



July 12, 2022

The Honorable Kimberly D. Bose  
Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

**Re: California Independent System Operator Corporation  
CAISO Tariff Revisions to Comply with Order No. 881 –  
Managing Transmission Line Ratings**

**Docket No. ER22-\_\_\_\_-000**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this tariff amendment<sup>1</sup> to comply with Order No. 881, which the Commission issued to improve the accuracy and transparency of electric transmission line ratings.<sup>2</sup> In this filing, the CAISO proposes tariff revisions to support its implementation of the directives of Order No. 881. The CAISO respectfully requests that the Commission accept this filing in compliance with the requirements of Order No. 881.

Consistent with Order No. 881, the CAISO is targeting an effective date for these tariff revisions prior to summer 2025. The CAISO requests the Commission issue an order accepting its tariff revisions on or before May 1, 2023. The Commission should provide certainty for the CAISO and all affected entities that the tariff changes proposed herein comply with the requirements of Order No. 881. The CAISO requests the Commission authorize an effective date for these tariff revisions on or before June 15, 2025, subject to the CAISO filing a notice with the Commission within 5 days of the actual effective date.

---

<sup>1</sup> The CAISO submits this filing pursuant to section 205 of the Federal Power Act, 16 U.S.C. § 824d. Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff, and references to specific sections, articles, and appendices are references to sections, articles, and appendices in the current CAISO tariff and revised or proposed in this filing, unless otherwise indicated.

<sup>2</sup> *Managing Transmission Line Ratings* 177 FERC ¶ 61,179 (2021); *Order Addressing Arguments Raised on Rehearing and Clarification*, 179 FERC ¶ 61,125 (Order No. 881-A) (2022).

## I. Executive Summary

Order No. 881 seeks to improve the accuracy and transparency of electric transmission line ratings used by public utility transmission providers. Order No. 881 establishes requirements for public utility transmission providers to use ambient adjusted ratings and seasonal ratings in connection with transmission service they offer. In markets administered by regional transmission organizations (RTOs) and independent system operators (ISOs), Order No. 881 requires RTOs/ISOs to implement systems and procedures necessary to allow transmission owners to update transmission line ratings electronically at least hourly. Transmission providers must (1) use uniquely determined emergency ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints and (2) implement specific transparency reforms.

The CAISO is a public utility transmission service provider. To effect compliance with Order No. 881, the CAISO proposes that CAISO participating transmission owners will continue to calculate and submit their facility ratings to the CAISO consistent with North America Electric Reliability Corporation (NERC) Reliability Standards FAC-008-5.<sup>3</sup> The CAISO proposes to leverage existing business processes where possible to comply with Order No. 881. In particular, the CAISO intends to utilize data specification and collection processes that support its compliance with NERC Reliability Standards IRO-010 and TOP-003. Among other things, these standards require reliability coordinators and transmission operators to maintain a documented specification for the data necessary to perform operational planning analyses, real-time monitoring, and real-time assessments.<sup>4</sup>

The CAISO also serves as the market operator for the Western Energy Imbalance Market (WEIM), which provides real-time market services to participants throughout the Western Interconnection. In addition, as RC West, the CAISO provides reliability coordinator services to 42 customers in the Western Interconnection. Implementing Order No. 881 will affect the reliability coordinator functions the CAISO performs.

---

<sup>3</sup> Reliability Standards FAC-008-5, Requirement R3 and FAC-008-5, Requirement R6. See *also* Order No. 881 at P 140.

<sup>4</sup> The CAISO has implemented these requirements through operating procedures. See CAISO operating procedures RC0120 and 3140. These operating procedures are available on the CAISO's website: <http://www.caiso.com/rules/Pages/OperatingProcedures/Default.aspx>.

The CAISO anticipates holding structured dialogs with participating transmission owners, WEIM Entities, market participants, and RC West customers to address implementation issues and milestones associated with Order No. 881. These discussions will explore (1) the development of transmission rating methodologies by participating transmission owners; (2) data specification and collection requirements for transmission line ratings, including a standardized unit format for ratings; (3) enhanced functionality and interfaces for collecting and using transmission line ratings; (4) market rule changes to implement the requirements of Order No., 881; and (5) information sharing practices. The CAISO plans to undertake these discussions during 2022 and 2023. They will serve as a path to develop formal business requirement specifications to design systems necessary to comply with Order No. 881 and coordinate functional testing among all affected entities.

## II. Background

On December 16, 2021, the Commission issued Order No. 881, which directs public utility transmission providers to implement multiple reforms regarding transmission line rating methodologies and the use of transmission line ratings. These reforms include:

- **Ambient-adjusted ratings:** Public utility transmission providers must use ambient-adjusted ratings for evaluating requests for *near-term* transmission service (defined as transmission service that ends within 10 days of the date of the request).
- **Seasonal ratings:** Public utility transmission providers must use seasonal ratings for evaluating other, longer-term transmission service requests.
- **Electronic updates to transmission ratings:** RTOs/ISOs must establish and implement the systems and procedures necessary to allow transmission owners to update transmission line ratings electronically at least hourly.
- **Emergency ratings:** Public utility transmission providers must use uniquely determined emergency ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints.
- **Transparency:** Transmission owners must share transmission line ratings and transmission line rating methodologies with their respective transmission providers and, in RTOs/ISOs, with their respective market monitors. Order No. 881 requires transmission providers to maintain a database of each transmission owner's transmission line ratings and

transmission line rating methodologies on the transmission provider's open access same-time information system website, or on another password-protected website.

Order No. 881 directs each transmission provider to submit a compliance filing within 120 days of Order No. 881's effective date<sup>5</sup>, and it requires transmission providers to implement the requirements of Order No. 881 within three years of the date they submit compliance filings.

### **III. Compliance with Order No. 881**

The CAISO proposes to incorporate new definitions identified by Order No. 881 into Appendix A of its tariff. In addition, the CAISO proposes to incorporate a new Appendix JJ into its tariff, which includes language to comply with the directives of Order No. 881 regarding coordinating the development of transmission rating methodologies with participating transmission owners and use of transmission line ratings. This language largely tracks the *pro forma* language in Order No. 881. The CAISO also proposes to include new language in section 6 of its tariff to address Order No. 881's transparency reforms. The CAISO is not proposing changes to its transmission control agreement in this filing.<sup>6</sup> This agreement requires participating transmission owners to submit transmission line ratings and any changes to those ratings to the CAISO. The language of the transmission control agreement is broad enough to encompass the requirements of Order No. 881.

#### **A. The CAISO proposes to incorporate new definitions into Appendix A of its tariff.**

In Order No. 881, the Commission defines a transmission line rating as follows:

the maximum transfer capability of a transmission line, computed in accordance with a written transmission line rating methodology and consistent with Good Utility Practice, considering the technical limitations on conductors and relevant transmission

---

<sup>5</sup> Order No. 881 became effective on March 14, 2022.

<sup>6</sup> The CAISO's transmission control agreement is available at the following website: <http://www.caiso.com/Documents/TransmissionControlAgreement.pdf> and identifies those entities that have turned over transmission facilities and entitlements to the CAISO's operational control.

equipment (such as thermal flow limits), as well as technical limitations of the Transmission System (such as system voltage and stability limits).<sup>7</sup>

Order No. 881 states the definition requires transmission line ratings to incorporate a set of electrical equipment ratings that collectively operate as a single bulk electric system element (*e.g.*, transformers, relay protective devices, terminal equipment, and series and shunt compensation devices), and that the most limiting component from that set determines the transmission line rating. In addition, the definition encompasses transmission line ratings for electric system equipment that includes more than just overhead conductors.<sup>8</sup> For example, it includes ratings for electric system equipment such as circuit breakers, line traps, and transformers.<sup>9</sup> The CAISO proposes to incorporate the Commission's definition into Appendix A of its tariff.<sup>10</sup>

In Order No. 881, the Commission defines an ambient adjusted rating as follows:

A Transmission Line Rating that: (1) applies to a time period of not greater than one hour; (2) reflects an up-to-date forecast of ambient air temperature across the time period to which the rating applies; (3) reflects the absence of solar heating during nighttime periods where the local sunrise/sunset times used to determine daytime and nighttime periods are updated at least monthly, if not more frequently; and (4) is calculated at least each hour, if not more frequently.<sup>11</sup>

---

<sup>7</sup> Order No. 881 at PP 1, 44. Relevant transmission equipment may include, but is not limited to, circuit breakers, line traps, and transformers. *Id.* at PP 44-45.

