Resource Accreditation Reform in MISO

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Conceptual Design

- In the past, with most/all resources being dispatchable with little weather correlation, ensuring the system could be served at the Coincident Peak Demand effectively guaranteed the system could served at all other times
- Or, the correlation between the times of highest system load and greatest system risk was very high

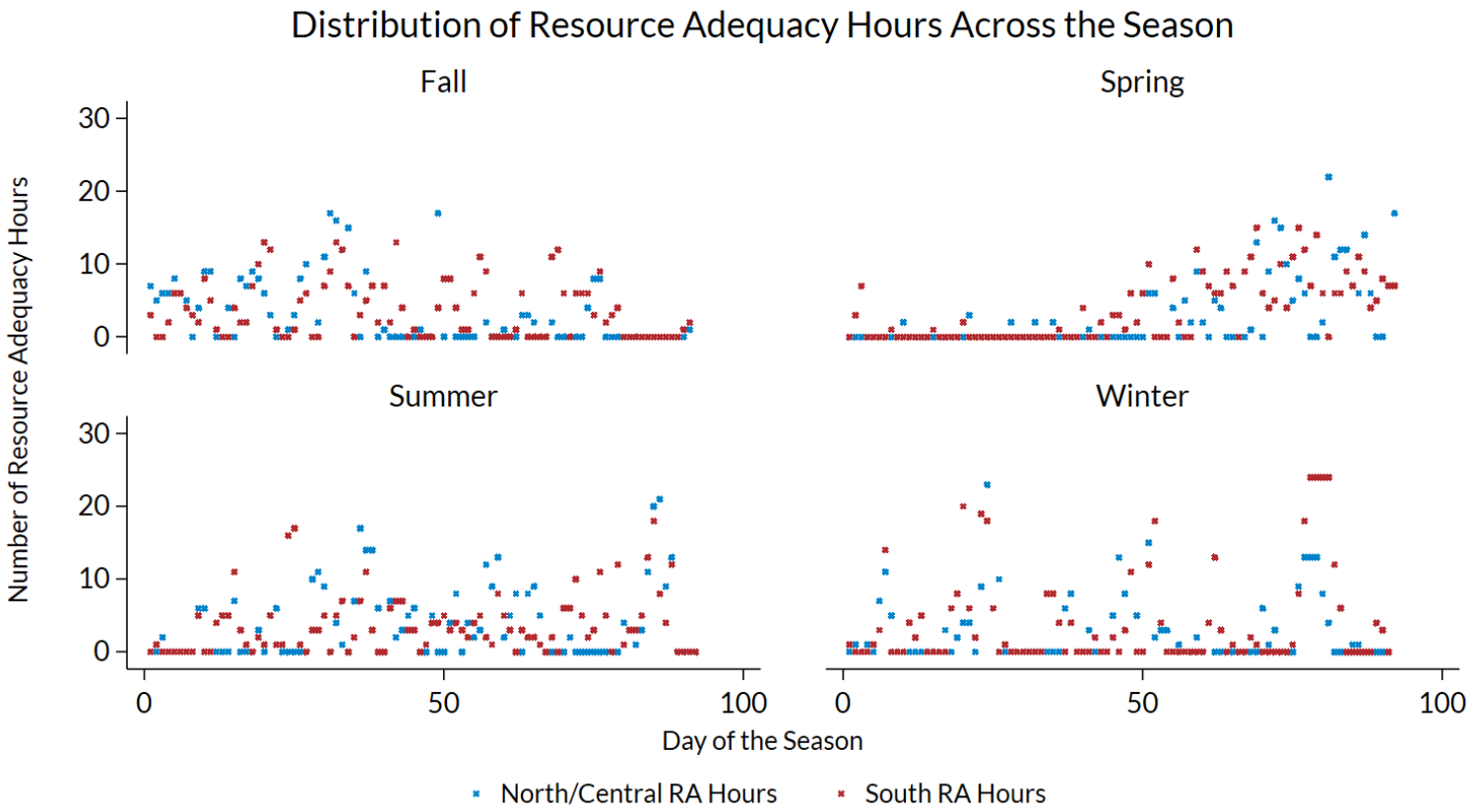
- As resources have become more dependent on the weather and time of day and the overall resource fleet has shifted, this correlation has decreased, so it is no longer a sufficient condition that being capable of serving the Coincident Peak Demand guarantees that all other Hours can be served

- Accreditation of resources must account for their capabilities during the times of system risk – that is a solar facility providing power on a summer afternoon with a high operating margin may not carry as much value as a peaker plant carries on a winter peak with a low operating margin
- Hence the creation of Resource Adequacy Hours

Distribution of Resource Adequacy Hours by Time of Day and by Season

Resource Adequacy Hours represent the Hours with the highest system risk and are calculated on a Seasonal basis

