



MISO Forward

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Three major trends are driving new opportunities challenges and needs for reliable grid operations

Three Identified Key Needs



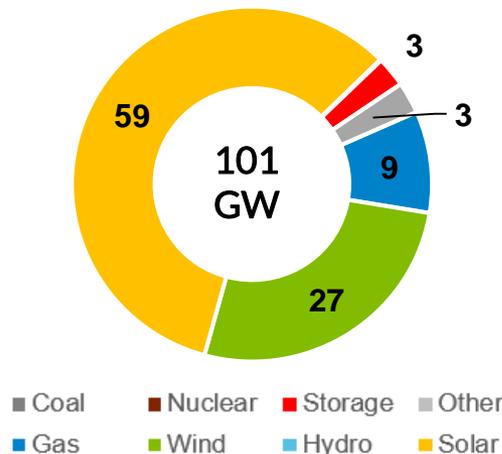
How are these trends driving utilities to what they'll be in the future?
Which needs will be most important for each of them?

Change is coming to the region, increasing complexity of operations at an accelerated pace

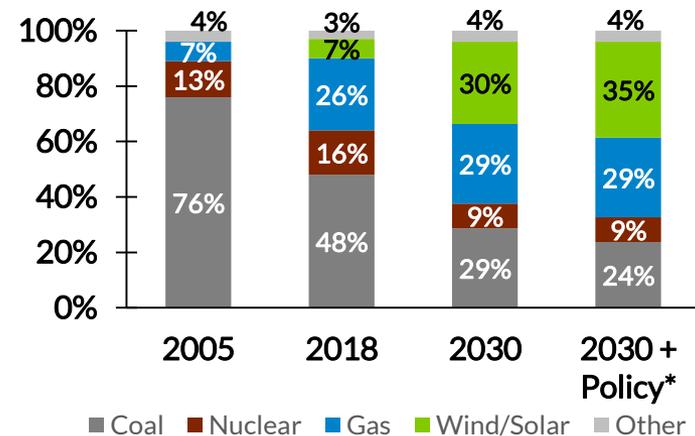
Longer-term Issues to Further Evaluate:

- Ensuring sufficient attributes to meet requirements every hour
- Aligning broad regional and local reliability requirements
- Sequencing and aligning enhancements to not only address near-term issues but also provide an effective progression of changes over time

MISO Total Interconnection Queue



Portfolio Change (energy mix %)
(Based on utility and state announcements)



The RAN initiative includes efforts to address near- and long-term reliability issues caused by portfolio evolution

| Progress, To Date Improve resource transparency and performance for spring 2019 and subsequent planning year | In Flight Continued refinements for 2020 Planning Resource Auction (PRA), progress on market-based solution | Next Focus Continued improvement in availability and flexibility |
|--|--|---|
| Load Modifying Resources (LMRs): <ul style="list-style-type: none">• Create transparency and better align LMR obligations with other resources Outage Coordination: <ul style="list-style-type: none">• Improve forward-looking transparency for stakeholders and MISO• Increase early outage notification and flexibility during emergencies | PRA Inputs: <ul style="list-style-type: none">• Improve PRA inputs, focus on LMR• Create rules outlining reasonable expectations for availability or replacement during the planning year Visibility: <ul style="list-style-type: none">• Multi-day Operating Margin forecast | Resource Adequacy Construct: <ul style="list-style-type: none">• Reflect risks throughout year• PRA reliability value reflected in auction results Resource Accreditation: <ul style="list-style-type: none">• Align with attributes based on all-hours reliability criteria• Deliverability improvements Market Incentives: <ul style="list-style-type: none">• Prices reflect operating conditions• Incentivize needed system attributes (e.g., multi-day market mechanism) |

RAN guiding principles to help ensure reliability for a transforming grid

Guiding Principles

- 1) Reliability Needs and Requirements:** Reliability criteria must reflect required attributes in all horizons – “all hours matter”
- 2) Reliability Contribution:** Members are responsible for meeting reliability criteria with resources that will be accredited based upon the resource’s ability to deliver those attributes
- 3) Alignment with Markets and Infrastructure:** Market prices must be reflective of underlying system conditions and resources must be appropriately incentivized for the attributes they provide; infrastructure should enable efficient utilization of resources

The States have a primary role in resource decisions. How might decision criteria change to ensure continued reliability, efficiency, and equity?

- Resource portfolios initially brought into MISO were similar and largely optimized the same in aggregate as on an individual basis
- Member resource mixes are becoming more divergent, based on new resource capabilities, and are creating reliable challenges
- MISO needs to develop reliability criteria consistent with a regional portfolio comprised of resources with less certain availability and less flexibility – “all hours matter”
- As reliability needs change, required Member contributions will also change, depending upon each Member’s portfolio capabilities versus system needs
- New market and planning reforms will also be needed to satisfy regional requirements and fairly compensate resources for the value they provide

Building on the 2019 MISO Forward report, the 2020 report will explore how utilities may evolve in the future

2020 MISO Forward: Utilities of the Future

What do they need from a system operator?



New Mix



High Wind



Self-Supply if Sunny



Traditional



Wireless