically addresses paths that through simulation do not achieve a reliability limit. Historically for these paths Transmission Operators have established TTC using the Facility Ratings of the facilities, and have been operated for years without reliability issues.

Since MOD-029-1a R3, establishes the TTC to the lesser of the value calculated in R2 or any System Operating Limit (SOL) the transmission system would be operated in an area previously studied for anticipated operating conditions such as load level, generation dispatch and generation and transmission facility status.

Proposed Modifications for R2.3

R2.3. For an ATC Path whose capacity is limited by contract, set TTC on the ATC Path at the lesser of the maximum allowable contract capacity or the ~~reliability limit~~TTC as determined by R2.1.

Basis for Proposed Modifications to R2.3

The proposed modification to R2.3 is intended to eliminate the erroneous assumption that a “reliability limit” was achieved through simulation in R2.1. The proposal is to replace the “reliability limit” language with “TTC”, to be consistent with the application of R2.1 and is applicable to both reliability limited paths and flow limited paths.

Process for documenting outreach and consensus building activities

This section will document any eventual consensus building results.

This will be in the paper that is submitted with the SAR to show the support for the proposed changes.