Increasing Dynamic Transfer Capacity on NW AC Intertie from 400 MW to 600 MW

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Executive Summary:

The purpose of this paper is to describe the increase of dynamic transfer capacity (DTC) on the Northwest AC Intertie (NWACI).

Customers using DTC continue to push for increased dynamic capability, most notably on NWACI. BPA recently completed a study regarding DTC on NWACI, and has assessed the reliability impacts, confirming that the DTC allowed on NWACI can be increased from 400 MW to 600 MW. BPA, PacifiCorp and Portland General Electric have agreed to the increase scheduled for July 1, 2018.

BPA, PAC and PGE are attempting to implement this change quickly to be responsive to customer needs and to provide increased system flexibility. Currently, the 400 MW of DTC on NWACI is often fully allocated during all hours of the day, and the additional 200 MW will likely be utilized immediately as well.

Purpose:

With an ever-increasing need to accommodate variability, customers using DTC continue to push for increased dynamic capability. In particular, due to the growth of Northwest participants in the CAISO Energy Imbalance Market (EIM), customers have focused on the DTC on NWACI. Having recently completed a study regarding DTC on NWACI, BPA has assessed the reliability impacts, and confirmed that the DTC allowed on NWACI can be increased. As more entities join the EIM, each entity using DTC on NWACI will be allocated less DTC due to the same DTC being allocated to an increased number of entities. Increasing DTC on NWACI will help to counteract this issue.

Background:

In August of 2015, prompted by studies conducted with Columbia Grid and other regional parties, DTC on NWACI was changed from 200 on-peak/550 off-peak to 400 MW both on- and off-peak. The 2015 change represented a conservative value based on the maximum flows on NWACI during the study periods. With the advancement in DTC study procedures, a follow-up study was recently run to further verify and examine DTC on NWACI.

Note that in this document, Max Total Transfer Capability (TTC) represents the upper reliability limit for NWACI flows rather than the System Operating Limit (SOL) because Max TTC is the value on which BPA Dispatch acts to maintain NWACI reliability. Max TTC will always be less than or equal to the path SOL.

DTC Limits:

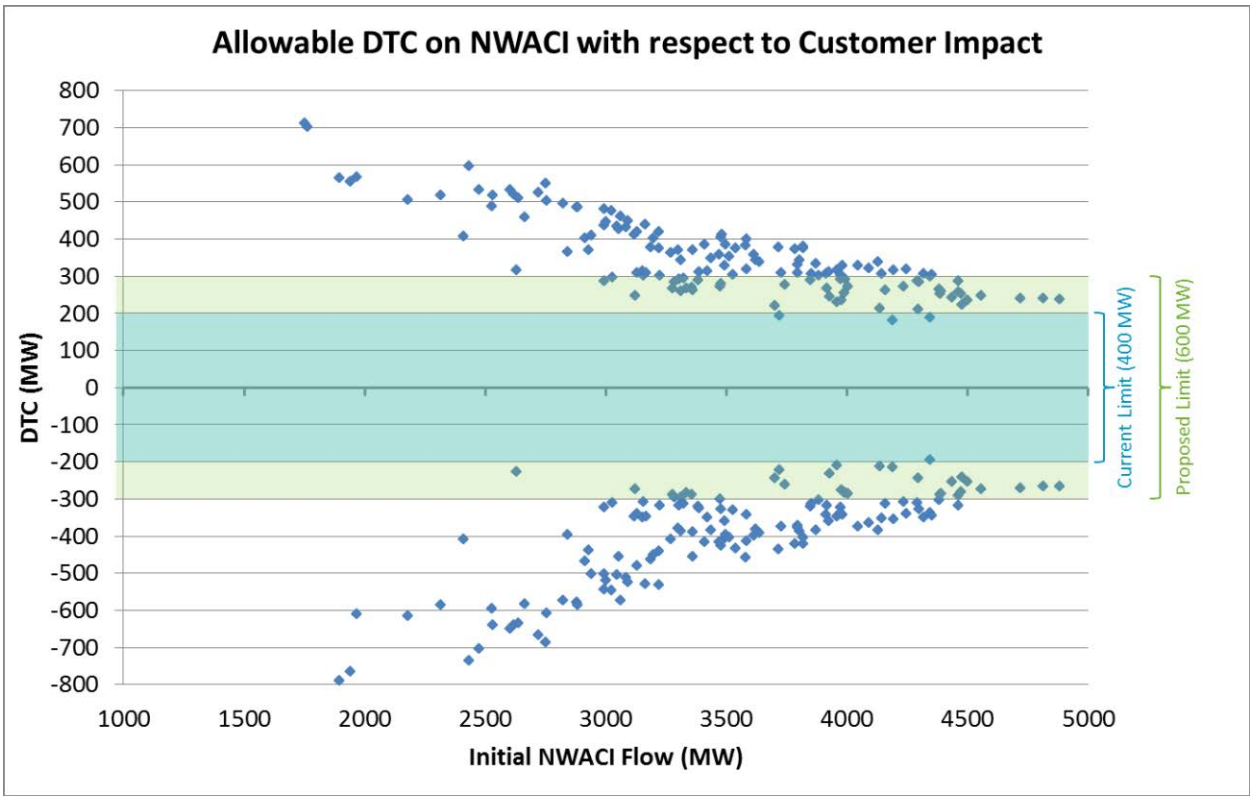
The follow-up study, commissioned by BPA and completed in June 2017, indicates that 600 MW of DTC can be allowed on NWACI without reliability concerns so long as the voltage stability limitation (described in Appendix A) remains in place.

