CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION PROJECT #9007

CONSULTING TSMSP
OATI OPINION ON CAISO STRAW PROPOSAL
v2.0

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The Smarter Future of Energy

OPEN ACCESS TECHNOLOGY INTERNATIONAL, INC.
3660 Technology Drive NE | Minneapolis, MN 55418 | Phone 763.201.2000 | Fax 763.201.5333 | www.oati.com

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Table of Contents

1. Introduction

Open Access Technology International, Inc. (OATI) is pleased to provide this write-up in support of some elements of the California Independent System Operator Corporation (CAISO) Transmission Service and Market Scheduling Priority (TSMSP) proposal. In providing this opinion we have considered both the prevalent industry practices and special circumstances dictated by CAISO's market design principles that have been in place for a quarter of a century.

Specifically, as a fundamental principle of its existing market design, the CAISO does not require or provide for forward reservation of transmission service as a pre-requisite to participate in the CAISO-facilitated markets. Rather, the CAISO market optimizes the use of all physically available transmission based on competitive bids for purchase and sale of different CAISO market products. In contrast, the Open Access Transmission Tariffs (OATT) adopted by other Balancing Areas and Transmission Providers across the west (WECC) require buyers/sellers to secure capacity/energy and separately reserve transmission service in advance of the transaction, to support delivery of the transaction from source to sink.

The CAISO market mechanism, like other ISO/RTO markets uses constraint relaxation parameter (aka penalty factors) to prioritize relaxation of otherwise hard constraints in cases where bids and offers prove inadequate for the market-clearing process to achieve a feasible solution. Scheduling priorities in CAISO's market become a factor when the market cannot find a feasible solution. The relative sequence of scheduling priorities are coordinated in the market solution through the use of the constraint relaxation parameters.

CAISO's TSMSP proposal is primarily concerned with scheduling priority of wheel-through transactions compared to import transactions intended to serve CAISO native load. As such, the straw proposal is primarily concerned with scheduling priority in the face of limited transmission capacity on the interties to accommodate both wheel-through schedules and wheel-in schedules to serve CAISO load.

The proposal adopts the industry accepted NERC formula for computation of the ATC, namely:

$$ATC = TTC - ETC - TRM - CBM$$

Where:

TTC = Total transfer capability of a path or intertie

ETC = Existing transmission commitment, which includes transmission capacity set aside for native load needs and native load growth.

TRM = Transmission Reliability Margin, which is a further transmission set-aside for uncertainty associated with service to load and preserving transmission system reliability.

CBM = Transmission set-aside of as a margin for imports of supply during declared emergency conditions.

Only a handful of FERC-regulated transmission providers utilize CBM. As such CAISO proposal sets the CBM component to 0.

OATI's opinion provided here pertains to:

- The component of ETC that CAISO's proposal sets aside for Native Load
- The TRM set aside

The comments are summarized in the next two sections.

2. Native Load Set Aside

2.1 Summary of CAISO Proposal on Import Capacity Set Aside For CAISO Native Load

The CAISO proposal on Native Load Set aside is to assign import of Resource Adequacy (RA) Showings and non-Resource Adequacy (non-RA) Contracted Supply at the individual interfaces.

The CAISO process for allocation of external interfaces use to serve Native Load within the CAISO boundaries will be based upon forecasts (based on two years of historical data) of future needs of the Load Serving Entities load (RA and non-RA contracted supply) at the external interfaces, plus the existing transmission commitments of entities use of the same applicable external interfaces. This process, though its components may be named differently than what neighboring Balancing Areas use, is nonetheless similar in usage to ensure that Transmission Capability to serve Native Load is prioritized in this new wheel through priority process.

CAISO presently will not incorporate any internal path congestion for ATC calculations but will closely monitor the impacts of import and wheel through volumes under different conditions. In addition CAISO will perform analyses periodically as suggested by stakeholders to test the ability of the internal network to operate reliably without triggering internal reliability constraints.

