

use of ambient adjusted ratings applies to relatively few facilities and involves a manual process to update line ratings for an applicable operating period. The CAISO supports efforts to expand and automate the use of ambient adjusted ratings on transmission facilities. This effort, however, must consider important regional issues affecting operation of the transmissions system, especially in connection with developing line rating methodologies and establishing the schedule for implementing any final rule. The NOPR's proposal for RTOs/ISOs to implement systems and procedures necessary to allow transmission owners to update transmission line ratings at least hourly will require additional market design changes the NOPR does not discuss and significant technology enhancements. For these reasons, the compliance schedule set forth in the NOPR is neither realistic nor achievable.

As part of any final rule, the CAISO recommends the Commission:

- Allow transmission owners the opportunity to justify an alternative implementation schedule for the use of ambient adjusted ratings on their transmission lines as part of any compliance filings.
- Allow transmission owners and transmission service providers to justify when they will utilize ambient adjusted ratings or seasonal ratings on transmission lines consistent with regional and local considerations as well as good utility practice.
- Recognize that RTOs/ISOs need to develop additional market rules associated with adjusting transmission line ratings on an hourly basis. Allow **at least 180 days** from the effective date of any final rule for RTOs/ISOs to submit tariff changes to maintain systems and procedures needed to allow for the use hourly-adjusted transmission line ratings.
- Recognize the technology enhancements necessary to automate the submission and use of hourly-adjusted transmission line ratings. Modify the compliance schedule to require RTOs/ISOs to implement systems and procedures **no sooner than 18 months** after the submission of tariff provisions in compliance with any final rule.

II. Background

Within its balancing authority area, the CAISO implements transmission equipment ratings provided by participating transmission owners.² At a minimum, participating transmission owners must provide four ratings for each transmission line and associated facility: summer normal, summer emergency, winter normal, and winter emergency. Some participating transmission owners employ seasonal ratings by selecting winter and summer ambient temperatures in their rating methodology, but other transmission owners maintain the same ambient temperature year round. Where equipment allows, emergency ratings permit exceeding the normal ratings for a time-period up to four hours typically. Participating transmission owners can provide shorter duration emergency ratings as their rating methodology permits. In instances where safety considerations prohibit overloads on equipment, even for a short duration of time, the normal and emergency ratings are the same.

In some cases, participating transmission owners provide temperature adjusted ratings. Some of these adjustments are relatively static, *i.e.*, they are seasonal and do not change on a day-ahead or real-time basis, and some are more dynamic, *i.e.*, they may change on a daily basis based on forecasted temperature. Participating transmission owners are the appropriate entities to determine any ambient adjusted ratings for their transmission equipment placed under the operational control of the

² Section 4.2 of the CAISO Transmission Control Agreement requires the CAISO to maintain a register of all transmission lines, associated facilities, and entitlements subject to CAISO operational control. The CAISO register contains the applicable ratings for each transmission line and associated facility. Any change in a transmission line or associated facility's rating requires an update to the CAISO register. Upon receiving a change and verifying it for accuracy, the CAISO modifies the register to incorporate the change by the end of the next business day. The NOPR's proposal to authorize hourly updates to transmission line ratings would require changes to the Transmission Control Agreement and/or processes to automate existing functions.

CAISO. In addition, participating transmission owners should remain the responsible entities for communicating the operationally appropriate adjusted ratings to the CAISO.

In the context of the Energy Imbalance Market (EIM), participating balancing authority areas determine the EIM transfer limit available for the CAISO to use in the real-time market and communicate that limit to the CAISO. Seasonal and ambient adjusted transmission line ratings within balancing authority areas participating in the EIM may inform this EIM transfer limit.

The CAISO recognizes the potential market and reliability benefits of using ambient adjusted ratings. They can provide a more accurate understanding of the transfer capability of the transmission system at any point in time, including any increased or decreased availability. All else being equal, this information should promote more reliable and efficient transmission operations.

For the CAISO, the fundamental challenge with utilizing ambient adjusted ratings is ensuring entities can timely transmit forecasted line ratings so the CAISO can incorporate them into the Energy Management System and market systems. Currently, participating transmission owners submit ambient adjusted ratings as an equipment rating change through the CAISO's outage management system (webOMS). The CAISO webOMS entry overwrites the normal and emergency rating of equipment for a specific time period and then broadcasts all equipment rating changes to downstream applications, including market models/applications and reliability models/applications. Given the manual process involved in submitting and approving equipment rating changes, the CAISO and participating transmission owners have utilized this process only for those facilities with expected congestion based on the results of the CAISO's

outage coordination process and day-ahead operational planning analysis process. The CAISO also has developed limited capability for its Energy Management System to consume adjusted line ratings using Inter Control Center Communications Protocol. This capability supports real-time reliability operations across the CAISO's reliability coordinator footprint. Scaling this capability to forecast transmission line ratings on an hourly basis across the CAISO's balancing authority and the EIM Entity balancing authority areas for market purposes will require additional work to create requirements, design and develop system changes, and complete necessary testing.

