2024 FERC Order 881 Update

Seams Management Working Group

May 07, 2024

Executive Summary

- Project team is actively planning with teams and 12+ systems impacted by Order 881 and working toward execution
- MISO is designing the ratings data exchange with TO engagement and driving commonality with RCs

Background

Key Definitions

- **Facility**: a set of electrical equipment ratings that collectively operates as a single bulk electric system element (e.g., transformers, relay protective devices, terminal equipment, and series and shunt compensation devices)
- **Facility Rating**: The maximum or minimum voltage, current, frequency, or real or reactive power flow through a facility that does not violate the applicable equipment rating of any equipment comprising the facility
- **Seasonal Facility Rating:** a transmission facility rating that: (1) applies to a specific season, where there are at least four seasons, and reasonably reflects portions of the year where expected high temperatures are relatively consistent; (2) reflects an up-to-date forecast of ambient air temperatures across the seasons; and (3) is recalculated at least annually for each season in which Transmission Service can be requested.
- **Emergency Rating**: a transmission facility rating that reflects operation for a specified, finite period, rather than reflecting continuous operation. An emergency rating may assume acceptable loss of equipment life or other physical or safety limitations for the equipment involved
- **Ambient-Adjusted Ratings (AARs):** a transmission facility 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 Ratings (DLRs):** a transmission facility rating that: (1) applies to a time period of not greater than one hour; and (2) reflects up-to-date forecasts of inputs such as (but not limited to) ambient air temperature, wind, solar heating intensity, transmission line tension, or transmission line sag.

FERC Order 881 Summary

- Released December 2021; Effective July 2025
- All facilities that are affected by ambient air temperature and solar heating shall have an AAR
  - Separate night and day AARs
  - Hourly Updates
- Forecasted Hourly AARs for 10 days
- ISO/RTO must support receiving DLRs
- Storage and Access: 5 years of rating data

Must Leverage AARs in:

- ☑ Real-Time Congestion Management (SE/RTCA)
- ☑ Real-Time Market (SCED)
- ☒ Near-Term Markets (Unit Commitment)
- ☒ Near-Term Transmission Service (< 10 days)

☑ = MISO Current Capability

☒ = MISO Does Not Have Current Capability

Ratings Today @ MISO

Ratings are **not** forecasted

15,000 transferred facilities in the MISO footprint

Ratings provided

- Summer and Winter (Seasonal)
- Normal, Emergency, and Load Shed
- Conditional (topology based)

>1,500 facilities with Ambient Adjusted Ratings (AARs)

Anticipated Ratings in July 2025 @ MISO

Anticipating >13,000 facilities with AAR required

10-day Hourly Ratings Forecasts updated hourly

- 3 ratings per hour, per facility: Normal, Emergency, and Load Shed
- Each facility topology forecasted
- > 22MM individual forecasted ratings per hour

All >13,000 facility Real-Time AAR sets will be sent via ICCP; Forecasted AARs via a web API (LEP)

Jointly owned facilities will account for multiple ratings and MISO will determine the reliable operating limit

MISO's Challenges

Challenges as Reliability Coordinator

Large and diverse footprint

- Ratings on jointly owned facilities internally
- Ratings on jointly owned facilities with other RCs
- Need consistent methodology among RCs, especially for tie lines