2.2 Reference Frame to Assess Degree of Alignment with Industry Practices

CAISO proposes a simple methodology for resource assessment supporting native load needs. This includes resource assessment based on historical resource data (RA and non-RA imports) for similar months. As the CAISO straw proposal points out, other transmission providers across the West also rely on resource forecasts and estimates, to the extent supply is not under contract at the time of the ATC calculation, based on where they expect supply to be contracted and delivered to serve load.

To put the CAISO proposal for Native Load set aside in the context of Transmission Service Provider (TSP) practices in the West, we note that CAISO Load Serving Entities' (LSEs) load may be comparable to the Network Integration Transmission Service (NITS) loads served by other TSPs in the West. Accordingly, references to Bonneville Power Administration (BPA), Salt River Project (SRP), and Idaho Power Company (IPC) practices for Native Load and NITS set asides are offered below as representative samples.

Relevant BPA Set Aside Practice (Reference: Available Transfer Capability Implementation Document (MOD-001-1a)):

For BPA's paths where NITS commitments exist to serve Network Load outside BPA's BAA, the firm capacity set aside for NITS is equal to the Load forecast, which includes losses and Load growth, minus generation outside BPA's BAA that is designated to serve that Load. For BPA's paths where NITS commitments exist to serve Network Load inside BPA's BAA from a forecasted or designated network resource that impacts the path, the firm capacity set aside for NITS is equal to the amount the resource is forecasted/designated for.

Relevant SRP Set Aside Practice (Reference: Available Transfer Capability Implementation Document, Ver. 7):

For use in the ETC calculation for the Native Load/Network load, SRP "uses load and resource forecasts provided by network customers to determine the transmission capacity to be set aside for each network customer."

"SRP sets aside transmission for resources and energy purchases to serve native load needs, via the 13 Month Transmission Plan. The 13 Month Transmission Plan utilizes the peak hour forecast to establish native load needs for each month for 13 months. The 13 Month Transmission Plan is updated at a minimum of once a month for the next 13 months. Transmission capacity that is needed for resources and energy purchases is assigned a unique TSN(s) and the associated MWs are allocated via OASIS at a minimum of once a month for the next 13 months."

Relevant IPC Set Aside Practice (Reference: Idaho Power Transmission Business Practices Section 6 – Available Transfer Capability Implementation Document (ATCID) and Section 2 – Network Integration Transmission Service):

Idaho references the use of their transmission system by NITS or Native Load Service (NLS) customers within the Business Practice, Section 2 – Network Integration Transmission Service. Within this BP the following is stated: "Any load growth reservation must be based upon reasonably forecasted loads in the customer's current planning horizon and be supported by a reasonable plan for Network Resources to meet that load growth. Any energy replacement reservation must be based upon the customer's current planning horizon and be supported by a reasonable generation forecast for the Network Resource."

Moreover, different RTOs treat the native load needs differently in their ATC calculations based on their resource sufficiency practices. For example, PJM and MISO have capacity markets where supply is secured over a longer period of time, but the CAISO has a unique RA program with shorter look-ahead time frame. This should be considered in comparing CAISO's proposal to the ATCIDs of other RTOs who do have capacity markets in place.

2.3 OATI Opinion on Native Load Set Aside Methodology

It is OATI's opinion that due to difference in the CAISO's market mechanism and the market mechanisms of the above referenced ISOs/RTOs, a step by step comparison cannot be made. OATI believes the lack of a capacity market should not be an impediment for CAISO to set aside transmission for native load based on resource assumptions derived from historical RA and non-RA showings.

More broadly, every TSP has to make some assumptions on load forecast, and associated resources to serve load, in their ATC calculations. As noted in Section 2.2, the methods of determining Native Load set-aside utilized by several Western Balancing Areas (Bonneville Power Administration, Idaho Power Company and Salt River Project), all rely on a native load forecast method, and involve commensurate generation assumptions informed by designated and forecasted resources. As such, the use of historical data for Resource Adequacy to serve CAISO LSE load along with Non-Resource Adequacy Contracted Capacity Supply allocated to the Transmission Paths from External Balancing Entities is not dissimilar, and in our opinion is adequate as a start as a simple forecasting method for Native Load needs.