III. Any final rule should recognize important regional and local issues facing transmission providers

The NOPR proposes a staggered approach to implementing the proposed requirement for seasonal ratings and ambient adjusted ratings that prioritizes application to congested lines.³ This approach would require implementing seasonal and ambient adjusted ratings on all historically congested lines within one year from the date of the compliance filing contemplated by the NOPR. The NOPR defines historically congested lines as transmission lines that experienced congestion at any time in the five years prior to the effective date of any final rule.⁴ However, the NOPR offers no rationale for this implementation schedule.⁵ There appear to be no nexus

³ NOPR at P 81.

⁴ *Id.* at P 92.

⁵ The Commission must explain the reason for its implementation timeline in any final rule. As part of that explanation, the Commission should examine relevant considerations and develop an explanation that evidences a rational connection between those considerations and the implementation schedule it adopts. *Motor Vehicle Mfrs. Assn. of United States, Inc. v. State Farm Mut. Automobile Ins. Co.*, 103 S.Ct. 2856 (1983).

between the timeframe for implementation and the fact a transmission line experienced some level of congestion at some point during a five-year period. For example, a line with *de minimis* congestion for several hours during the last five years resulting from an outage elsewhere on the system or local area transmission has been upgraded to address congestion would have the same implementation schedule as a line that faces regular congestion. The NOPR also would require implementing seasonal ratings and ambient adjusted ratings on all transmission lines, whether or not historically congested, within two years of from the date of the compliance filing.⁶ Again, the NOPR provides no rationale for requiring seasonal and ambient adjusted line ratings on all transmission lines within this timeframe.

The CAISO recommends the Commission develop an alternative implementation priority that reflects important regional and local considerations. This priority could reflect a number of factors, including voltage levels, safety considerations, temperature zones, summer or winter peaking seasons, fire or other threats to transmission operations, implementation costs, as well as the levels and duration of historical congestion on transmission lines. In the first instance, transmission owners are best suited to prioritize implementation of seasonal and ambient adjusted ratings on their facilities. In RTO/ISO regions, transmission owners may wish to consult with their transmission service provider to assess where use of ambient adjusted ratings may be most beneficial given levels of congestion on the system and other factors.

Any final rule should acknowledge that regional and local issues should inform this implementation priority and afford transmission owners the opportunity justify an

⁶ NOPR at P 93.

implementation schedule as part of any compliance filing. The schedule should also account for the technology and infrastructure upgrades and business procedures transmission owners will need to develop and deploy to meet the NOPR's requirements. The Commission could establish an outer limit on this implementation schedule, but it is likely to be a multi-year effort as opposed to a two-year effort. The CAISO strongly recommends that prior to adopting any final rule, Commission staff schedule and hold compliance workshops with transmission owners in different regions. These educational sessions may help identify the unique regional and local challenges facing transmission owners and inform appropriate implementation schedules under any final rule.

In addition, the Commission should afford transmission providers greater flexibility to identify timelines in which they would use ambient adjusted ratings as opposed to seasonal ratings. The NOPR would require transmission providers use hourly ambient adjusted ratings as the relevant transmission line ratings when performing various transmission functions within a window of the next 10 days.⁷ Given fluctuating weather and operating conditions across transmission systems, this requirement may cause forecasted hourly ratings to vary significantly. The Commission should instead allow transmission owners and transmission service providers to justify when they will utilize ambient adjusted ratings or seasonal ratings on transmission lines consistent with regional and local consideration and good utility practice. In addition, the Commission should clarify transmission providers may use their seasonal ratings as

⁷ NOPR at P 89.

hourly ratings when appropriate to do so, consistent with rating methodologies transmission owners developed under any final rule.

IV. Any final rule should recognize the impacts to market processes in organized electricity markets

The NOPR proposes to require all RTOs/ISOs to implement systems and procedures necessary to allow transmission owners to update transmission line ratings electronically at least hourly to facilitate use of ambient adjusted ratings and dynamic line ratings.⁸ The NOPR proposes RTOs/ISOs revise their tariffs to require implementation of ambient adjusted ratings within their security constrained economic dispatch and security constrained unit commitment models (and relevant related models) in both the day-ahead and real-time markets and any intra-day reliability unit commitment or reliability assessment commitment.⁹

These requirements, coupled with the proposal for transmission owners to implement ambient adjusted rating on all of their lines within a two-year period, will significantly increase the complexity of RTO/ISO markets and increase the likelihood of divergence between different market process for the same trading day and even the trading hour.