<sup>8</sup> *Id.* at P 44.

<sup>9</sup> *Id.* at P 45.

<sup>10</sup> See proposed changes to Appendix A of the CAISO tariff included in Attachment A to this filing. The CAISO has not capitalized the words *transmission system* in this definition. Instead, the CAISO has drafted this definition to refer to transmission system generally so that it can encompass transmission line ratings on the CAISO controlled Grid as well as the transmission systems of WEIM Entities.

<sup>11</sup> Order No. 881 at P 4.

Order No. 881 emphasizes that the definition requires computation of transmission line ratings in accordance with good utility practice, including up-to-date forecasts, to ensure the accuracy of the relevant transmission line rating.<sup>12</sup> The CAISO proposes to incorporate the Commission's definition into Appendix A of its tariff.<sup>13</sup> The CAISO also proposes to incorporate into its tariff the definition of dynamic line ratings adopted by Order No. 881.<sup>14</sup> Order No. 881 does not require using dynamic line ratings, but the CAISO's work to implement process and systems to allow for electronic updates of transmission line ratings will support the use of dynamic line ratings, if participating transmission owners and other entities elect to use them.

In Order No. 881, the Commission defines seasonal line rating to reflect a transmission line rating that applies to a specific season and reflects an up-to-date forecast of ambient air temperature across the relevant season over which the rating applies.<sup>15</sup> Order No. 881 requires that seasons include not fewer than four seasons in each year, and to reasonably reflect portions of the year where expected high temperatures are relatively consistent.<sup>16</sup> Order No. 881 also states that transmission providers should review seasonal line ratings annually.<sup>17</sup> In addition, once established, transmission providers should review these seasonal ratings when equipment changes are made, climate or weather data necessitates, or when otherwise prudent. The CAISO proposes to incorporate the following definition of seasonal line ratings into Appendix A of its tariff:

A Transmission Line Rating that (a) applies to a specified season where seasons to include not fewer than four seasons in each year, and to reasonably reflect portions of the year where expected high temperatures are relatively consistent.; and (b)

---

<sup>12</sup> Order No. 881 at P 181.

<sup>13</sup> See proposed changes to Appendix A of the CAISO tariff included in Attachment A to this filing.

<sup>14</sup> Order No. 881 defines dynamic line ratings to mean a "Transmission Line Rating that applies to a time period of not greater than one hour and reflects up-to-date forecasts of inputs such as (but not limited to) ambient air temperature, wind, solar heating, transmission line tension, or transmission line sag." Order No. 881 at PP 235-239.

<sup>15</sup> Order No. 881 at PP 204-216.

<sup>16</sup> *Id.* at P 211.

<sup>17</sup> *Id.* at P 215.

reflects an up-to-date forecast of ambient air temperature across the relevant season over which the rating applies. Seasonal Line Ratings are calculated annually, if not more frequently, for each season in the future for which transmission service can be requested.<sup>18</sup>

This language tracks the Commission's definition of seasonal line ratings.<sup>19</sup> The CAISO also includes elements of this definition as parameters to guide transmission line methodologies developed by its participating transmission owners. As explained in Section III.B.ii, the CAISO will coordinate with participating transmission owners in developing their transmission rating methodologies.

In Order No. 881, the Commission defines emergency rating as follows:

A Transmission Line Rating that reflects operation for a specified, finite period, rather than reflecting continuous operation. An Emergency Rating may assume an acceptable loss of equipment life or other physical or safety limitations for the equipment involved.<sup>20</sup>

Order No. 881 states the definition for emergency rating reflects that most transmission equipment can withstand high currents for short periods of time without sustaining damage. The requirement to implement uniquely determined emergency ratings simply requires that emergency ratings calculations be based

---

<sup>18</sup> See proposed changes to Appendix A of the CAISO tariff included in Attachment A to this filing.

<sup>19</sup> This definition tracks the definition of seasonal line ratings set forth in the *pro forma* tariff language included in Order No. 881 although the CAISO has not capitalized the term *transmission service*. The CAISO tariff does not define this term nor does the CAISO provide transmission reiterations in a manner similar to the *pro forma* open access transmission tariff. The CAISO does not require or provide for forward reservation of transmission service to participate in the market. Rather, the market optimizes all physically available transmission.

<sup>20</sup> Order No. 881 at P 293.

on this ability, where it exists.<sup>21</sup> The CAISO proposes to incorporate the Commission's definition into Appendix A of its tariff.<sup>22</sup>

Order No. 881 also proposes to define near-term transmission service as:

Transmission Service which ends not more than 10 days after the Transmission Service request date. When the description of obligations below refers to either a request for information about the availability of potential Transmission Service (including, but not limited to, a request for ATC), or to the posting of ATC or other information related to potential service, the date that the information is requested or posted will serve as the Transmission Service request date. "Near-Term Transmission Service" includes any Point-To-Point Transmission Service, Network Resource designations, or secondary service where the start and end date of the designation or request is within the next 10 days.<sup>23</sup>

The CAISO proposes not to include the definition of near-term transmission service into Appendix A of its tariff because the CAISO does not operate under a traditional Open Access Transmission Tariff (OATT) regime. The CAISO tariff does not follow the traditional OATT transmission service request model and does not provide for forward reservations of transmission service. The CAISO does not currently offer point-to-point transmission service or network resource designations over the CAISO controlled grid or at its interties. Instead, the CAISO operates day-ahead and real-time markets to provide transmission services over the CAISO controlled grid and also serves as the operator of WEIM. These daily markets constitute "near-term transmission service" under the CAISO's tariff and are the means by which the CAISO determines the need to curtail, interrupt, or redispatch transmission service. The CAISO explains in section III.B how it intends incorporate transmission line ratings required by Order No. 881 into these markets processes.

---

<sup>21</sup> Order No. 881 at P 301.

<sup>22</sup> See proposed changes to Appendix A of the CAISO tariff included in Attachment A to this filing.

<sup>23</sup> Order No. 881 at P 92. See *also*, definition of near-term transmission service set forth in the *pro forma* tariff language included in Order No. 881.

**B. The CAISO will incorporate hourly ambient adjusted transmission line ratings into its day-ahead market and real-time market**

Order No. 881 requires transmission providers to use ambient adjusted ratings as the relevant transmission line ratings when: (1) evaluating requests for near-term transmission service, defined as transmission service ending within 10 days of the date of the request; (2) responding to requests for information on the availability of potential near-term transmission service (including requests for available transmission capacity or other information related to potential service); and (3) posting available transmission capacity or other information regarding near-term transmission service to their OASIS site.<sup>24</sup> Order No. 881 also directs transmission providers to use ambient adjusted ratings as the basis for determining curtailment, interruption, or dispatch of transmission service anticipated to occur within those 10 days.<sup>25</sup> Pursuant to Order No. 881, transmission providers must update ambient adjusted ratings at least hourly.<sup>26</sup>

In RTO/ISO regions, transmission owners, not transmission providers, are responsible for calculating transmission line ratings.<sup>27</sup> Accordingly, Order No. 881 states RTOs/ISOs will need to rely on their member transmission owners to calculate transmission line ratings and provide them to the RTO/ISO.<sup>28</sup> In the CAISO, participating transmission owners are obligated to submit applicable ratings to the CAISO.<sup>29</sup> The CAISO transmission control agreement requires participating transmission owners to provide, in a format acceptable to the CAISO, applicable ratings of all transmission lines and associated facilities, as well as changes to those ratings.<sup>30</sup>

The CAISO intends to develop a new interface for participating transmission owners to submit applicable transmission facility ratings and communicate these ratings to its market and reliability applications. This

---

<sup>24</sup> Order No. 881 at PP 4, 86, 120.

<sup>25</sup> *Id.* at PP 4, 87-88.

<sup>26</sup> *Id.* at P 89.

<sup>27</sup> *Id.* at P 140.

<sup>28</sup> *Id.*

<sup>29</sup> Transmission Control Agreement, Section 4.2.