Transmission Owners are looking to MISO to set a standard

Challenges as Market Operator

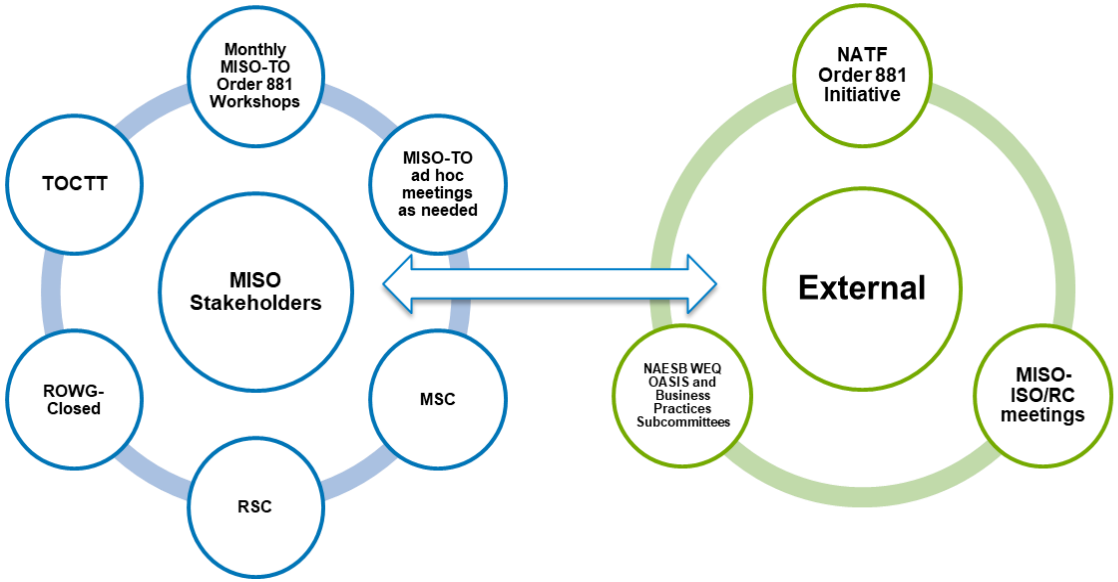
Incorporate forecasted AARs into Day Ahead market, Unit Commitment

- Currently using seasonal ratings
- Only have on-peak and off-peak study
- Now needs hourly forecasted ratings

How much is market efficiency improved? How to track this?

MISO's Approach to Order 881 Requirements

- System engineering approach
  - Concept of Operations
  - Documentation of decisions and impacts of decisions
- Requirements gathering
  - Internal impacts to different systems
  - Collaboration with different working groups
  - Working with vendors to refine requirements and solution concepts



RC-to-RC Rating Coordination Example

Jointly Owned Facility

Note: This example is for a single rating on a single facility. In practice, the concept is extended to the rating set on multiple facilities

Compliance Posture

Order 881 does not fundamentally change any NERC compliance positions

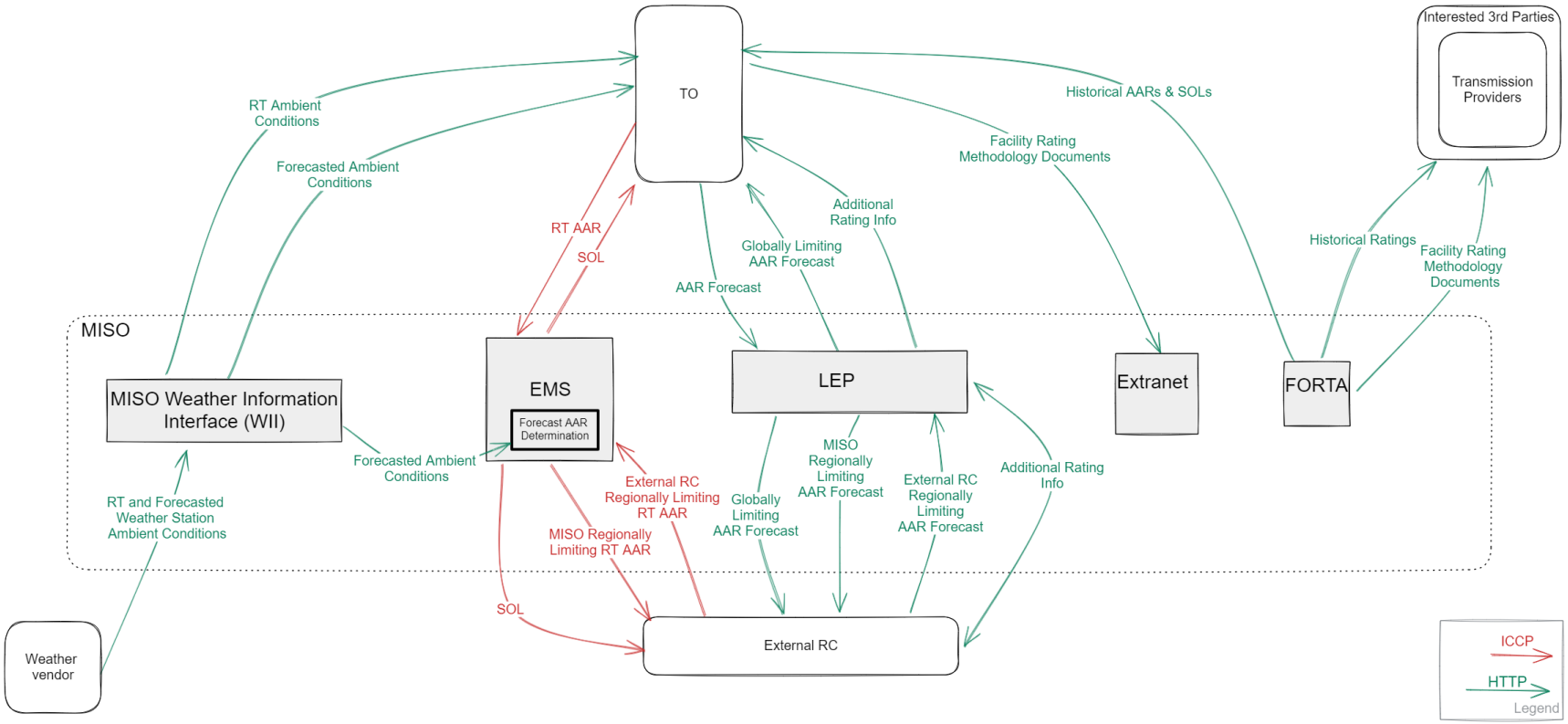
FERC Order 881 does:

- Introduce a great deal of FERC Tariff compliance
- Require (often) updated ratings methodologies that must follow FAC-008
- Intersect with the ongoing work with FAC-011
- TOP requirements of FAC-014
- Additional rating factors for PRC-023 protection settings
- Introduce a lot more moving parts

Automation is key and documentation of rating/limit workflows are crucial

Studies have shown that the AARs can provide more reflective ratings when ambient temperatures exceed the temperature basis for seasonal ratings

Rating Data Exchange



LEP – Limit Exchange Portal;
FORTA – Forecasted Operational Ratings Transparency Archive

Seams

FERC Order 881 Requirements in Seams

- Use AAR for evaluation of near-term transmission service requests where the start and end date is within the next 10 days
  - Inclusion of up-to-date hourly AAR calculations in ATC
  - Network, Point-to-Point, Secondary Transmission service

(AFC, ASTFC)

- Use AAR for determination of curtailment, interruption, or redispatch of Transmission service anticipated to occur within 10 days(PTP, Network)

(TLR)

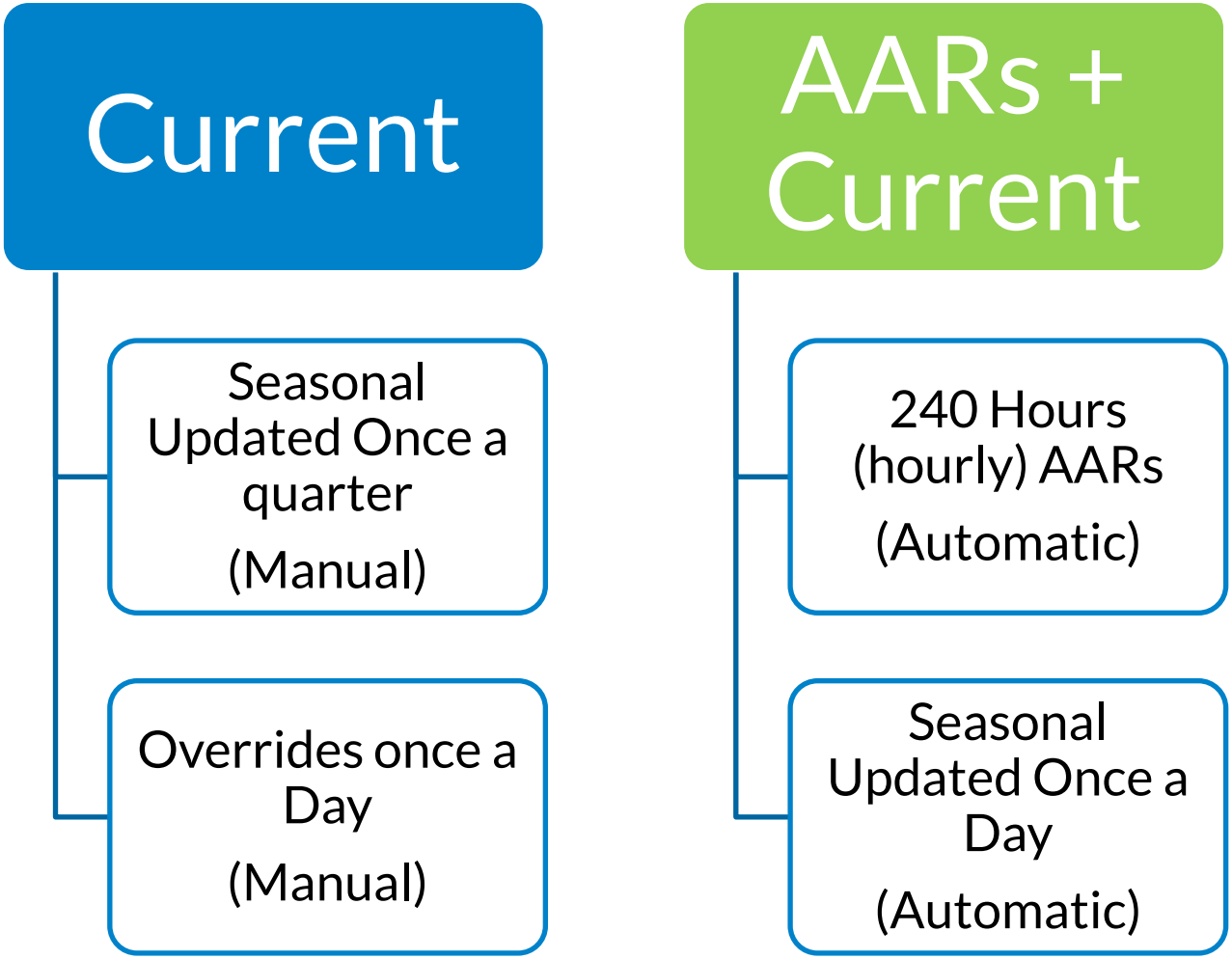
- Implement AARs in both day-ahead and real-time markets and any intra-day reliability unit commitment

(M2M)

- TSP to define seasons to include not fewer than four seasons in each year

(AFC, Long Term TSR)

AFC Ratings Process