Having said that, for better alignment with Native Load set aside practices of other RTOs and Western Balancing Areas, we recommend the following enhancements be considered as the proposed framework evolves and the CAISO and stakeholders gain experience with the design:

- Forecasting Enhancement: The CAISO should investigate the use of modern forecasting techniques and solutions in order to supplement and/or replace the currently proposed forecast method for load and resource forecasting needs for Native Load and Load Growth Set-Asides used in the ATC calculation for wheel through priority service.
- Horizon consideration: The CAISO should also consider future adaptation of the currently proposed Native Load set aside for different time horizons as more experience is gained after the initial implementation.

We note that methodologies for Native Load set-aside forecasting used by all comparable entities are refined as time passes, and evolve as their experience grows with providing these values for usage within their process to calculate ATC.

3. The TRM Set Aside

3.1 Summary of CAISO Proposal on Transmission Reliability Margin

CAISO's TSMSP proposal includes the use of TRM in the calculation of ATC. The NERC Reliability Standard for TRM, MOD-008-1, outlines several elements that can be considered in evaluating TRM. CAISO is proposing to include the following three elements in its TRM evaluation:

- Aggregate load forecast uncertainty – TRM will be calculated across the entire 13-month ATC horizon, so this element is needed to account for load forecast uncertainty across that time horizon.
- Forecast uncertainty in transmission system topology – This TRM element is necessary to account for a risk that certain transmission outages may not be submitted with enough lead time to be incorporated into ATC calculations and therefore require TRM usage.
- Variations in generation dispatch - This TRM element sets aside transmission capacity in case there are needs to bring in additional generation to account for resource outages or other system conditions. CAISO plans to incorporate this TRM element to account for scenarios such as net peak load periods when variable energy resources may be unavailable and additional imports are needed to reliability serve load, or other scenarios where expected generation supply such as hydropower or variable energy is impacted and must be replaced to serve load.

For each of the three TRM components the CAISO proposal is to start with to 2% of TTC on select interties where CAISO has historically relied upon import supply to serve load. Each element of TRM would be assessed independently to determine the TRM need, so the final TRM amount on a given intertie may not have a full 2% TRM per component.

CAISO plans to incorporate TRM into both the monthly ATC and daily ATC calculations.

3.2 Reference Frame to Assess Degree of Alignment with Industry Practices

CAISO is using the NERC TRM standard as the guideline for developing and implementing its TRM approach. The following summaries outline how some of the other RTOs define their TRM approaches.

- MISO – MISO applies TRM in the Operating Horizon for the next 48 hours of operation covering Real-Time and Day-Ahead periods as well as the Planning Horizon which is the

time period beyond the Operating Horizon up to 36 months ahead. The same calculation is applied for both Firm and Non-Firm ATC, although TRM may be released for sales as non-firm capacity by the MISO transmission provider. The following components are part of MISO's TRM:

- Automatic Reserve Sharing: MISO calculates the MW amount required on transmission flowgates to deliver contingency reserves based on contingency reserve obligations of its reserve sharing members. This component is calculated seasonally (summer and winter) and applied to both the Operating and Planning Horizons.
- Uncertainty Components: These include the following:
  - Aggregate Load Forecast: Load forecast errors can cause the need for TRM to account for real-time transmission facility loading about forecasted values. This TRM component is only applicable in the Planning Horizon.
  - Load Distribution Uncertainty: This TRM component is similar to Aggregate Load Forecast in accounting for differences in real-time transmission facility loading compared to predicted load forecasts. This TRM component is only applicable in the Planning Horizon.
  - Forecast Uncertainty in Transmission System Topology: This TRM component accounts for uncertainty in transmission system configuration from events including but not limited to forced, unplanned and maintenance outages. This TRM component is only applicable in the Planning Horizon.
  - Allowances for Parallel Path (Loop Flow) Impacts: This TRM component accounts for scheduled transfers from other entities which contribute to unexpected real-time facility loading and impact AFC values. This TRM component is only applicable in the Planning Horizon.
  - Variations in Generation Dispatch: This TRM component captures unplanned generator outages which impact AFC values. This uncertainty also can arise from the MISO market dispatch which may vary from forecasted levels based on economic and congestion factors. This TRM component is only applicable in the Planning Horizon.