- All Hours during a declared Maximum Generation Alert or higher are automatically a Resource Adequacy Hour
  - If a Season has fewer than 65 Hours with the above declarations, MISO begins classifying Hours with the lowest operating margin as Resource Adequacy Hours until either:
    - 65 Hours have been reached in a Season
    - All Hours with an operating margin of no greater than 25% have been used



Data ranges from Sept 1, 2019 through Sept 1, 2024

Direct Loss of Load - Overview

- The Direct Loss of Load (DLOL) methodology uses a two-step approach to accredited Schedule 53A Resources (generation resources):
  - A forward-looking probabilistic risk analysis evaluates how much the Resource Class contributes to total system generation during the Hours predicted to experience a high probability of experiencing a loss of load event
  - A backward-looking historic evaluation of how each individual Resource performed during hours of greatest system risk

- This methodology is a risk-based, performance-drive accreditation approach and aligns the accreditation of resources with system risk

Forward Looking Probabilistic Risk Analysis

- Answers the question of how much a Resource Class can be expected to contribute to addressing expected system risk

- System risk is evaluated by running a sequential Monte-Carlo analysis
  - Load is predicted by correlating 5-years' worth of actual load data with temperature and then forecasting predicted load using the last 30 years worth of temperature data
  - Generation is predicted using a Monte Carlo approach to outages for thermal resources and predicted wind/solar profiles
  - The model is adjusted until a 1 day in 10 Loss of Load Expectation is achieved

- All hours across all runs that experienced less than a 3% operating margin are identified and the total output of each Resource Class is summed up – these hours are called Critical Hours

- MISO calculates for each Resource Class across all Critical Hours its expected contribution during expected system risk – this is the slice of the pie

Backward Looking Historic Evaluation

- The second component to accreditation uses a backward looking historic evaluation where Generation Resources are accredited based on actual real-time availability during all Hours of the Year

- MISO weighs these Hours with the riskiest Hours, defined as Resource Adequacy Hours, accounting for 80% of the total contribution to the Generation Resource's Accredited Capacity value and all other Hours accounting for 20% of the total contribution.

- Real time availability emphasizes resources that are Offering into the real-time markets

- What it boils down to: individual resources that are available and plan well receive more accreditation than resources that are not, taking a greater portion of the slice of the pie determined during the forward-looking probabilistic risk analysis

Emergency Resources (Schedule 53B Resources)

- **Problem Statement:** With the increased penetration of Intermittent Resources, changing weather patterns, and growing electrification, higher uncertainty and complexity is expected in the future. This evolving situation requires MISO and LSEs to fully understand the capabilities and responsibilities of all Demand and other Emergency Resources clearing the Planning Resource Auction (PRA). Rules and procedures need to be developed for effective market participation of such resources while helping MISO maintain reliability during Capacity Emergency situations.

    - Resource accreditation should reflect the availability of resources when they are most needed. MISO's existing accreditation methods for Load Modifying Resources (LMRs) and Demand Response Resources require further evaluation to ensure that the accredited capacity value appropriately reflects each resource's contribution to Resource Adequacy.
    - Real-Time availability data for LMRs indicates far less capacity than the PRA-cleared quantity.
    - Allowed response times for LMRs require evaluation to better address capacity Emergencies (EEA2 or higher).