AFC Ratings submissions

- AFC Rating Override (Manual) - Current
- AFC AAR Hourly (Automatic) - New
- Seasonal (Automatic) - New
- Seasonal (Manual) - Current

AFC and ASTFC Work

- Projects are in progress to ensure the 881 requirements are met for the AFC and ASTFC processes
- New IT services are needed to interact with LEP and process the data

Questions?

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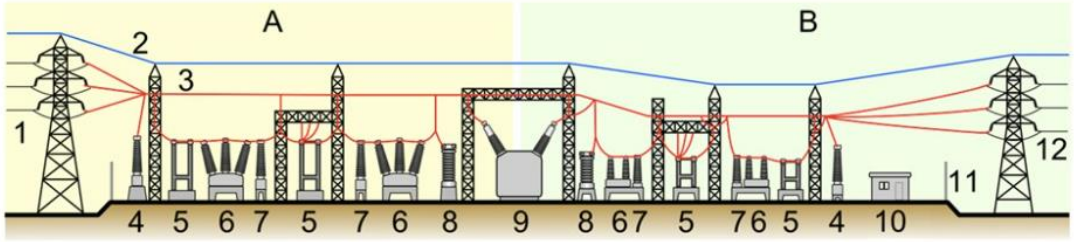
Appendix

Transmission Facility Rating

- Facility can be line or transformer
- The facility includes all the components that make up the line or transformer operation
- Most limiting element determines the facility rating

Parts of a substation



1. Primary power lines
2. Ground wire
3. Overhead lines
4. Transformer for measurement of electric voltage
5. Disconnect switch
6. Circuit breaker
7. Current transformer
8. Lightning arrester
9. Main transformer
10. Control building
11. Security fence
12. Secondary power lines

Not shown: protective relays, wave traps

Transmission Owners (TOs) Today are Charged with Providing Ratings to MISO

MISO Transmission Owners Agreement

- TOs are required to provide normal and emergency ratings for all equipment in the Transmission System
- MISO has the ability to verify and accept ratings
- MISO has the ability to request rating methodologies