The CAISO's market model incorporates transmission line ratings of facilities under its operational control. In its day-ahead market, the CAISO optimizes supply and

⁸ NOPR at PP 5, 82.

⁹ The NOPR also states for the real-time market, RTOs/ISOs should update the ambient adjusted ratings at least hourly. See NOPR at P 91. It is unclear if the statement infers the RTOs/ISO need not utilize hourly-adjusted ratings that vary across operating hours in their day-ahead market processes. Cf. NOPR at P 82. The Commission should clarify this language in any final rule.

demand bids over a 24-hour trading day.¹⁰ The CAISO's day-ahead market processes perform unit commitment and congestion management and clear bids against bid-in demand, taking into account transmission limits as well as resource technical and inter-temporal operating constraints and procures ancillary services. The day-ahead market processes also clear additional supply to meet CAISO forecasted demand in its residual unit commitment process.

The CAISO's day-head market processes generally utilize constant line ratings submitted by transmission owners. In limited instances, the optimization will enforce adjusted transmission ratings during the 24-hour trading day at the branch group level. A branch group is either a line or set of lines recognized by the CAISO's full network model. Requiring the CAISO to utilize hourly-adjusted ratings for transmission lines across the 24-hour horizon of a trading day will necessarily and significantly increase the complexity of the CAISO's day-ahead optimization processes across those hours.

Using hourly-adjusted ratings will also affect the CAISO's residual unit commitment process used to secure additional capacity to meet CAISO forecasted demand.¹¹ Utilizing hourly-adjusted line ratings will make this reliability process more complex. For instance, the CAISO may need to forecast hourly-adjusted line ratings in some cases similar to its practice of forecasting demand and supply from variable energy resources as part of the residual unit commitment process. In addition, utilizing hourly ratings in this process may require the CAISO to procure additional capacity to

¹⁰ See *generally* CAISO tariff section 31.

¹¹ CAISO tariff section 31.5.

ensure the CAISO market respects temporal limits in connection with adjusted-line ratings.

The CAISO currently performs an outage coordination process for (1) managing the impact of facility outages in Total Transfer Capability (TTC) on rated paths and internally congested paths and (2) calculating the impacts of these de-rates and re-rates on TTC, existing transmission contracts and transmission ownership rights.¹² Utilizing hourly ratings on transmission lines will exponentially increase the complexity of this effort and require the CAISO to develop additional automation to perform these calculations.

In the context of its real-time market processes, the CAISO also performs a short-term unit commitment and multi-interval optimization, which look forward in time. These processes span more than one trading hour. Utilizing different hourly ratings for transmission lines will make it more difficult for the CAISO to obtain a feasible market solution within the limited timeframe in which these processes run.¹³

Utilizing hourly-adjusted ratings for transmission facilities in the day-ahead market may also create variances from how the CAISO has modeled its system for purposes of issuing congestion revenue rights. Implementing hourly-adjusted ratings in the real-time market may give rise to variances between total transfer capability used in the CAISO's hour-ahead scheduling process for intertie transactions and the CAISO's fifteen-minute market or 5-minute real-time dispatch. These variances may affect prices

¹² See CAISO Operating Procedure 3640 - Existing Transmission Contract Calculator Update: <https://www.aiso.com/Documents/3640.pdf>

¹³ See CAISO tariff section 34, which sets forth market timelines for the real-time market. As an example, the CAISO's real-time dispatch starts 7.5 minutes before the operating interval and issues dispatch instructions 2.5 minutes in advance of the operating interval. In addition to the binding interval, the CAISO's real-time dispatch includes 12 additional 5-minute advisory intervals.

by causing unexpected and possibly inefficient market outcomes. Variances also can give rise to additional cost uplifts, which the CAISO allocates to market participants. Additionally, any market run that performs unit commitment might generate unexpected and inefficient outcomes since transmission line ratings may change over the market run's look-ahead period. The NOPR does not consider or meaningfully discuss these market convergence or efficiency issues. In some cases, these concerns may prove relevant to the submission of updated transmission line ratings. The Commission should expressly recognize in any final rule that RTOs/ISOs and their stakeholders may consider these issues in developing market rules for updating transmission line ratings.

