Grid operators take many actions over time to prepare for real time conditions.

- **7-Day Ahead**
- **Inter Day**
- **Day Ahead**
- **Intra Day**
- **Look-Ahead**
- **Real-Time**

**MISO OPERATING RESERVES**

- Regulating Reserve
- Spinning Reserve
- Supplemental Reserve

**ACTUAL SYSTEM CONDITION**

- Current MISO Market Prices
- No Current MISO Market Prices
A series of procedures are also in place to address emergencies...

• MaxGen emergencies have occurred in all seasons but have not surpassed step 2
... as conditions can deviate from the expected
Gaps in availability & flexibility are expected to expand due to the combined effect of trends

Key industry trends

- Age and retirement of the portfolio’s generating units
- High correlation in timing of planned outage for scheduled resources
- Growth in demand side and other emergency-only capacity as a percent of the overall portfolio
- Growing reliance on intermittent or unscheduled resources, including interchange
- Growth of variable energy resources as a major element of the fleet

MISO Energy Mix Transition (GWH)
from 2005 to 2018 to 2030

*Chart reflects ratios of generation.

Based on Utility Announcements & State Integrated Resource Plans*
Effective market, operations & planning products, services & tools across time periods are necessary.

SAMPLE SET OF NEEDS

- Ramping capability (beyond real-time dispatch)
- Effective reserves & deliverability
- Effective dispatch
- Operating day capacity
- Unit commitment efficiency
- Effective system planning
- FTR funding sufficiency
- Effective market signals
- Effective forecasts
- Decision-making tools
- Computational performance

Across Timescales