The MISO Uncertainty Component, applicable only in the Planning Horizon, does not directly utilize uncertainty components to establish TRM values for Flowgates; instead, it addresses them by applying a factor of two percent (2%) of the Flowgate rating on the top of the Automatic Reserve Sharing component for each transmission flowgate. The

TRM Automatic Reserve Sharing component uses a study process to determine the largest MW impact on each flowgate on a post-contingency basis and sets a value that is used in the Operating and Planning Horizons.

- PJM – PJM applies the same TRM calculation for all time horizons and ATC products (hourly, daily, weekly, and monthly) which cover 18 months and both Firm and Non-Firm ATC calculations. The following components are part of PJM's TRM:
  - Aggregate Load Forecast: Load forecast errors can cause the need for TRM to account for real-time transmission facility loading about forecasted values. PJM notes that load forecast error generally increases as the forecast time period moves further away from real-time, and that the average day-ahead load forecast error has historically been approximately 2%. Therefore PJM sets 2% of the flowgate rating as TRM for both Non-Firm and Firm ATC calculations to account for aggregate load forecast error.
  - Allowances for Parallel Path (Loop Flow) Impacts: This TRM component accounts for scheduled transfers from other entities which contribute to unexpected real-time facility loading and impact AFC values. PJM simulates the loop flow impact on flowgates in its ATC process to calculate the difference in flowgate MW flow with and without the loop flow to calculate the difference as a percentage of the flowgate rating. If this loop flow percentage is greater than the 2% TRM set by aggregate load forecast then it is used for TRM.
  - Variations in Generation Dispatch: This TRM component captures unplanned generator outages which impact AFC values. This uncertainty also can arise from the MISO market dispatch which may vary from forecasted levels based on economic and congestion factors. PJM monitors for limitations on flowgates in ATC calculations which do not occur in real-time and may be attributable to variations in generation dispatch. PJM may apply an adjustment to TRM to prevent this type of flowgate limitation from restricting ATC.

Beyond the TRM components already listed, the PJM TRM Methodology allows for TRM adjustments due to certain historic conditions, current and expected operating conditions, unusual circulation and other operating conditions. PJM may set TRM on specific Flowgates consistent with historic loading, load forecast and distribution error, variations in facility loadings, uncertainty in transmission system topology, loop flow

impact, variations in generation dispatch, automatic sharing of reserves, and other uncertainties, as identified through the NERC reliability standards. If a flowgate is constrained in real time operations, but not in the AFC calculation, PJM may increase TRM to prevent additional commitments on the flowgate. PJM also sets a TRM of 5% of the flowgate rating for the following scenarios:

- A PJM owned flowgate had a Transmission Loading Relief (TLR) issued in the 12 months prior to PJM's TRM re-evaluation;
- Flowgates identified in Manual 37: Reliability Coordination as Interconnection Reliability Operating Limit (IROL) facilities; and
- A PJM owned flowgate that were bound constrained by the PJM market in the 12 months prior to PJM's TRM re-evaluation.

- SPP – SPP applies TRM in the Planning and Study time horizons which cover 12 months for firm ATC calculations. TRM may be released for sales as non-firm capacity by the SPP transmission provider in the Operating, Planning, and Study horizons. The following components are part of PJM's TRM:
  - Aggregate Load Forecast: Load forecast errors can cause the need for TRM to account for real-time transmission facility loading about forecasted values. SPP uses forecast hourly load for the next seven days for all applicable control areas; beyond seven days, SPP projects a demand based on seasonal peak load models for all applicable Transmission Owners.
  - Variations in Generation Dispatch: This TRM component captures unplanned generator outages which impact AFC values. SPP uses real-time snapshots of network system conditions for generation dispatch in near-term models. For the longer-term horizons, whenever possible, generation dispatch information provided by generation owners will be applied to the ATC calculations. However, it is recognized that longer-term dispatch is probably unknown to the generation controlling entities themselves except for baseload and must run type units.
  - Allowances for Parallel Path (Loop Flow) Impacts: This TRM component accounts for scheduled transfers from other entities which contribute to unexpected real-time facility loading and impact AFC values. Parallel flows can be an issue if pertinent data to the ATC calculations are not shared among the transmission providers and those transactions that have multiple wheeling parties are not identified. SPP

transmission owners of facilities that are impacted by unaccounted parallel flows or variations in dispatch may request additional TRM for their impacted Flowgates.