V. Any final rule must permit RTOs/ISOs the time necessary to develop market rules and technology to accommodate automated processes to update transmission line ratings

In the NOPR, the Commission proposes to revise its regulations to require RTOs/ISOs to establish and implement systems and procedures to allow transmission owners to electronically update transmission line ratings (for each period for which transmission line ratings are calculated) at least hourly.¹⁴ The Commission proposes to require transmission owners submit this data directly into an RTO's/ISO's EMS through Supervisory Control and Data Acquisition or related systems.¹⁵ The NOPR would require RTOs/ISOs to submit proposed tariff changes designed to maintain needed systems and procedures for using hourly-adjusted transmission line ratings within 60

¹⁴ NOPR at PP 5, 82, 108.

¹⁵ *Id.* at P 108.

days of the effective date of any final rule and to implement these systems within one year of any compliance filing.¹⁶ The Commission requests comment on the additional costs, if any, needed to comply with the proposed requirement that RTOs/ISOs have the capability to accommodate frequently updated transmission line ratings from transmission owners and the timeframe to develop prepare and submit compliance filings.¹⁷

Allowing only 60 days for RTOs/ISOs to submit tariff changes to maintain systems and procedures to enable using hourly-adjusted transmission line ratings is insufficient. The CAISO and participating transmission owners will need to assess and develop changes to the transmission control agreement to align its provisions with any final rule. The NOPR contains no discussion of questions RTOs/ISOs and their stakeholders must address and resolve to develop rules incorporating adjusted ratings into market processes. These questions include:

- By what time will transmission owners need to submit adjusted line ratings for use in day-ahead market processes?
- Will these line ratings remain constant in the RTO's/ISO's reliability commitment processes?
- After the CAISO publishes day-ahead market results, when will transmission owners be able to update these day-ahead ratings for use in real-time market processes? Will there be a deadline to submit these adjusted ratings in advance of various real-time market processes. If so, what will it be?
- What steps should an RTO/ISO use if a transmission owner submits an incorrect rating? Should this inform any price correction process that occurs after a relevant market process?
- What ratings should an RTO/ISO use if there is a communication failure between a transmission owner and the RTO's/ISO's EMS? Will the RTO/ISO

¹⁶ NOPR at PP 131 and 135.

¹⁷ *Id.* at PP 109 and 133.

use the last rating or some other default rating, *e.g.*, a rating from the same hour on the preceding operating day?

- Should an RTO/ISO consider ambient adjusted ratings in modeling Special Protection or Remedial Action Schemes designed to prevent thermal overloads?

The CAISO recommends the Commission modify its compliance schedule to allow sufficient time for RTOs/ISOs to discuss these and other related questions with stakeholders before submitting tariff provisions to implement any final rule. The CAISO recommends the Commission allow **at least 180 days** from the effective date of any final rule for transmission providers to submit tariff changes to maintain systems and procedures needed to allow for the use hourly adjusted transmission line ratings.

The NOPR's proposal for RTOs/ISOs to implement systems and procedures necessary to accommodate automated updates to transmission line ratings within one year of any compliance filing is unrealistic. The NOPR correctly recognizes this work may be "a complex endeavor."¹⁸ Based in its initial effort to map the proposals in the NOPR to new tools and processes, the CAISO has identified several efforts necessary to ensure its systems can receive and process hourly-adjusted transmission line ratings, including:

- Building an interface to receive and validate forecasted transmission line ratings submitted by transmission owners;
- Building mechanisms for day-ahead and real-time market systems to receive and process adjusted transmission line ratings;
- Building mechanisms for Look Ahead Contingency Analysis processes and Hosted Advanced Network Applications to receive and process adjusted transmission line ratings;

¹⁸ NOPR at P 131.

- Building mechanisms for Integrated Optimal Outage Coordination system to receive and process adjusted line ratings;
- Building mechanisms for updating Existing Transmission Contract Calculator with adjusted transmission line ratings;
- Building mechanisms for the CAISO's open access and same time information system, market results interface, and enterprise data repository to receive and process adjusted transmission line ratings as well as ensure access capabilities for the CAISO's Department to Market Monitoring;¹⁹
- Building mechanisms for the CAISO congestion revenue rights model to reflect forecasts of hourly line adjustments;
- Building mechanisms to estimate hourly-adjusted transmission line ratings based on weather forecasts and associate weather forecast zone with transmission zone;
- Building mechanisms for outage management system to receive and process adjusted hourly ratings; and
- Building mechanisms to track potential real-time market offsets resulting from adjusted ratings that differ between day ahead and real time market.