<sup>30</sup> *Id.* Section 6.4.

functionality will support the electronic submission of hourly ambient adjusted ratings and also serve as a platform to accept the submission of any dynamic line ratings. This work will necessarily involve close coordination with participating transmission owners and other transmission providers that share their transmission line ratings with the CAISO for use in its market processes or its reliability applications. The CAISO plans to accommodate submission of this information directly into the CAISO's energy management system through supervisory control and data acquisition (SCADA) capability, by means of inter-control center communications protocol (ICCP), or similar communication systems.<sup>31</sup>

**i. The CAISO will coordinate with participating transmission owners as they develop transmission line methodologies**

Order No. 881 includes numerous directives for transmission providers regarding ambient adjusted ratings. These directives include applying ambient adjusted ratings to all transmission lines unless otherwise subject to an exception and an alternative rating.<sup>32</sup> In establishing ambient adjusted ratings, transmission providers must calculate a temperature at which there is sufficient confidence that the actual temperature will not be greater than that temperature (*i.e.*, expected temperature plus an appropriate forecast margin).<sup>33</sup> Ambient adjusted ratings must include separate daytime and nighttime ratings.<sup>34</sup> Transmission providers must update the sunrise and sunset times used to calculate their ambient adjusted ratings at least monthly.<sup>35</sup>

Order No. 881 also specifies that methods for determining ambient adjusted ratings must be valid for at least the range of local historical temperatures (over the entire period for which records are available) plus or

---

<sup>31</sup> The communication systems used by entities submitting transmission line ratings to the CAISO will need to interface with downstream systems used by the CAISO for reliability and market applications, including the CAISO's energy management system. The CAISO has not designed this interface yet, so it proposes to identify similar communications systems to SCADA or ICCP in an applicable Business Practice Manual or Operating Procedures.

<sup>32</sup> Order No. 881 at P 84.

<sup>33</sup> Order No. 881 PP 120, 126.

<sup>34</sup> Order No. 881 PP 122, 147. The Commission requires transmission providers to reflect the lack of solar heating in the technical assumptions for nighttime ambient adjusted ratings.

<sup>35</sup> Order No. 881 PP 147 – 149.

minus a margin of 10 degrees Fahrenheit.<sup>36</sup> Transmission providers must have procedures in place to handle a situation where forecast temperatures fall outside of this range of temperatures to ensure they are using safe and reliable transmission line ratings. If actual temperatures set new high or low records, transmission providers must revise their ratings and methodologies, if necessary, and within a timely manner, to maintain the 10 degree Fahrenheit margin.

Transmission providers must implement ambient adjusted ratings that change at least with every five degree Fahrenheit increment of temperature change, to meet the requirement that an ambient adjusted rating reflect an up-to-date forecast of ambient air temperature.<sup>37</sup> The Commission states that an ambient adjusted rating is inconsistent with the requirements of Order No. 881 if it results in transmission line ratings that do not change when temperature forecasts increase or decrease by five degrees Fahrenheit.

As recognized by Order No. 881, the CAISO will not calculate ambient adjusted ratings for transmission lines that comprise the CAISO controlled grid. Participating transmission owners will calculate and submit these ratings to the CAISO. Order No. 881 requires RTOs/ISOs on compliance to propose and justify a methodology for ambient adjusted rating implementation, delineating the expected roles between transmission owners and the transmission provider. In doing so, the Commission encourages RTO/ISO transmission owners to coordinate implementation methodologies and promote implementation consistency to the greatest extent possible within an RTO/ISO service territory.<sup>38</sup> In proposed Appendix JJ, the CAISO includes tariff language that recognizes the elements specified by the Commission for calculating ambient adjusted ratings by stating the CAISO will coordinate with participating transmission owners to develop transmission rating methodologies that include these elements.<sup>39</sup> Appendix JJ states that in undertaking this coordination, the CAISO will seek to promote implementation consistency to the greatest extent possible. In addition to the elements identified by Order No. 881, the CAISO has included a requirement for the CAISO to coordinate with participating transmission owners to address how ambient adjusted ratings interact with system voltage and stability limits, remedial action schemes and system operating limits. This

---

<sup>36</sup> Order No. 881 at PP 185 – 186.

<sup>37</sup> *Id.* at P 186.

<sup>38</sup> *Id.* at P 142.

<sup>39</sup> See proposed Appendix JJ, Part 1 of the CAISO tariff included in Attachment A to this filing.

additional element constitutes good utility practice because it recognizes physical constraints on the transmission system and how ambient adjusted ratings will respect those constraints.

Order No. 881 requires transmission providers to identify exceptions to the use of ambient adjusted ratings and to establish alternative ratings.<sup>40</sup> For example, Order No. 881 allows for instances in which the rating of a transmission line is not affected by ambient air temperature and instances in which a transmission provider reasonably determines, consistent with good utility practice that using a temporary alternate rating is necessary to ensure the safety and reliability of the transmission system.<sup>41</sup> Order No. 881 states that examples of such a transmission line may include but are not limited to: (1) a transmission line for which the technical transfer capability of the limiting conductors and/or limiting transmission equipment is not dependent on ambient air temperatures; or (2) a transmission line whose transfer capability is limited by a transmission system limit (such as a system voltage or stability limit) which is not dependent on ambient air temperatures.<sup>42</sup> The CAISO proposes to include language in Appendix JJ of its tariff describing the parameters of how it will coordinate with participating transmission owners in their development of any exceptions or alternative ratings to ambient adjusted ratings.<sup>43</sup> This language tracks the *pro forma* tariff language included by Commission in Order No. 881.

---

<sup>40</sup> Order No. 881 at P 6 and 227.

<sup>41</sup> *Id.* at P 227.

<sup>42</sup> *Id.*

<sup>43</sup> Order No. 881 explains “[I]n the RTO/ISO regions where there is a distinction between transmission owners and transmission providers, we clarify that we expect RTOs/ISOs to require their member transmission owners to make timely determinations on transmission line rating exceptions, and to provide them to the RTO/ISO. In such instances, we require the transmission provider to explain in its compliance filing . . . , through what mechanism (tariff, membership agreement, etc.) the transmission owner(s) will have the obligation for making and communicating to the transmission provider the timely determinations related to transmission line ratings exceptions.” Order No. 881 at P 227, n. 477. As explained in Sections III.B herein, participating transmission owners within the CAISO have an obligation under the Transmission Control Agreement to establish and communicate transmission line ratings to the CAISO, including any updates to those ratings.

**ii. The CAISO proposes to establish deadlines for the submission of transmission line ratings for use in its day-ahead and real-time markets.**

Order No. 881 does not specify a timeline by which transmission owners must calculate ambient adjusted ratings or submit them for use by the CAISO in its day-ahead and real-time markets. For ambient adjusted ratings, the Commission states that new forecast data should be incorporated as close to real time as reasonably possible given the timelines needed to obtain forecast data and perform the calculation, as well as any other steps needed for validation, communication, or implementation of ambient adjusted ratings.<sup>44</sup> Order No. 881 directs that transmission providers must explain their timelines as part of their compliance filings.<sup>45</sup> In addition, Order No. 881 directs RTOs/ISOs to propose on compliance to use updated ambient adjusted ratings as part of any market process associated with the day-ahead and real-time markets, including the residual unit commitment, as well as any look-ahead commitment processes or other such processes. For purposes of using ambient adjusted ratings in its day-ahead and real-time markets, the CAISO must balance the ability of transmission owners to incorporate new forecast data into their ratings, undertake any validation steps, and then communicate their ratings to the CAISO within the market process timelines the CAISO administers. The same is true for the submission of dynamic line ratings if a participating transmission owner elects to use dynamic line ratings.

To incorporate ambient adjusted ratings into its day-ahead market, which includes the residual unit commitment process, the CAISO proposes to require transmission owners submit any ambient adjusted ratings for use in the day-ahead market prior to 10 a.m. on the day before the applicable trading day. The CAISO's day-ahead market opens seven days before an applicable trade day and requires the submission of bids and all self-schedules no later than 10 a.m. on the day before the applicable trading day.<sup>46</sup> However, the CAISO will need time to process submitted transmission line ratings for each hour of the day-ahead market and undertake data quality checks and take any necessary remedial steps.<sup>47</sup> For this reason, the CAISO proposes to require that

---

<sup>44</sup> Order No. 881 at P 143.

<sup>45</sup> *Id.*

<sup>46</sup> CASIO tariff section 31.1 and definition of the term "Market Close" in Appendix A of the CAISO tariff.