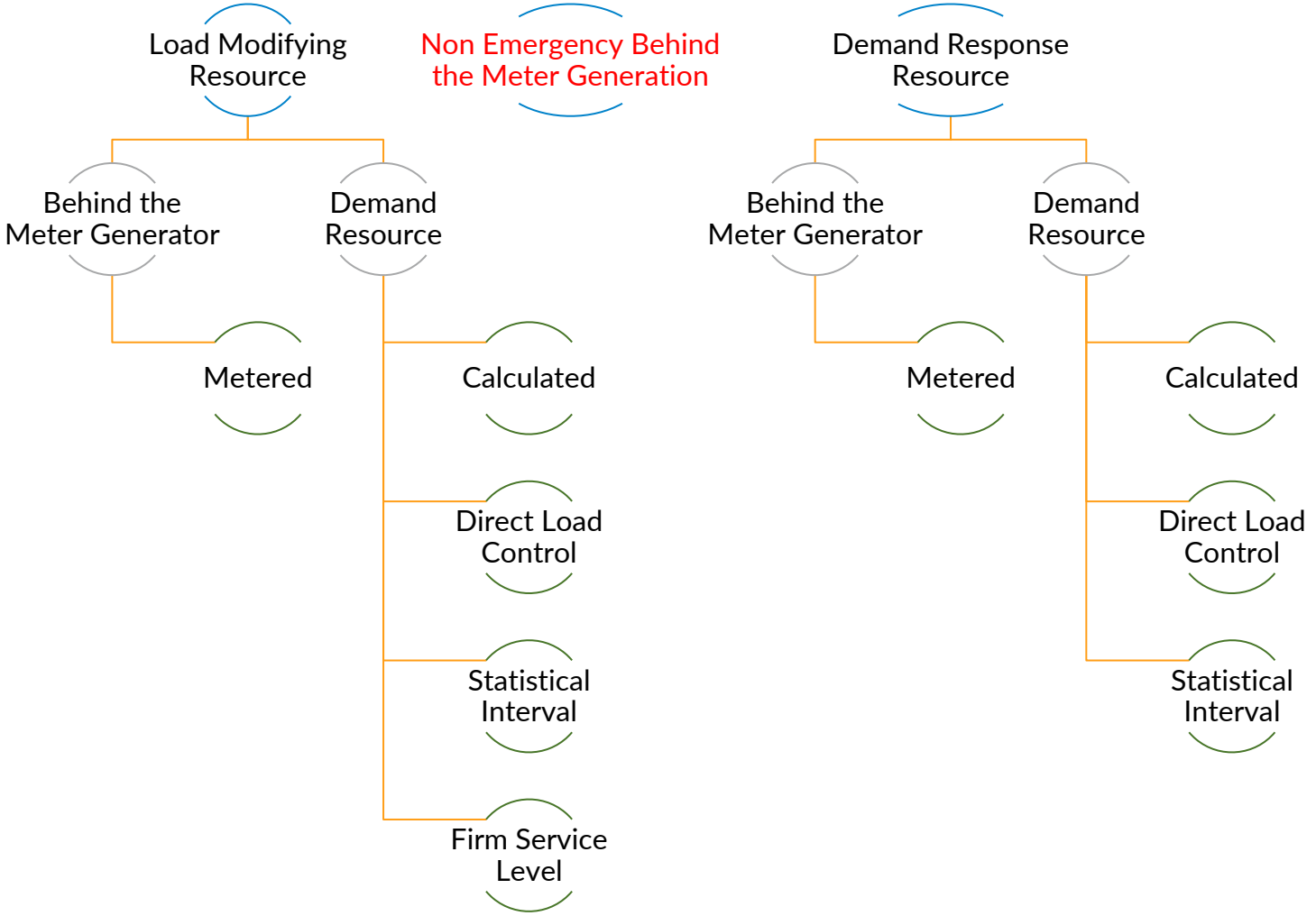
Capacity At Risk Hours

- Generation Resources are accredited across all Hours of the Planning Year
    - This is weighted as 80% for Resource Adequacy Hours and 20% for Non-Resource Adequacy Hours
- Emergency Resources do not have an obligation year-round however and may have characteristics that are very different during Emergencies than during normal Hours
    - MISO has developed a new type of Hour for Emergency and Demand Resources – Capacity At Risk Hours
    - These Hours represent declared Emergencies and are necessary because these are the Hours Schedule 53B Resources will be used
- MISO currently tracks, though it may need improvement, when Capacity Advisories and higher Capacity declarations are made
- By accrediting these Hours, MISO is improving the availability of Schedule 53B Resources because some of the accreditation penalties determined below will be applied to resources that submit bad information to MISO during these Hours
- MISO also explicitly informs stakeholders which ensures these Resources have more visibility into when they are being accredited

Accreditation Does not Depend on How you Participate

- There is no discussion of accreditation by participation instrument
- The various participation instruments (e.g., LMRs, DRRs) determine your deployment order, the compensation you receive in the form of LMP, and your obligations but otherwise do not impact your accreditation
- What this incentivizes is resources self-selecting into the instrument that most accurately reflects their ability and willingness to perform
    - Resources desiring compensation are used first followed by resources that take a long time to curtail followed by resources that can curtail rapidly

Schedule 53B Resources -- Ordered by Measurement and Verification



What Problems Needed to be Solved?

- LMRs are rarely used so MPs have grown accustomed to not being used
  - This requires putting in rules that strongly incentivize accurate availability
    - Keep in mind, some resources don't pay penalties for inaccurate availability which drove the need for some of the accreditation rules

- LMRs have long-lead times that create enormous difficulty in effectively using these resources
  - This motivated the creation of the LMR – Type I and LMR – Type II instruments
  - One permits long-lead time resources but lets MISO use them earlier
  - Both instruments motivate response times to be much faster
    - MISO has anecdotal evidence that most LMRs can actually respond within an hour

- Multiple MPs have been identified as committing fraud and sanctioned by FERC

- Operations also requested LMRs no longer be capped on deployments due to this increasing the difficulty in using LMRs – stakeholders expressed extreme displeasure at unlimited deployments
  - The compromise was to permit resources to exchange accreditation for availability which increased the complexity of the design but strongly motivates people to be available
  - This is why we have the concept of Events in the design

Accrediting Demand Resources

- the fundamental question that must always be asked is, how much Demand reduction could occur at any given time?

- The answer to this question considers the following:
    1. What was offered or made available?
    2. What was the load doing in the moment?
    3. What is the maximum this resource can be accredited at?

- These questions are IDENTICAL to those asked for Schedule 53A!

- Answering those questions is quite a bit more difficult than it was for Schedule 53A