- Operating Reserve Sharing: SPP instituted an Operating Reserve Sharing program to provide both reliability and economic benefits to its members. This program reduces the amount of internal operating reserves each entity is required to maintain while providing an automated way of allocating resources on a region wide level to ensure quick recovery for the loss of any unit. Transmission facilities must be able to support the automatic implementation of the Reserve Sharing program. To that end, TRM on the Flowgates will provide enough capacity to withstand the impact of the most critical generation loss to that facility. All generation contingencies will be simulated by the Operating Reserve Sharing algorithm to determine the highest impact on each Flowgate. This capacity will be included in TRM.
- Counter Flow Impacts: Another factor SPP considers in its TRM process is that for the planning horizon the counter flow impacts of reservations on the Flowgates are removed with the exception of Designated Network Resources. This counter flow provides an inherent margin in the ATC calculation which is a proxy for the generation variation.

SPP uses a power flow model approach to find the generator outage that has the largest impact on a given flowgate. Therefore there is no standard percentage TRM offset for SPP ATC calculations but instead it is determined per flowgate. There are a limited number of flowgates in the SPP TRMID which have exceptions to the TRM calculation process and define additional TRM requirements for stability based flowgate definitions or per accepted FERC agreement.

3.3 OATI Opinion on TRM Methodology

California ISO is using the NERC TRM standard (MOD-008-1) as the guiding document for defining its needs for TRM. The previous section which outlined how some other ISO/RTO entities utilize TRM show that CAISO is using TRM in a similar manner. The main components which are common to all ISOs/RTOs are load forecast uncertainty to account for discrepancies in forecasted values compared to real-time transmission element loading, transmission system topology uncertainty due to planned and unplanned transmission system outages, and variations in generation dispatch due to unplanned generator outages or market dispatch differences compared to forecasted amounts.

The primary difference in TRM approach adopted by CAISO compared to the majority of utility transmission providers is attributable to the needs of a market-based transmission provider compared to the more traditional transmission providers who do not have day-ahead and real-time market processes to serve native load. However, as already stated CAISO is using similar TRM approaches compared to other ISO/RTO entities. The interties where CAISO has historically relied upon import supply to serve load may not warrant the inclusion of other TRM components provided for by NERC, although flexibility in the CAISO TRM implementation could allow for evaluating other TRM components as warranted.

The current CAISO proposal states that TRM will apply to both the Daily ATC and Monthly ATC calculations. OATI agrees with that approach, but there is no additional detail on whether the TRM evaluation between these two ATC calculations would apply TRM differently. As noted by other ISO/RTO entities, the uncertainty of the TRM elements increases as the time horizon from real-time increases. Additionally the NERC TRM standard allows for variations in how TRM is applied between different ATC horizons. Accordingly, OATI recommends that for monthly ATC computations for months farther away from the effective date, higher TRM levels be considered compared to the months closer to the effective date. OATI also recommends that the Daily ATC would decrease the amount of TRM, as forecast and outage information is less prone to change. The Daily ATC horizon still would expect to have a non-zero TRM component to allow for some risk in having unplanned transmission or generation outages.

OATI also recommends that the CAISO TRMID allow for the evaluation and inclusion of additional TRM components as system conditions or additional studies may identify the need for additional margin. This flexibility in defining the CAISO TRM approach is consistent with the approach of

other transmission providers and will evolve and be refined as their experience grows with setting a TRM for usage within their process to calculate ATC.

OATI also would like to point out that CAISO's proposal currently sets the Capacity Benefit Margin (CBM) to zero for ATC computations on the interties. This approach is in line with practices in most other RTOs and Western transmission providers with a few notable exceptions such as PJM, MISO and Idaho Power. However, as mentioned above, this and other set-aside components provided by NERC in ATC computation may be included in CAISO's ATC computations for wheel-through scheduling priority in the future, as warranted, based on minoring the outcome of the currently proposed methodology in practice.