<sup>47</sup> Order No. 881 states, if an ambient adjusted rating is unavailable, the transmission provider must use the relevant seasonal line rating as the appropriate transmission line rating.

transmission owners submit hourly ambient adjusted ratings for use in the day-ahead market processes no later than 9 a.m. on the day before the applicable trading day. The CAISO will apply this same submission deadline for dynamic line ratings. The CAISO will allow transmission owners to submit ambient adjusted ratings through the use of SCADA or ICCP or a similar communications systems as identified in the CAISO's Business Practice Manuals or Operating Procedures. In addition, the CAISO proposes to require participating transmission owners to undertake validation steps prior to transmitting ambient adjusted ratings. The CAISO expects this validation would involve an automated process that confirms the rating transmitted to the CAISO accurately reflects the applicable temperature forecast for a specific transmission line.<sup>48</sup>

To incorporate ambient adjusted ratings into its real-time market, the CAISO proposes to require transmission owners to submit any ambient adjusted ratings for use in the real-time market 5 hours before the applicable Trading Hour. The CAISO will apply this same submission deadline for dynamic line ratings. The CAISO's real-time day market opens at 1 p.m. the day before an applicable trade day and requires the submission of bids and all self-schedules no later than 75 minutes prior to the trading hour.<sup>49</sup> By requiring the submission of ratings for use in the real-time market 5 hours before an applicable trading hour, the CAISO can ensure transmission line ratings remain constant over its short-term unit commitment (STUC) process time horizon and throughout any subsequent real-time market processes. STUC is a reliability function for committing short Start Units to meet the CAISO Forecast of CAISO Demand.<sup>50</sup>

---

Order No. 881 at P 180. However, Order No. 881 also states “[t]o the extent any transmission provider becomes aware of an apparent inaccurate transmission line rating, the transmission provider is expected to inform the transmission owner immediately and both the transmission provider and transmission owner should take appropriate action to correct any inaccuracy. If the transmission provider and transmission owner are unable to resolve the inaccuracy of a submitted AAR, then . . . the transmission provider must use an appropriate recourse rating until the AAR inaccuracy is resolved.” *Id.* at PP 182. The CAISO has included proposed tariff language to allow for the use of alternate line ratings other than the seasonal line ratings in this instance.

<sup>48</sup> The Commission anticipates transmission owners may need to take steps to validate ambient adjusted ratings. See Order No. 881 at P 143, citing *pro forma* definition of Ambient Adjusted Ratings.

<sup>49</sup> See CAISO tariff section 34.1.3.

<sup>50</sup> Short start units have a cycle time less than or equal to 255 minutes, *i.e.* start-up time plus minimum run time is less than or equal to 255 minutes and can be fully optimized with respect to this cycle time.

The CAISO runs STUC at approximately 52 minutes before an operating hour. The time horizon for STUC is 270 minutes or 4 hours and 30 minutes.<sup>51</sup> Because the CAISO is requiring that hourly ratings remain constant over each 15-minute interval of a trading hour, it proposes the submission deadline for ratings it will use in the real-time market to be 5 hours before the applicable trading hour.

Changing transmission line ratings after STUC has the potential to create uneconomic unit commitments for short start units. STUC includes commitments for short start units and transition determinations for multi-stage generating resources<sup>52</sup> and transfers this information to the CAISO's 15-minute market and real-time dispatch. Accepting transmission line rating changes up to 75 minutes before an applicable trading hour could potentially result in adjustments that make prior STUC commitments uneconomic. If the CAISO determines it can adjust the submission deadline for transmission line ratings used in its real-time market to a time period closer to when bid submissions are due (*i.e.* 75 minutes before an applicable trading hour), it will refile proposed tariff language with the Commission under section 205 of the Federal Power Act.

Again, the CAISO will allow participating transmission owners to submit ambient adjusted ratings for use in the real-time market through the use of SCADA or ICCP or a similar communications systems as identified in the CAISO's Business Practice Manuals or Operating Procedures. Ambient adjusted ratings submitted for use in the real time market would need to have 15-minute granularity, but the CAISO proposes that each value remain constant over all 15-minute intervals during a clock hour. This requirement is consistent with the Commission's directive that RTOs/ISOs establish processes and systems to allow transmission line ratings to be updated electronically at least hourly. In addition, the CAISO proposes to require participating transmission owners undertake validations steps prior to transmitting ambient adjusted ratings to the CAISO. The CAISO expects this validation will involve an automated process that confirms that the rating transmitted to the CAISO accurately reflects the applicable temperature forecast for a specific transmission line.

In addition, the CAISO's proposed language for both the day-ahead and real-time market processes clarifies that if, for any reason, communications between a participating transmission owner and the CAISO are disrupted and prevent a participating transmission owner submitting or the CAISO receiving ambient adjusted ratings, or a data input failure occurs, or a hardware or software failure occurs, the CAISO will use the seasonal rating for the relevant

---

<sup>51</sup> See CAISO tariff section 34.6.

<sup>52</sup> *Id.*

transmission line for the applicable trading hour. This provision is consistent with the Commission's guidance in Order No. 881 that transmission providers use the applicable seasonal rating if a data failure occurs that prevents the use of an ambient adjusted rating.<sup>53</sup>

**C. The CAISO will use seasonal ratings as contemplated by Order No. 881**

Order No. 881 requires transmission providers to use seasonal line ratings when: (1) evaluating requests for transmission service ending more than 10 days from the date of the request; (2) responding to requests for information on the availability of such transmission service (including requests for available transmission capacity or other information related to potential transmission service); and (3) posting transmission availability or other information related to transmission service ending more than 10 days from the date of the request to their OASIS site.<sup>54</sup> Order No. 881 also requires transmission providers to use seasonal line ratings as the basis for determining the necessity of curtailment, interruption, or redispatch of transmission service anticipated to occur more than 10 days in the future.<sup>55</sup>

In terms of the requirements for seasonal ratings, Order No. 881 requires that transmission providers define seasons to include not fewer than four seasons in each year, and reasonably to reflect portions of the year where expected high temperatures are relatively consistent.<sup>56</sup> Order No. 881 also clarifies that seasonal line ratings may be derived from historical temperatures. As with ambient adjusted ratings, participating transmission owners will calculate and submit seasonal ratings to the CAISO.<sup>57</sup> The CAISO proposes to include language in Part 1 of proposed Appendix JJ recognizing the elements specified by the Commission for calculating seasonal ratings and stating the CAISO will coordinate with participating transmission owners to develop transmission rating methodologies that include these elements.<sup>58</sup> Appendix JJ states that in

---

<sup>53</sup> Order No. 881 at P 180.

<sup>54</sup> Order No. 881 at PP 5 and 198.

<sup>55</sup> *Id.* at PP 5, 198, 199.

<sup>56</sup> *Id.* at P 211.

<sup>57</sup> *Id.* at P 141.

<sup>58</sup> See proposed Appendix JJ, Part 1 of the CAISO tariff included in Attachment A to this filing.

undertaking this coordination, the CAISO will seek to promote implementation consistency to the greatest extent possible.

The CAISO does not currently offer long-term transmission service, *i.e.* transmission service ending more than 10 days from the date of the request. However, the CAISO is discussing opportunities for wheeling through customers to obtain a scheduling priority in advance of its day-ahead and real-time markets as part of an ongoing stakeholder initiative.<sup>59</sup> The CAISO proposes to include language as part of Appendix JJ that states, “the CAISO will use Seasonal Line Ratings in connection with evaluation of any transmission service authorized under the CAISO Tariff ending more than 10 days from the date of the request.” This language tracks the *pro forma* tariff language adopted by Order no. 881.

**D. The CAISO will use uniquely determined emergency ratings as required by Order No. 881**

Order No. 881 requires transmission providers to use uniquely determined emergency ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints.<sup>60</sup> Order No. 881 defines emergency ratings as a transmission line rating that reflects operation for a specified, finite period, rather than reflecting continuous operation.<sup>61</sup> The Commission offers the following specifications for emergency ratings:

- An emergency rating may assume acceptable loss of equipment life or other physical or safety limitations for the equipment involved.<sup>62</sup>
- Uniquely determined emergency ratings must incorporate an adjustment for ambient air temperature and daytime and nighttime

---

<sup>59</sup> More information about the CAISO’s stakeholder process is available on the following website: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Transmission-service-and-market-scheduling-priorities>.

<sup>60</sup> Order No. 831 at PP 10, 38.