This preliminary list of work will require a significant effort and expenditures, as well as extensive coordination with transmission owners. The CAISO follows a phased process for all technology upgrades it undertakes. This consists of requirements, design, development, testing, market simulation, and deployment phases. Although these phases commonly overlap, each step is necessary to ensure successful implementation of a technology enhancement. Based on initial assessment, the CAISO recommends the Commission modify its compliance schedule to require RTOs/ISOs to

¹⁹ The NOPR would require transmission owners to share transmission line ratings and methodologies with their transmission provider(s) and, in regions served by an RTO/ISO, also with the market monitor(s) of that RTO/ISO. The NOPR does not explain what role, if any, market monitors should perform with respect to these rating methodologies. The CAISO anticipates that at a minimum it must ensure its market monitor can assess adjusted transmission line rating information to assess their impact on CAISO market outcomes.

implement systems and procedures ***no sooner than 18 months*** after the submission of tariff provisions in compliance with any final rule.

VI. The CAISO recommends that the Commission not adopt additional directives regarding emergency ratings or dynamic line ratings in any final rule

In the NOPR, the Commission seeks comment on whether to require transmission providers implement unique emergency ratings a transmission provider would utilize during post-contingency operations.²⁰ Transmission owners in the CAISO balancing authority area commonly utilize emergency ratings on transmission lines placed under the CAISO's operational control. The CAISO maintains these ratings in the CAISO Register. For this reason, there is no need to mandate using unique emergency ratings. In some cases, based on safety reasons or other good utility practice for maintaining transmission equipment, emergency ratings of a transmission facility could be the same as a facilities normal rating. Any final rule requiring unique emergency ratings for transmission lines should recognize exceptions exist and appropriately account for those exceptions.

In the NOPR, the Commission also seeks comments on whether to require transmission providers implement dynamic line ratings across their systems or on certain transmission lines that would benefit most from a dynamic rating.²¹ The Commission also asks whether it should require RTOs/ISOs to conduct a one-time

²⁰ NOPR at PP 6 and 83.

²¹ *Id.* at P 100.

study of the cost effectiveness of implementing dynamic line ratings, and if so, what details/format any such study should include.²² Similar to using ambient adjusted ratings, using dynamic line ratings offers the promise of greater market efficiency and reliability. However, the CAISO does not support adopting such a requirement at this time. It is premature to require transmission providers to implement dynamic line ratings until RTOs/ISOs gain sufficient experience with automated systems to incorporate ambient adjusted systems. Dynamic line ratings, whether through direct measure of the conductor's temperature and/or sag or calculated through wind velocity, will require transmission owners to develop additional systems and communication tools. Implementing and operating with ambient adjusted ratings will allow RTOs/ISOs and transmission owners to gain valuable experience before assessing implementation steps necessary to incorporate dynamic line ratings on selected transmission facilities.

Also, the CAISO does not support directing RTOs/ISOs to complete a cost effectiveness study of implementing dynamic line ratings. Any such study effort will appropriately involve the participation of transmission owners and other stakeholders within an RTO/ISO footprint to develop study parameters. Each RTO/ISO should have the latitude to explore any cost-effectiveness assessment of dynamic line ratings with input from these stakeholders and on a schedule that makes sense for their individual regions. On the other hand, the CAISO is not opposed to submitting an informational report on the efforts it undertakes with its transmission owners and other stakeholders to assess the costs and benefits of implementing dynamic line ratings, while it works in parallel to implement the directives of any final rule adopted in this proceeding.

²² NOPR at P 110.

Developing the systems and procedures to incorporate hourly-adjusted ratings in the CAISO's markets will inform this effort; so will transmission owners' work to develop and implement ambient adjusted rating methodologies.

VII. Conclusion

The CAISO supports efforts to expand and automate the use of ambient adjusted ratings on transmission lines. However, as explained in these comments, the implementation schedule set forth in the Commission's NOPR is too aggressive. Transmission owners will need to assess regional and local issues that may inform their methodologies to establish ambient adjusted ratings on transmission lines. RTOs/ISOs will also need time to develop additional market rules associated with the automated submission and use of hourly-adjusted transmission line ratings, as well as design and implement necessary technology enhancements.

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Respectfully submitted,

/s/ Andrew Ulmer

Roger E. Collanton
General Counsel
Anthony Ivancovich,
Deputy General Counsel, Regulatory
Andrew Ulmer
Director, Federal Regulatory Affairs
California Independent System Operator Corporation
250 Outcropping Way
Folsom, California 95630
(916) 608-7209
(916) 608-7222 (fax)
aulmer@caiso.com

CERTIFICATE OF SERVICE

I certify that I have served the foregoing document upon the parties listed on the official service list in the captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California this 22nd day of March, 2021.

/s/ Martha Sedgley
Martha Sedgley