Figure 1 below illustrates the results of this follow-up study of DTC on NWACI. The figure shows the amount of DTC that is allowable on NWACI with respect to customer impact criteria. Each point plotted on the graph represents the allowable DTC determined for a given State Estimator case plotted versus the base flow across NWACI in that case.

The current and proposed limits are highlighted on the graph in blue and green respectively. As seen in the graph, virtually all points fall outside of the current limit, meaning that the current limit was set such that under study conditions, BPA would not cause a customer impact issue. This approach, while legitimate, was determined to be overly conservative for a number of reasons.

For one, customer impact studies calculate DTC by analyzing voltage change across the system as a source/sink pair is ramped. This approach implicitly assumes that all of the DTC usage happens within a single period. In reality, however, coincidental usage of the full dynamic capacity rarely occurs. Additionally, the studies consider the voltage change associated with actual generation movement, but operationally, the DTC limit is applied against dynamic schedules. While one might expect that a change in schedule would result in a demonstrable, predictable change to the flow across the flowgate, this is often untrue for dynamic schedule changes. This means that even if coincidental use of the full dynamic capacity was scheduled, the actual impact to NWACI flows (and thus system voltages) would be smaller than indicated by that schedule. Lastly, the studies are performed on a “locked” system, with the assumption that DTC should be limited to a level that prevents dispatcher action. While exceeding the allowabe DTC can result in noticeable voltage change, such a change would be dealt with by dispatchers in the same manner they would deal with any voltage change issue.

Given the above reasoning, NWACI DTC will be increased from its current limit of 400 MW. Increasing the DTC to 600 MW is a reasonable balance between respecting customer voltage impacts and recognizing the realities of DTC usage versus the assumptions necessary in DTC study methodology. Under the reasoning above, BPA expects that dynamic transfers will rarely cause notable voltage deviations, but BPA will reserve the right to revert the NWACI DTC limit should dispatchers begin experiencing a noticeable uptick in actions against voltage change.



Conclusion:

Based on the most recent study, the DTC limit on NWACI can be raised to 600 MW without adverse reliability implications. The current voltage stability limitation algorithm will remain in place.

Appendix A: Voltage Stability Limitation on Dynamic Schedules on NWACI

A voltage stability study run by BPA Transmission Planning at the time the DTC limit on NWACI was changed to 400 MW demonstrated the need for an additional limitation on dynamic transfers. A potential voltage stability issue is introduced when there are dynamic schedules moving on NWACI when the actual flows are within 400 MW of the Max TTC. In order to mitigate this issue, an algorithm has been implemented that limits dynamic transfers on NWACI when the actual flows are within 400 MW of the Max TTC. When this condition is met, the algorithm sets each dynamic transfer's limit equal to its current dynamic dispatch. If, during the limitation, a dynamic transfer is dispatched toward zero, its limit follows that dispatch value toward zero. This limitation is lifted once the actual MW flow on NWACI is more than 450 MW below Max TTC.

When DTC is increased to 600 MW on NWACI, BPA expects that this limitation will occur less frequently. The transmission scheduling process includes the provision that scheduled ATC and scheduled DTC must sum equal to or less than the Total Transfer Capability (TTC). Thus, because there will be more capacity set aside for dynamic use, the static schedules must decrease by the amount of the DTC increase. Since DTC is fully utilized now at 400 MW and customers are asking for additional DTC on NWACI, BPA expects that the full 600 MW will be utilized for DTC, thereby lowering the amount of transmission available for static schedules by 200 MW. This will likely decrease the overall flows on NWACI due to the difference in usage of dynamic schedules versus static schedules, as static schedules are always 100% filled and dynamics vary between 0% and 100% of their schedules. With lower overall flow, the flow is less likely to get within 400 MW of Max TTC.

This limitation is undergoing further review by the BPA DTC team to confirm its continued necessity. A recent addition of the Synchrophasor RAS to the Remedial Action Schemes supporting NWACI may mitigate the voltage stability issue on NWACI, which would allow this limitation to be removed. Studies are being conducted at BPA to evaluate this, and are planned to be completed by September of 2018. If it is shown that the Synchrophasor RAS does mitigate the issue, the limitation will be removed once that scheme has been certified as a Wide Area Protection Scheme, rather than its current classification as a Safety Net.