<sup>61</sup> The Commission states: “Most transmission equipment has the ability to withstand high currents for short periods of time without sustaining damage. The requirement to implement uniquely determined emergency ratings simply requires that emergency ratings calculations be based on this existing ability, where it exists.” *Id.* at P 302.

<sup>62</sup> *Id.* at P 293.

solar heating, consistent with the ambient adjusted rating requirements for normal ratings.<sup>63</sup>

- Emergency ratings, like all transmission line ratings, must incorporate a set of electrical equipment ratings that collectively operate as a single electric system element (e.g., transformers, relay protective devices, terminal equipment, and series and shunt compensation devices), and the most limiting component from that set will determine the transmission line rating.<sup>64</sup>

Today, in establishing system operating limits and undertaking pre-contingency analysis, the CAISO utilizes normal ratings of transmission lines.<sup>65</sup> Upon implementing Order No. 881, the CAISO will continue to do so. In post-contingency analysis, the CAISO utilizes short-term ratings provided by participating transmission owners for the duration specified in establishing system operating limits. If a short-term rating is not available, the CAISO will utilize the normal rating. The CAISO is not proposing to change this operating practice.

The CAISO also proposes to include language in Part 1 of new Appendix JJ to its tariff regarding the CAISO's coordination with participating transmission owners in their development of emergency ratings.<sup>66</sup> This will help ensure these methodologies account for the elements required by FERC Order No. 881. This coordination will seek to ensure emergency ratings reflect an acceptable loss of equipment life or other physical or safety limitations for the equipment involved, incorporate an adjustment for ambient air temperature and daytime and nighttime solar heating, use the most limiting component from a set of electrical equipment that collectively operate as a single electric system element to set the emergency rating for the transmission line. This language will guide the CAISO's efforts to ensure methodologies used to calculate emergency ratings developed by transmission owners are consistent to the maximum extent possible and meet the directives of Order No. 881.

---

<sup>63</sup> Order No. 831 at P 297-298.

<sup>64</sup> *Id.* at P 305.

<sup>65</sup> CAISO Operating Procedure 3100 <http://www.caiso.com/Documents/3100.pdf>.

<sup>66</sup> See proposed Appendix JJ, Part 1 of the CAISO tariff included in Attachment A to this filing.

In addition, the CAISO proposes to include the following language in Part 2 of new Appendix JJ that explains how the CAISO will use emergency ratings:

Consistent with Appendix L of the CAISO Tariff, the CAISO will use uniquely determined Emergency Ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints.<sup>67</sup>

Appendix L of the CAISO tariff describes the CAISO's method to assess available transfer capability. Section L.6.1 of the Appendix L already explains that the CAISO will perform contingency analysis with all pre-contingency line flows at or below their normal ratings and all post-contingency line flows at or below their emergency ratings. These parameters for analysis will not change with implementation of Order No. 881.

Order No. 881 also requires RTOs/ISOs to identify in their compliance filing the mechanism, *i.e.*, tariff or membership agreement, under which the transmission owner will timely make and communicate calculations and determinations regarding emergency ratings, including any discretion a transmission owner may exercise in its calculations.<sup>68</sup> CAISO tariff section 4.3.1 requires each participating transmission owner execute the transmission control agreement. Under the CAISO's transmission control agreement, participating transmission owners submit applicable ratings to the CAISO for inclusion in the transmission register.<sup>69</sup> The transmission control agreement requires participating transmission owners to provide in a format acceptable to the CAISO applicable ratings of all transmission lines and associated facilities and any changes to those ratings.<sup>70</sup> Participating transmission owners must exercise a duty of care that calls for them to act in accordance with applicable law.<sup>71</sup> These provisions establish the obligations for participating transmission owners to communicate to the CAISO timely calculations and determinations regarding emergency ratings. They do not attribute discretion to participating transmission

---

<sup>67</sup> See proposed Appendix JJ, Part 2 of the CAISO tariff included in Attachment A to this filing.

<sup>68</sup> Order No. 881 at P 300.

<sup>69</sup> Transmission Control Agreement, Section 4.2.

<sup>70</sup> *Id.*, Section 6.4.

<sup>71</sup> *Id.*, Section 6.1.3.

owners to calculate emergency ratings in a manner that conflicts with Order No. 881.

As with ambient adjusted ratings and seasonal ratings, and consistent with NERC Reliability Standards, transmission owners will calculate and communicate these ratings to the CAISO.<sup>72</sup> The CAISO will use these emergency ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints.<sup>73</sup> Similarly, transmission providers that are WEIM Entities and/or RC West customers will communicate emergency ratings that they calculate to the CAISO in its role as the WEIM operator and reliability coordinator.

**E. The CAISO will develop a database to comply with the Commission's transparency reforms**

Order No. 881 directs public utility transmission providers to implement transparency reforms regarding transmission line ratings. First, Order No. 881 requires public utility transmission owners to share transmission line ratings and methodologies with their transmission provider(s) and with market monitors in RTO/ISO regions.<sup>74</sup> Order No. 881 also requires public utility transmission providers to share their transmission owners' transmission line ratings and methodologies with any transmission provider(s) upon request and in a timely manner.<sup>75</sup>

The Commission's transparency reforms require transmission providers to maintain a database of their transmission owners' transmission line ratings and methodologies on the transmission provider's Open Access Same-Time Information System (OASIS) site or another password-protected website.<sup>76</sup> The database must include a record of all transmission line ratings, used in real-time operations, and for all future market periods for which transmission service is

---

<sup>72</sup> Order No. 881 at P 299.

<sup>73</sup> *Id.* at P 293.

<sup>74</sup> *Id.* at P 330.

<sup>75</sup> *Id.* at P 335. Order No. 881 states that any information sharing method should be sufficient to accommodate the reasonable business needs of the other transmission provider(s) (e.g., to allow the other transmission provider(s) to process transmission service requests in a timely manner).

<sup>76</sup> *Id.* at P 330.

offered. Order No. 881 states that “[t]he Commission expects that transmission providers will insert records into [their] transmission line rating database each hour, shortly after calculation of ambient adjusted ratings.”<sup>77</sup> Order No. 881 also states the transmission provider would insert a separate record into its database for each hour reflecting:

- (1) each transmission line;
- (2) each current and forward hour for which transmission line ratings are calculated (at least one rating for each of the 240 hours in the next 10 days); and
- (3) each rating type (normal and each type of emergency rating).<sup>78</sup>

The Commission also expects transmission providers to maintain in their database records of which seasonal line ratings (for use in evaluating longer-term transmission service requests) or other types of transmission line ratings were in effect at which times for each transmission line. For example, if a transmission provider implements dynamic line ratings on any of its transmission lines, the database would document the dynamic ratings on these transmission lines in the same way it documents ambient adjusted ratings.<sup>79</sup>

Order No. 881 requires each record in the database to reflect which transmission line the record applies to, as well as the date and time the transmission provider entered the record into the database. Transmission providers must maintain the database so users can view, download, and query data in standard formats, using standard protocols.<sup>80</sup> The database must be in a form all parties with OASIS access or access to the password-protected website can access. The database should also archive and allow for querying of all current transmission line ratings and all transmission line ratings used in the past five years.<sup>81</sup>

---

<sup>77</sup> Order No. 881 at P 330.

<sup>78</sup> *Id.* P 339.

<sup>79</sup> *Id.*

<sup>80</sup> *Id.* at P 340.

<sup>81</sup> *Id.* at P 330.

Finally, Order No. 881 requires transmission providers to post on OASIS or another password-protected website any exceptions or temporary alternate ratings.<sup>82</sup> These postings must document the nature of and basis for each exception or alternate rating, as well as the date(s) and time(s) of initiation and (if applicable) withdrawal for the exception or the alternate rating.<sup>83</sup>

To comply with these directives, the CAISO proposes to revise section 6 of its tariff, which governs CAISO communications.<sup>84</sup> The CAISO will also develop business requirement specifications to govern the design of this database and, once developed, undertake functional testing to ensure affected entities can query and access information regarding transmission line ratings in a manner consistent with the directives of Order No. 881. The CAISO anticipates it will also develop a user guide to facilitate user acceptance testing. The CAISO intends to use this database for transmission lines that comprise the CAISO controlled grid. The database will not include information received from transmission providers such as RC West customers outside of the CAISO balancing authority area, WEIM Entities, or other reliability coordinators in the Western Interconnection. The database will serve as the mechanism for sharing information with all entities authorized by Order No. 881 to obtain access to transmission line ratings for prospective and historical periods, as well as transmission line rating methodologies developed by participating transmission owners. This proposed language tracks language regarding transparency reforms required by Order No. 881. In addition, the proposed language explains the steps the CAISO will take if there is a database or communications failure that prevents the CAISO from posting applicable transmission line ratings or exceptions for an applicable time period. In such event, the CAISO will endeavor to provide this information within the next thirty days from the date of the failure, after which time the CAISO will not provide the information. This language requires the CAISO to retrieve and post information, but it also recognizes there is a limit to what the CAISO can do in the event of lost data or a system failure. The Commission has accepted similar language in connection with the CAISO's

---

<sup>82</sup> Order No. 881 at PP 11, 39, 341.

<sup>83</sup> *Id.* at PP 330, 341.

<sup>84</sup> See proposed tariff section 6.5.17 entitled Transmission Line Ratings included in Attachment A to this filing. The CAISO proposes that users that meet the requirements to access protected data on OASIS may also access the database of transmission line methodologies and transmission line ratings.

OASIS postings.<sup>85</sup> Finally, the CAISO's proposed tariff language will allow both market participants and no-market participant's access to the database.<sup>86</sup>

#### **IV. The CAISO anticipates undertaking several work streams to implement Order No. 881**

The CAISO anticipates the need to orchestrate multiple work streams to implement the requirements of Order No. 881. This work will involve coordinating with participating transmission owners to develop methodologies for transmission line ratings consistent with the requirements of Order No. 881. In coordination with affected entities, the CAISO will also need to develop data specification and collection requirements for transmission line ratings, including a standardized unit format for ratings. The CAISO will need to enhance technology systems to collect transmission line ratings and communicate those ratings to the CAISO's reliability and market applications. Finally, the CAISO will need to design and build a database to comply with Order No 881's transparency reforms. To meet the requirements of Order No. 881 within the time allowed for implementation, the CAISO anticipates addressing this work in multiple tracks. Although the CAISO continues to assess the scope and timelines for this work, the CAISO expects to start by ensuring its real-time reliability applications can incorporate transmission line ratings. As part of the next track, the CAISO will work to deploy its operational model for the CAISO balancing authority area, the WEIM, and RC West footprint, including functionality to enhance the CAISO's transmission register. Additional tracks will involve enhancing the CAISO's market and look-ahead applications, developing a database to house transmission line ratings, and ensuring the WECC planning model and seasonal study work align with the requirements of Order No. 881. The CAISO plans to coordinate with affected stakeholders throughout all stages of implementation.

#### **V. Effective Date and Requested Order**

The CAISO is targeting an effective date for these tariff revisions prior to summer 2025. The CAISO requests the Commission issue an order accepting its tariff revisions on or before May 1, 2023. The Commission should provide certainty for the CAISO and all affected entities that the tariff changes proposed

---

<sup>85</sup> See e.g. CAISO tariff section 6.5.10.

<sup>86</sup> See language in proposed tariff section 6.5.17, which reads: "Users that meet the requirements of Section 6.5.10.2 may obtain access to the database of Transmission Line Ratings and Transmission Line Rating methodologies." Section 6.5.10.2 of the CAISO tariff provides a mechanism for provide protected data to market participants and non-market participants.

herein comply with the requirements of Order No. 881. The CAISO also requests the Commission authorize an effective date for such tariff revisions on or before June 15, 2025, subject to the CAISO filing a notice with the Commission within 5 days of the actual effective date.<sup>87</sup>

The CAISO commits to inform the Commission of any need to modify its requested effective date. Over the next three years, the CAISO has planned significant market enhancements and is working with stakeholders to explore extending its day ahead market to WEIM entities.<sup>88</sup> Additionally, the CAISO generally targets significant releases in the fall timeframe.<sup>89</sup> Depending on the implementation work required by Order No. 881, the CAISO and its stakeholders may need additional time to complete functional testing of new processes and systems required by Order No. 881. Updating how the CAISO uses transmission line ratings may have significant impact on both the market solution and how our system operations and neighboring balancing authority areas interact with the CAISO market. To this end, implementing large changes to market process immediately prior to our summer operating season may not be good utility practice. In addition, as a practical matter, the CAISO controlled grid will likely realize the most significant benefit from Order No. 881 implementation when forecasted daytime high temperatures tend to decrease, *i.e.* after the summer season.

---

<sup>87</sup> The CAISO has included an effective date of 12/31/9998 for the tariff records submitted in this filing. The CAISO will notify the Commission of the actual effective date of these tariff records within five business days after implementation in an eTariff submittal using Type of Filing code 150 – Report.

<sup>88</sup> See CAISO policy roadmap available on the CAISO's website: <http://www.caiso.com/Documents/Briefing-Annual-Roadmap-Three-Year-Plan-Joint-Presentation-Feb-9-2022.pdf>.

<sup>89</sup> Information about the CAISO's release planning schedule is available on the CAISO's website: <http://www.caiso.com/informed/Pages/ReleasePlanning/Default.aspx>.

## **VI. Communications**

Under Rule 203(b)(3),<sup>90</sup> the CAISO respectfully requests that all correspondence and other communications about this filing be served upon:

Anthony Ivancovich  
Deputy General Counsel  
California Independent System  
Operator Corporation  
250 Outcropping Way  
Folsom, CA 95630  
Tel: (916) 608-7135  
Fax: (916) 608-7222  
[aivancovich@caiso.com](mailto:aivancovich@caiso.com)

Andrew Ulmer  
Assistant General Counsel  
California Independent System  
Operator Corporation  
250 Outcropping Way  
Folsom, CA 95630  
Tel: (916) 608-7209  
Fax: (916) 608-7222  
[aulmer@caiso.com](mailto:aulmer@caiso.com)

## **VII. Service**

The CAISO has served copies of this filing on the California Public Utilities Commission, the California Energy Commission, and all parties with scheduling coordinator agreements under the CAISO tariff. In addition, the CAISO has posted a copy of the filing on the CAISO website.

## **VIII. Contents of this Filing**

Besides this transmittal letter, this filing includes the following attachments:

Attachment A	Clean CAISO tariff sheets
Attachment B	Redlined CAISO tariff sheets

---

<sup>90</sup> 18 C.F.R. § 385.203(b)(3).

Honorable Kimberly D. Bose

July 12, 2022

Page 26

**X. Conclusion**

The CAISO supports the objective to increase the accuracy and transparency of electric transmission line ratings in order obtain greater efficiency from the transmission system. The CAISO respectfully requests the Commission accept this filing in compliance with Order No. 881.

Respectfully submitted,

/s/ Andrew Ulmer

Roger E. Collanton

General Counsel

Anthony Ivancovich

Deputy General Counsel

Andrew Ulmer

Asst. General Counsel

*Counsel for the California Independent System  
Operator Corporation*

**Attachment A – Clean Tariff**

**Compliance Filing – FERC Order No. 881**

**California Independent Systems Operator Corporation**

**July 12, 2022**

## **Section 6**

\* \* \* \* \*

### **Section 6.5.17 Transmission Line Ratings**

The CAISO will maintain on the password-protected section of its OASIS page or on another password-protected website a database of Transmission Line Ratings and Transmission Line Rating methodologies. The database will include a record of all Transmission Line Ratings used in real-time operations and in each future period for which they are calculated. Any postings of temporary alternate Transmission Line Ratings or exceptions will be part of this database. The database will include records of which Transmission Line Ratings and Transmission Line Rating methodologies were in effect at which times over the previous five years, including records of which temporary alternate Transmission Line Ratings or exceptions in effect during the previous five years. Each record in the database will reflect which transmission line to which the record applies and the date and time the record was entered into the database.

The database will document the nature of and basis for each exception, the date(s) and time(s) that the exception was initiated, and (if applicable) the date(s) and time(s) that each exception was withdrawn and the standard rating that became effective again. The database will also document the use of an alternate Transmission Line Rating, including the nature of and basis for the alternate rating, the date and time that the alternate rating was initiated, and, if applicable, the date and time that the alternate rating was withdrawn and the standard rating became effective again.

To the extent that the CAISO fails to make available any Transmission Line Rating used in real-time operations or in any future period for which they are calculated, the CAISO will endeavor to provide this information within the next 30 days, after which the information will not be provided.

Users that meet the requirements of Section 6.5.10.2 may obtain access to the database of Transmission Line Ratings and Transmission Line Rating methodologies. The CAISO will maintain the database so that users can view, download, and query data in a standard formats, using standard protocols. Upon request, the CAISO will provide other transmission providers with access to the database.

\* \* \* \* \*

## **Appendix A**

\* \* \* \* \*

### **- Ambient Adjusted Rating**

A Transmission Line Rating that: (1) applies to a time period of not greater than one hour; (2) reflects an up-to-date forecast of ambient air temperature across the time period to which the rating applies; (3) reflects the absence of solar heating during nighttime periods where the local sunrise/sunset times used to determine daytime and nighttime periods are updated at least monthly, if not more frequently; and (4) is calculated at least each hour, if not more frequently

**- Dynamic Line Rating**

A Transmission Line Rating that applies to a time period of not greater than one hour and reflects up-to-date forecasts of inputs such as (but not limited to) ambient air temperature, wind, solar heating, transmission line tension, or transmission line sag.

**- Emergency Rating**

A Transmission Line Rating that reflects operation for a specified, finite period, rather than reflecting continuous operation. An Emergency Rating may assume an acceptable loss of equipment life or other physical or safety limitations for the equipment involved.

**- Seasonal Ratings**

A Transmission Line Rating that (a) applies to a specified season where seasons to include not fewer than four seasons in each year, and to reasonably reflect portions of the year where expected high temperatures are relatively consistent; and (b) reflects an up-to-date forecast of ambient air temperature across the relevant season over which the rating applies. Seasonal Line Ratings are calculated annually, if not more frequently, for each season in the future for which transmission service can be requested.

**- Transmission Line Rating**

The maximum transfer capability of a transmission line, computed in accordance with a written Transmission Line Rating methodology and consistent with Good Utility Practice, considering the technical limitations on conductors and relevant transmission equipment (such as thermal flow limits), as well as technical limitations of the transmission system (such as system voltage and stability limits).

\* \* \* \* \*

## Appendix JJ

### Transmission Line Ratings

#### Part 1: Transmission Line Rating Methodologies

The CAISO will coordinate with Participating Transmission Owners in their development of Transmission Line Rating methodologies to ensure these methodologies account for the following elements:

- Calculation of temperatures at which there is sufficient confidence that the actual temperature will not be greater than that temperature (i.e., expected temperature plus an appropriate forecast margin).
- For Ambient Adjusted Ratings, including separate daytime and nighttime ratings.
- For Ambient Adjusted Ratings, updating the sunrise and sunset times used to calculate at least monthly.
- Ensuring Ambient Adjusted Ratings are valid for at least the range of local historical temperatures plus or minus a margin of 10 degrees Fahrenheit.
- Establishing procedures to handle a situation where forecast temperatures fall outside of such a range of temperatures, to ensure the use of safe and reliable Transmission Line Ratings, and in the event that actual temperatures set new high or low records, revising their look-up tables/databases or formulas/programs, as necessary and within a timely manner, to maintain a 10 degree Fahrenheit margin.
- Updating Ambient Adjusted Ratings with every five degree Fahrenheit increment of temperature change.
- Addressing how Ambient Adjusted Ratings for Transmission Lines interact with system voltage and stability limits, Remedial Action Schemes and system operating limits.
- For Seasonal Line Ratings, including not fewer than four seasons in each year, and reflecting portions of the year where expected high temperatures are relatively consistent.
- For Seasonal Line Ratings, reflecting an up-to-date forecast of ambient air temperature across the relevant season over which the rating applies.
- Calculating Seasonal Line ratings at least annually, for each season in the future for which transmission service can be requested under the CAISO Tariff.
- Developing forecasts of ambient air temperature for Ambient Adjusted Ratings and Seasonal Line Ratings, consistent with Good Utility Practice and on a non-discriminatory basis.
- For Emergency Ratings, reflecting an acceptable loss of equipment life or other physical or safety limitations for the equipment involved.
- For Emergency Ratings, incorporating an adjustment for ambient air temperature and daytime and nighttime solar heating,
- For Emergency ratings, incorporating a set of electrical equipment ratings that collectively operate as a single electric system element (e.g., transformers, relay protective devices, terminal

equipment, and series and shunt compensation devices), and using the most limiting component from that set to determine the Transmission Line Rating

In undertaking this coordination, the CAISO will seek to promote implementation consistency to the greatest extent possible.

The CAISO will also coordinate with Participating Transmission Owners in their development of exceptions or alternate ratings identified by their Transmission Line Rating methodologies, consistent with the following:

- Where a Participating Transmission Owner determines, consistent with Good Utility Practice, that the Transmission Line Rating of a transmission line is not affected by ambient air temperature or solar heating.
- Where a Participating Transmission Owner reasonably determines, consistent with Good Utility Practice that the temporary use of an alternate Transmission Line Rating is necessary to ensure the safety and reliability of the Transmission System, then the Transmission Provider may use such an alternate rating.

## **Part 2 – CAISO Use of Transmission Line Ratings**

### **Day-Ahead Market**

Unless an exception applies, the CAISO will use Ambient Adjusted Ratings, Dynamic Line Ratings, or alternate ratings validated and submitted by Participating Transmission Owners no later than 9:00 a.m. Pacific Time on the day before a Trading Day as the relevant Transmission Line Ratings in its Base Market Model for the Day-Ahead Market. Ambient Adjusted Ratings should reflect hourly values for each Trading Hour of the Trading Day. Participating Transmission Owners may submit Ambient Adjusted Ratings using SCADA, ICCP or similar communication systems as described in the applicable Business Practice Manual or Operating Procedures. If, for any reason, communications between a Participating Transmission Owner and the CAISO are disrupted and prevent a Participating Transmission Owner from submitting or the CAISO receiving the applicable Transmission Line Rating, or a data input failure occurs, or a hardware or software failure occurs, the CAISO will use the Seasonal Rating for the relevant Transmission Line for the applicable Trading Hour. If the CAISO detects an apparent inaccurate transmission line rating, the CAISO will inform the Participating Transmission Owner and take appropriate actions to resolve any inaccuracy, including use of an alternate rating specified by the Participating Transmission Owner.

### **Real-Time Market**

Unless an exception applies, the CAISO will use Ambient Adjusted Ratings, Dynamic Line Ratings, or alternate ratings validated and submitted by Participating Transmission Owners and EIM Entities no later than 5 (five) hours before a Trading Hour as the relevant Transmission Line Ratings in its Base Market Model for the Real-Time Market. Ambient Adjusted Ratings should reflect equal values across each fifteen-minute interval of a Trading Hour. Participating Transmission Owners may submit Ambient Adjusted Ratings using SCADA, ICCP or similar communication systems as described in the applicable Business Practice Manual or Operating Procedures. If, for any reason, communications with the CAISO are disrupted and prevent a Participating Transmission Owner or EIM Entity from submitting or the CAISO receiving the applicable Transmission Line Rating, or a data input failure occurs, or a hardware or software failure occurs, the CAISO will use the applicable Seasonal Rating for the relevant Transmission Line for the applicable Trading Hour. If the CAISO detects an apparent inaccurate transmission line rating, the CAISO will inform the Participating Transmission Owner or EIM Entity and take appropriate actions to resolve any inaccuracy, including use of an alternate rating specified by the Participating Transmission Owner or EIM Entity.

### **Longer-Term Transmission Service**

The CAISO will use Seasonal Line Ratings in connection with evaluation of any transmission service authorized under the CAISO Tariff ending more than 10 days from the date of the request.

**Emergency Ratings**

Consistent with Appendix L of the CAISO Tariff, the CAISO will use uniquely determined Emergency Ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints.

**Attachment B – Marked Tariff**

**Compliance Filing – FERC Order No. 881**

**California Independent Systems Operator Corporation**

**July 12, 2022**

## **Section 6**

\* \* \* \* \*

### **Section 6.5.17 Transmission Line Ratings**

The CAISO will maintain on the password-protected section of its OASIS page or on another password-protected website a database of Transmission Line Ratings and Transmission Line Rating methodologies. The database will include a record of all Transmission Line Ratings used in real-time operations and in each future period for which they are calculated. Any postings of temporary alternate Transmission Line Ratings or exceptions will be part of this database. The database will include records of which Transmission Line Ratings and Transmission Line Rating methodologies were in effect at which times over the previous five years, including records of which temporary alternate Transmission Line Ratings or exceptions in effect during the previous five years. Each record in the database will reflect which transmission line to which the record applies and the date and time the record was entered into the database.

The database will document the nature of and basis for each exception, the date(s) and time(s) that the exception was initiated, and (if applicable) the date(s) and time(s) that each exception was withdrawn and the standard rating that became effective again. The database will also document the use of an alternate Transmission Line Rating, including the nature of and basis for the alternate rating, the date and time that the alternate rating was initiated, and, if applicable, the date and time that the alternate rating was withdrawn and the standard rating became effective again.

To the extent that the CAISO fails to make available any Transmission Line Rating used in real-time operations or in any future period for which they are calculated, the CAISO will endeavor to provide this information within the next 30 days, after which the information will not be provided.

Users that meet the requirements of Section 6.5.10.2 may obtain access to the database of Transmission Line Ratings and Transmission Line Rating methodologies. The CAISO will maintain the database so that users can view, download, and query data in a standard formats, using standard protocols. Upon request, the CAISO will provide other transmission providers with access to the database.

\* \* \* \* \*

## **Appendix A**

\* \* \* \* \*

### **- Ambient Adjusted Rating**

A Transmission Line Rating that: (1) applies to a time period of not greater than one hour; (2) reflects an up-to-date forecast of ambient air temperature across the time period to which the rating applies; (3) reflects the absence of solar heating during nighttime periods where the local sunrise/sunset times used to determine daytime and nighttime periods are updated at least monthly, if not more frequently; and (4) is calculated at least each hour, if not more frequently

### **- Dynamic Line Rating**

A Transmission Line Rating that applies to a time period of not greater than one hour and reflects up-to-date forecasts of inputs such as (but not limited to) ambient air temperature, wind, solar heating, transmission line tension, or transmission line sag.

### **- Emergency Rating**

A Transmission Line Rating that reflects operation for a specified, finite period, rather than reflecting continuous operation. An Emergency Rating may assume an acceptable loss of equipment life or other physical or safety limitations for the equipment involved.

### **- Seasonal Ratings**

A Transmission Line Rating that (a) applies to a specified season where seasons to include not fewer than four seasons in each year, and to reasonably reflect portions of the year where expected high temperatures are relatively consistent; and (b) reflects an up-to-date forecast of ambient air temperature across the relevant season over which the rating applies. Seasonal Line Ratings are calculated annually, if not more frequently, for each season in the future for which transmission service can be requested.

### **- Transmission Line Rating**

The maximum transfer capability of a transmission line, computed in accordance with a written Transmission Line Rating methodology and consistent with Good Utility Practice, considering the technical limitations on conductors and relevant transmission equipment (such as thermal flow limits), as well as technical limitations of the transmission system (such as system voltage and stability limits).

\* \* \* \* \*

## Appendix JJ

### Transmission Line Ratings

#### Part 1: Transmission Line Rating Methodologies

The CAISO will coordinate with Participating Transmission Owners in their development of Transmission Line Rating methodologies to ensure these methodologies account for the following elements:

- Calculation of temperatures at which there is sufficient confidence that the actual temperature will not be greater than that temperature (i.e., expected temperature plus an appropriate forecast margin).
- For Ambient Adjusted Ratings, including separate daytime and nighttime ratings.
- For Ambient Adjusted Ratings, updating the sunrise and sunset times used to calculate at least monthly.
- Ensuring Ambient Adjusted Ratings are valid for at least the range of local historical temperatures plus or minus a margin of 10 degrees Fahrenheit.
- Establishing procedures to handle a situation where forecast temperatures fall outside of such a range of temperatures, to ensure the use of safe and reliable Transmission Line Ratings, and in the event that actual temperatures set new high or low records, revising their look-up tables/databases or formulas/programs, as necessary and within a timely manner, to maintain a 10 degree Fahrenheit margin.
- Updating Ambient Adjusted Ratings with every five degree Fahrenheit increment of temperature change.
- Addressing how Ambient Adjusted Ratings for Transmission Lines interact with system voltage and stability limits, Remedial Action Schemes and system operating limits.
- For Seasonal Line Ratings, including not fewer than four seasons in each year, and reflecting portions of the year where expected high temperatures are relatively consistent.
- For Seasonal Line Ratings, reflecting an up-to-date forecast of ambient air temperature across the relevant season over which the rating applies.
- Calculating Seasonal Line ratings at least annually, for each season in the future for which transmission service can be requested under the CAISO Tariff.
- Developing forecasts of ambient air temperature for Ambient Adjusted Ratings and Seasonal Line Ratings, consistent with Good Utility Practice and on a non-discriminatory basis.
- For Emergency Ratings, reflecting an acceptable loss of equipment life or other physical or safety limitations for the equipment involved.
- For Emergency Ratings, incorporating an adjustment for ambient air temperature and daytime and nighttime solar heating.
- For Emergency ratings, incorporating a set of electrical equipment ratings that collectively operate as a single electric system element (e.g., transformers, relay protective devices, terminal

equipment, and series and shunt compensation devices), and using the most limiting component from that set to determine the Transmission Line Rating

In undertaking this coordination, the CAISO will seek to promote implementation consistency to the greatest extent possible.

The CAISO will also coordinate with Participating Transmission Owners in their development of exceptions or alternate ratings identified by their Transmission Line Rating methodologies, consistent with the following:

- Where a Participating Transmission Owner determines, consistent with Good Utility Practice, that the Transmission Line Rating of a transmission line is not affected by ambient air temperature or solar heating.
- Where a Participating Transmission Owner reasonably determines, consistent with Good Utility Practice that the temporary use of an alternate Transmission Line Rating is necessary to ensure the safety and reliability of the Transmission System, then the Transmission Provider may use such an alternate rating.

## **Part 2 – CAISO Use of Transmission Line Ratings**

### **Day-Ahead Market**

Unless an exception applies, the CAISO will use Ambient Adjusted Ratings, Dynamic Line Ratings, or alternate ratings validated and submitted by Participating Transmission Owners no later than 9:00 a.m. Pacific Time on the day before a Trading Day as the relevant Transmission Line Ratings in its Base Market Model for the Day-Ahead Market. Ambient Adjusted Ratings should reflect hourly values for each Trading Hour of the Trading Day. Participating Transmission Owners may submit Ambient Adjusted Ratings using SCADA, ICCP or similar communication systems as described in the applicable Business Practice Manual or Operating Procedures. If, for any reason, communications between a Participating Transmission Owner and the CAISO are disrupted and prevent a Participating Transmission Owner from submitting or the CAISO receiving the applicable Transmission Line Rating, or a data input failure occurs, or a hardware or software failure occurs, the CAISO will use the Seasonal Rating for the relevant Transmission Line for the applicable Trading Hour. If the CAISO detects an apparent inaccurate transmission line rating, the CAISO will inform the Participating Transmission Owner and take appropriate actions to resolve any inaccuracy, including use of an alternate rating specified by the Participating Transmission Owner.

### **Real-Time Market**

Unless an exception applies, the CAISO will use Ambient Adjusted Ratings, Dynamic Line Ratings, or alternate ratings validated and submitted by Participating Transmission Owners and EIM Entities no later than 5 (five) hours before a Trading Hour as the relevant Transmission Line Ratings in its Base Market Model for the Real-Time Market. Ambient Adjusted Ratings should reflect equal values across each fifteen-minute interval of a Trading Hour. Participating Transmission Owners may submit Ambient Adjusted Ratings using SCADA, ICCP or similar communication systems as described in the applicable Business Practice Manual or Operating Procedures. If, for any reason, communications with the CAISO are disrupted and prevent a Participating Transmission Owner or EIM Entity from submitting or the CAISO receiving the applicable Transmission Line Rating, or a data input failure occurs, or a hardware or software failure occurs, the CAISO will use the applicable Seasonal Rating for the relevant Transmission Line for the applicable Trading Hour. If the CAISO detects an apparent inaccurate transmission line rating, the CAISO will inform the Participating Transmission Owner or EIM Entity and take appropriate actions to resolve any inaccuracy, including use of an alternate rating specified by the Participating Transmission Owner or EIM Entity.

### **Longer-Term Transmission Service**

The CAISO will use Seasonal Line Ratings in connection with evaluation of any transmission service authorized under the CAISO Tariff ending more than 10 days from the date of the request.

**Emergency Ratings**

Consistent with Appendix L of the CAISO Tariff, the CAISO will use uniquely determined Emergency Ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints.