MISO Market Operations & Weather Events

June 6, 2019

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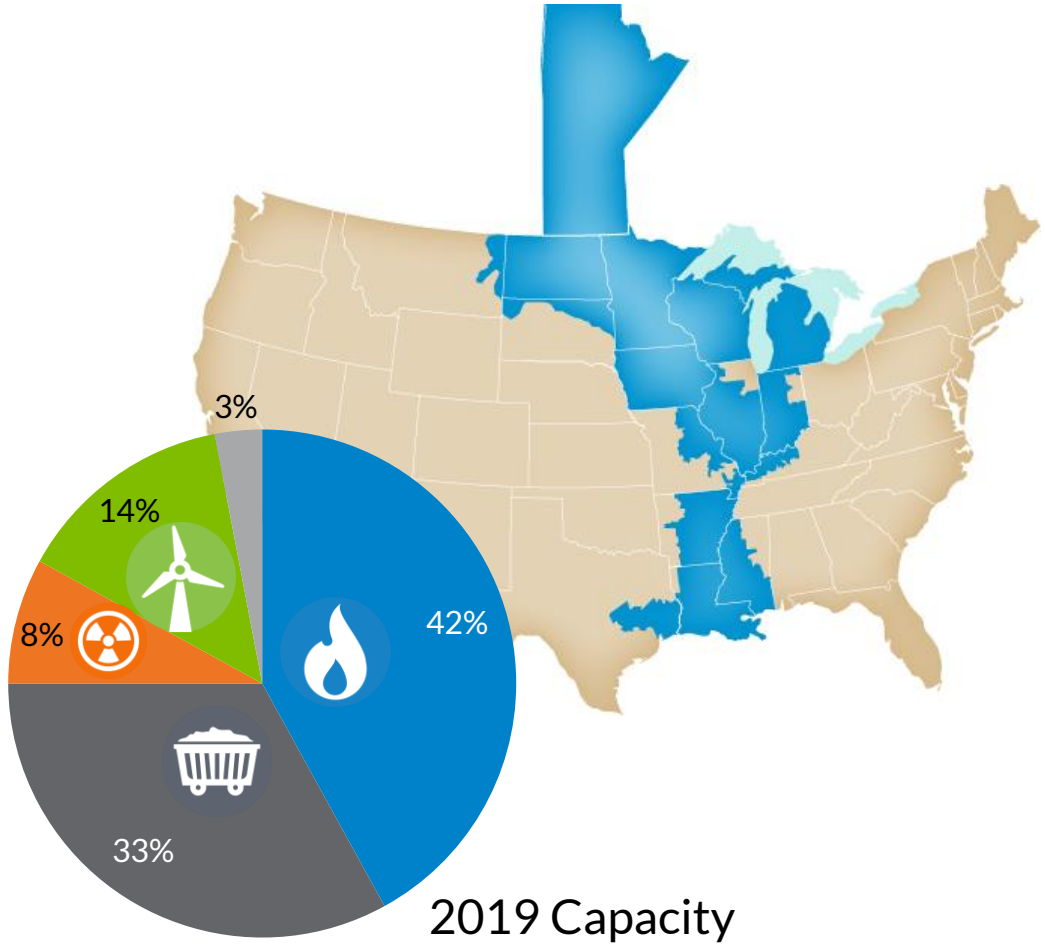
MISO Overview

- 131 GW peak load
- 189 GW gen. capacity
- 68,000 miles of transmission lines

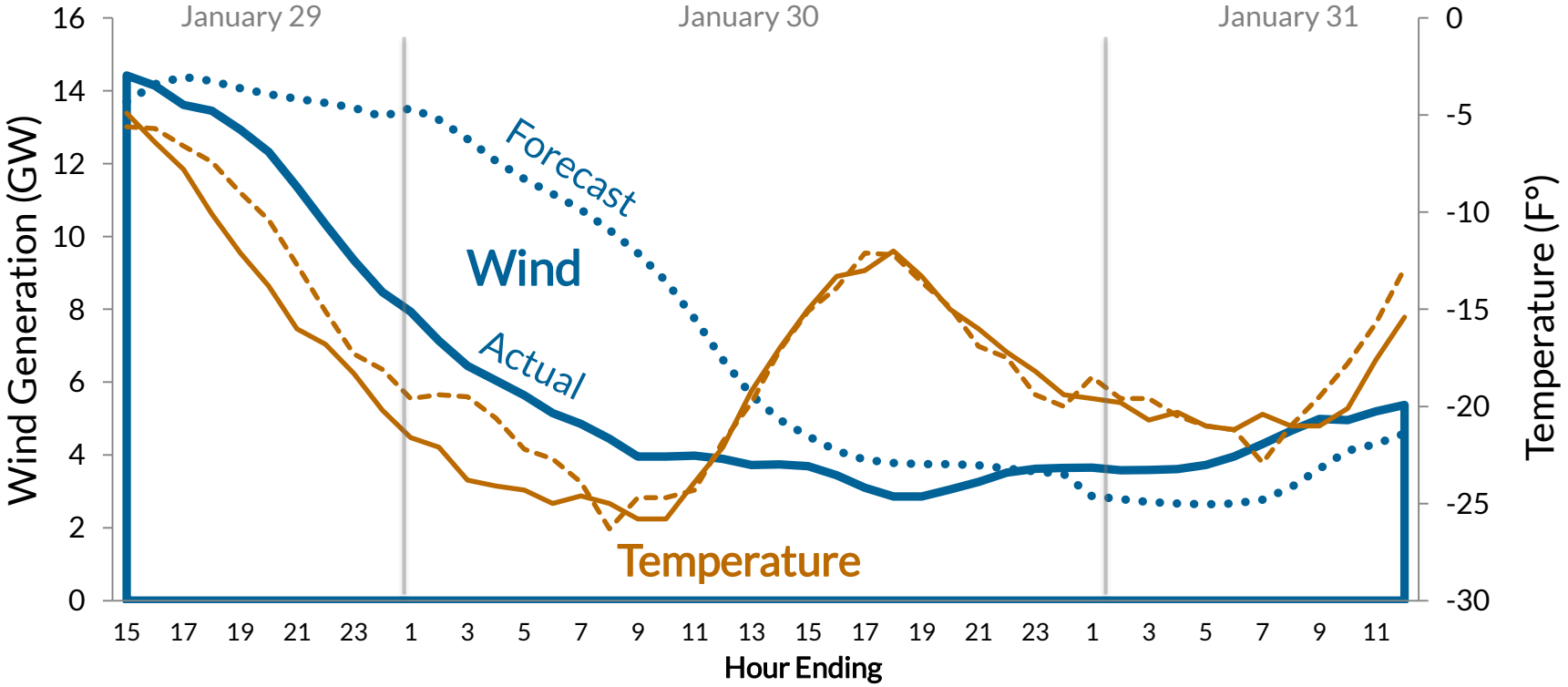


2019 Capacity

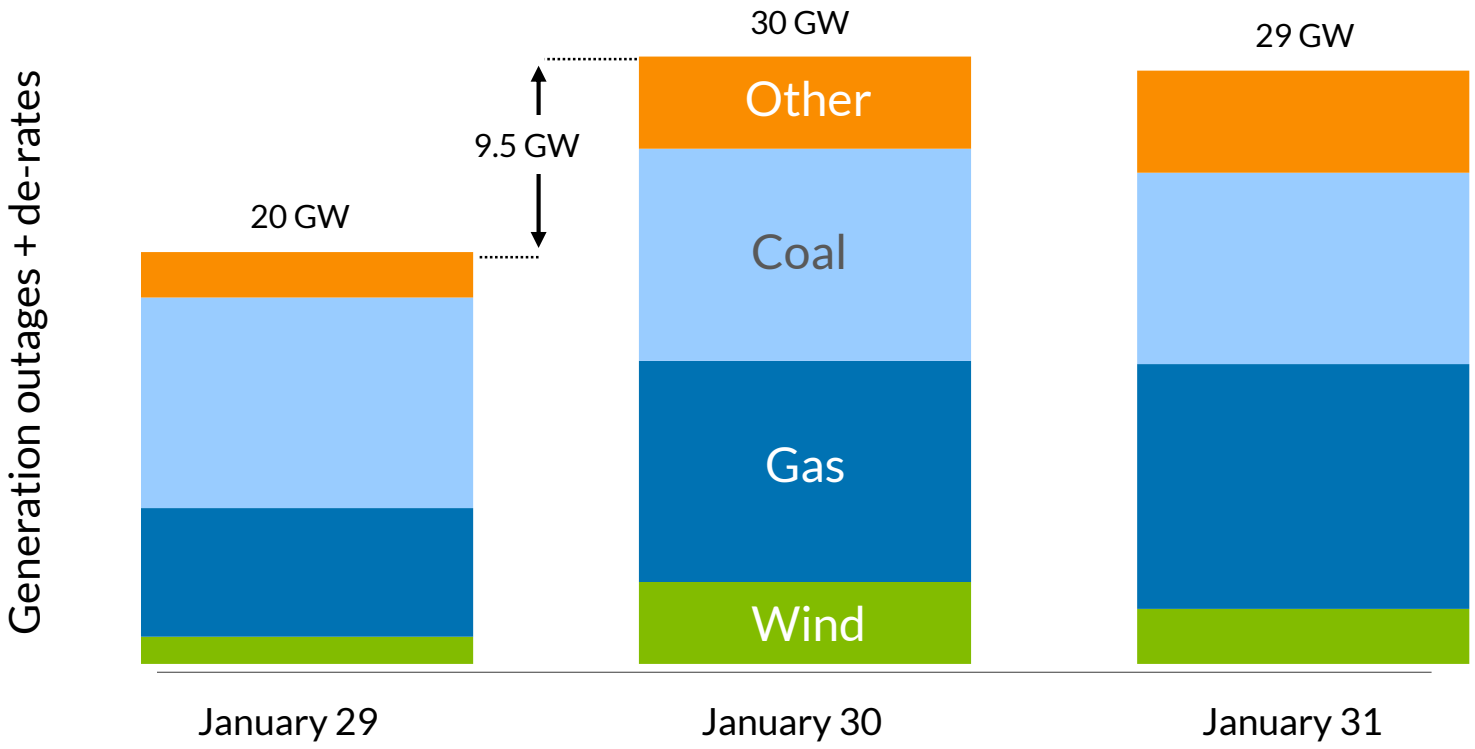
Extreme weather factors relevant to MISO

- Cold weather secondary effects
  - Wind turbine cold-weather shutdown
  - Thermal generator shutdowns: gas supply, mechanical problems
- Solar ramping
- Distributed solar
- Solar eclipse
- Hurricanes
- Tornadoes
- Ice storms

2019 unexpected low-temperature wind shutdowns

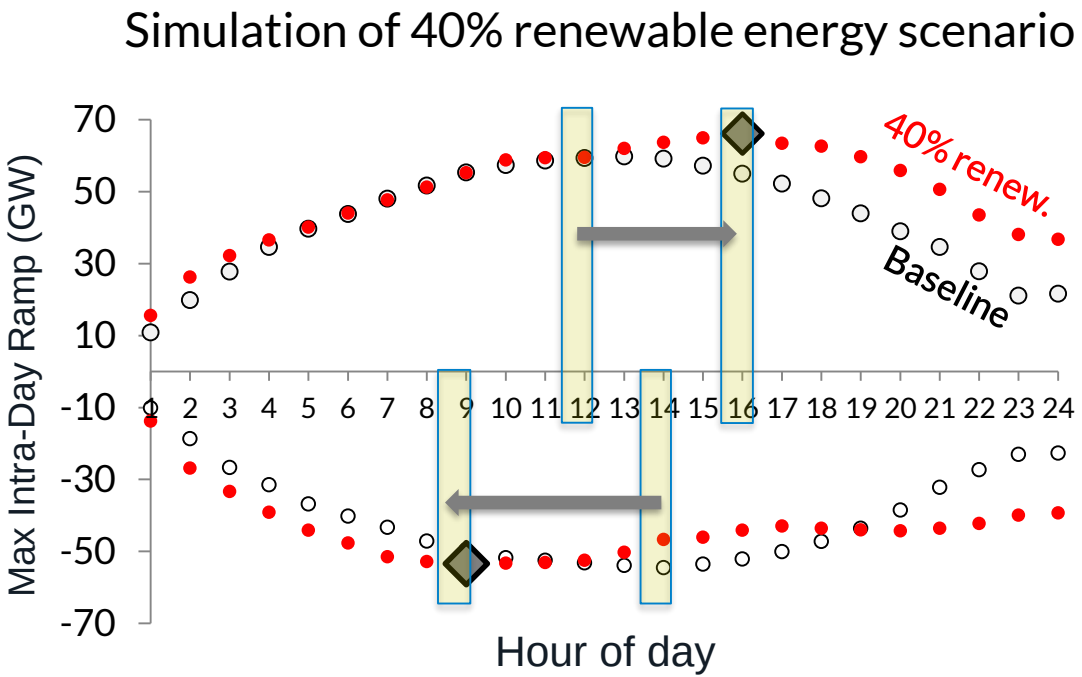


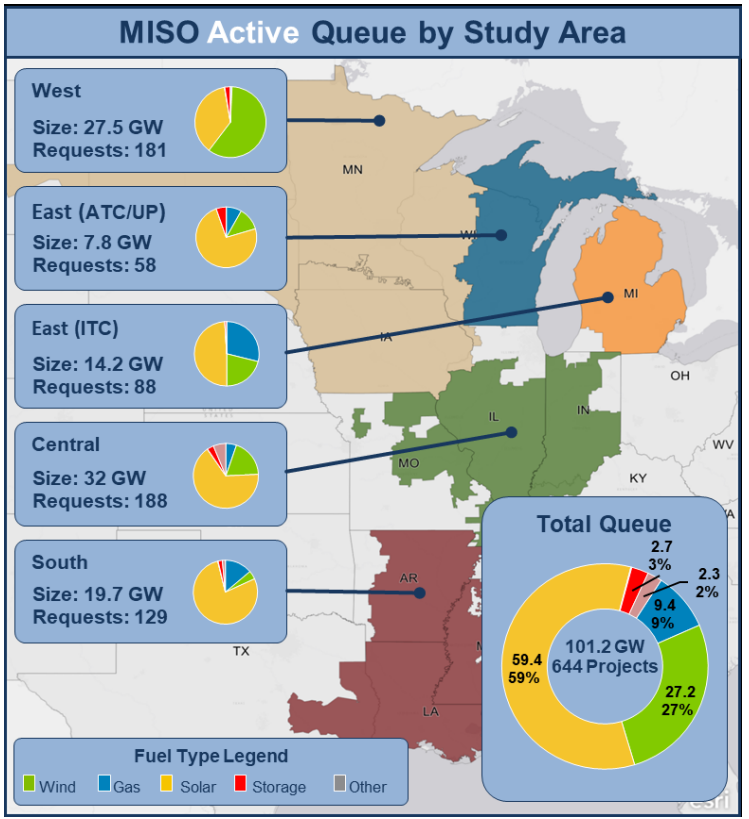
2019 gas supply and low-temperature challenges



The outage chart reflects the data as it resided in the CROW Outage system on February 11, 2019
Wind often reported as derate over the time period

Ramping increases and shifts with high renewables

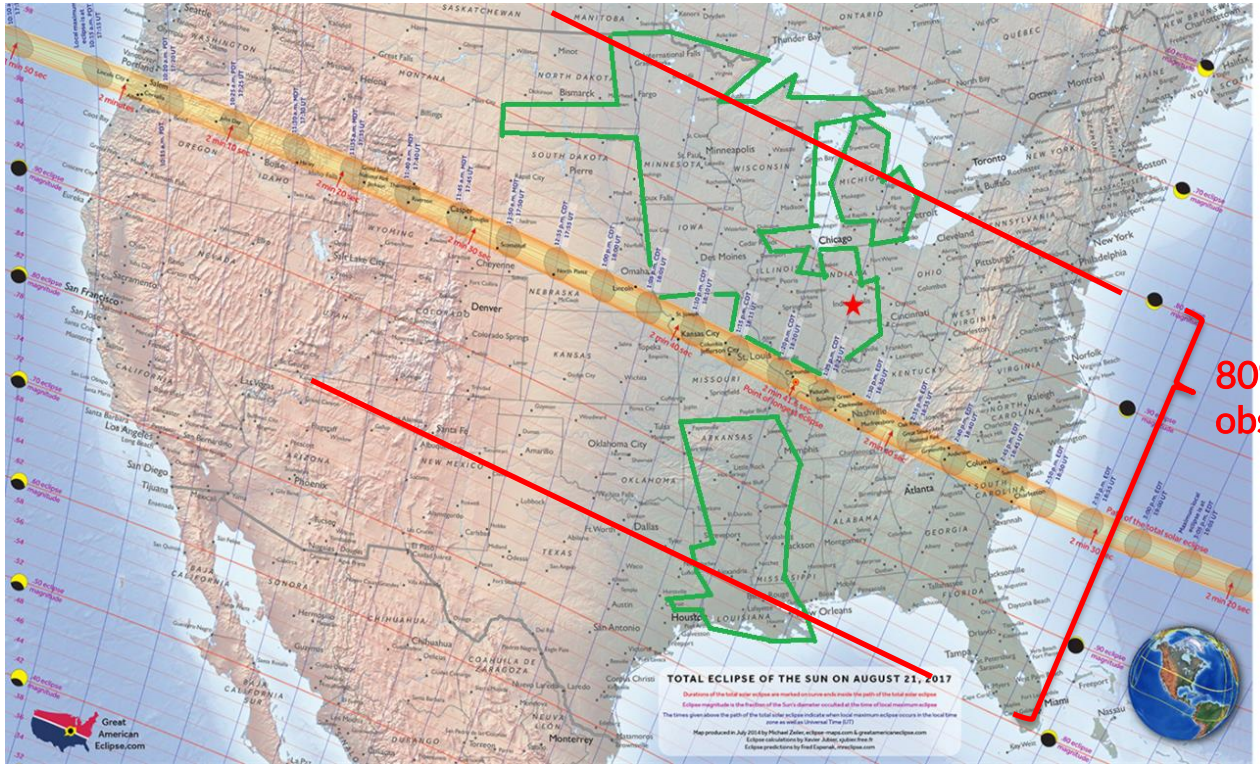




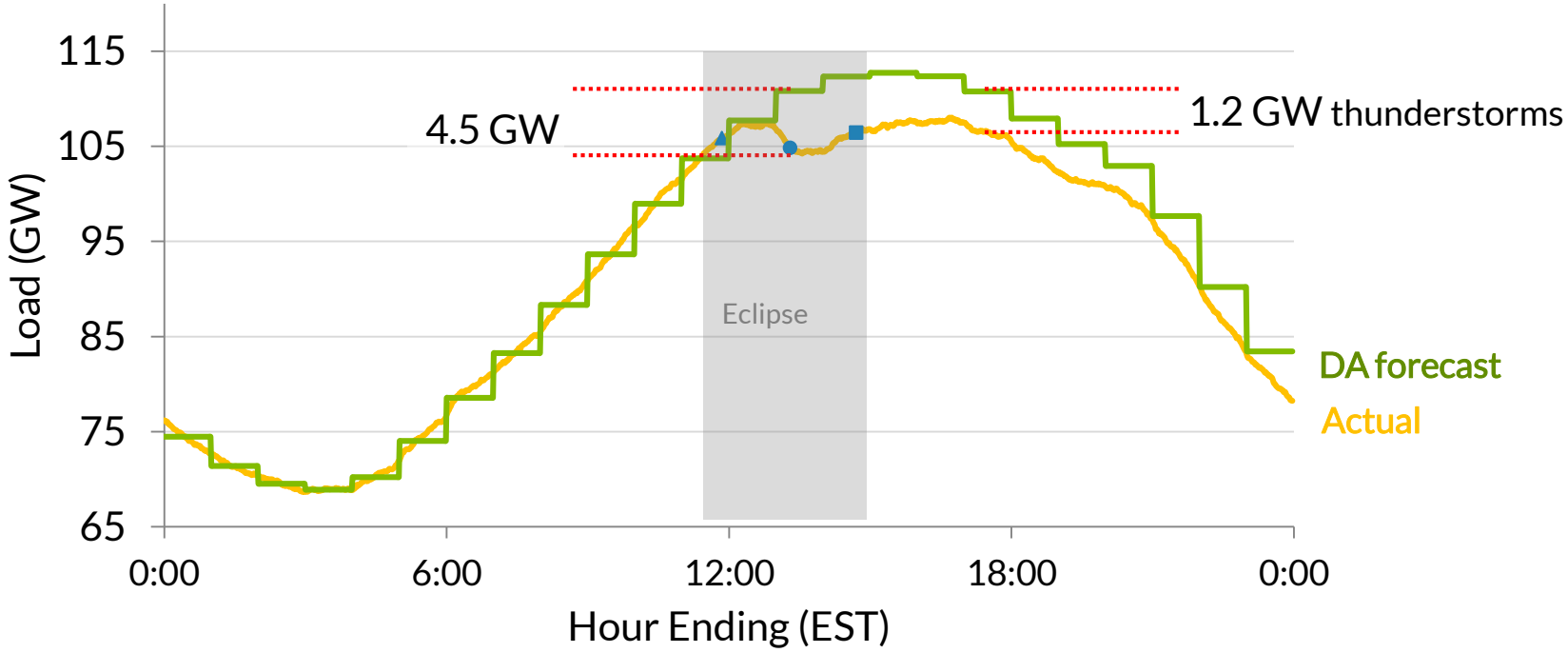
Distribute solar

- Can distributed solar be an “n-1” contingency? “n-1%”?
- Location matters: affects transmission grid reliability and congestion
- Currently it is not clear whether dist. solar generation will be visible to MISO

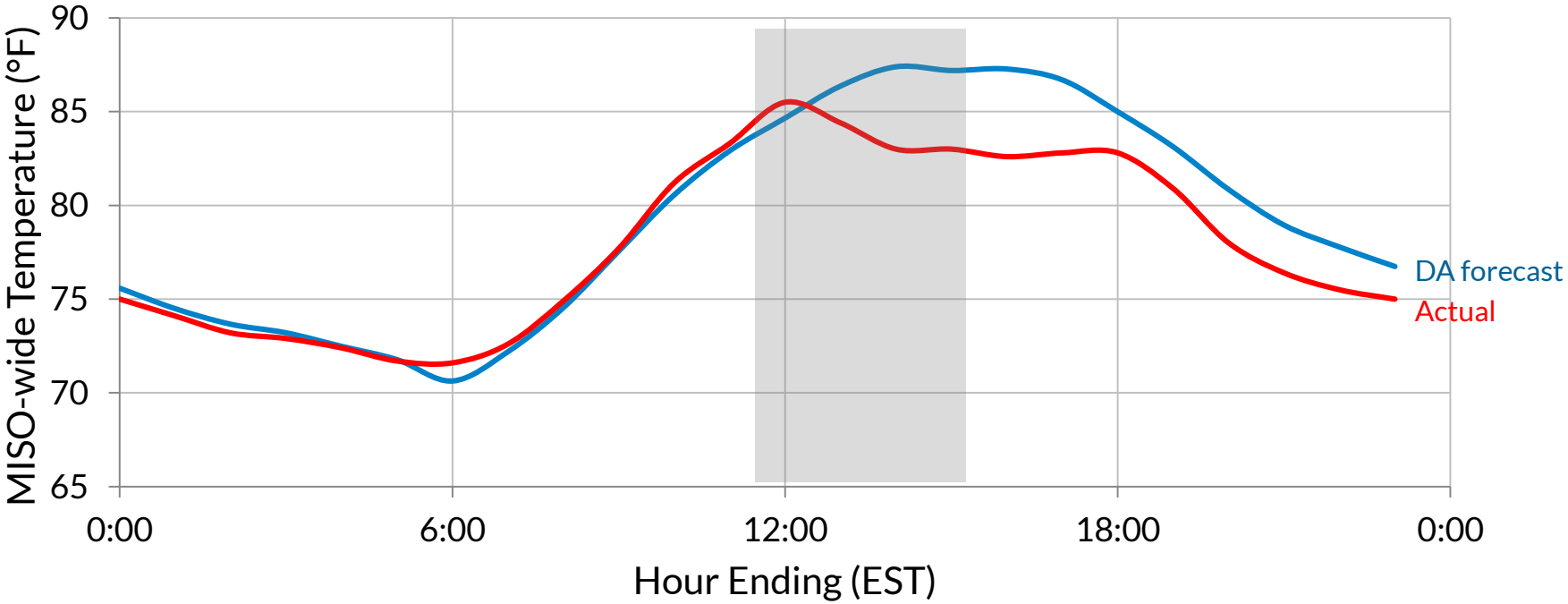
2017 Eclipse covered most of MISO footprint



Eclipse forecast load was 4.5 GW high



Eclipse temperature forecast was 2-4°F high



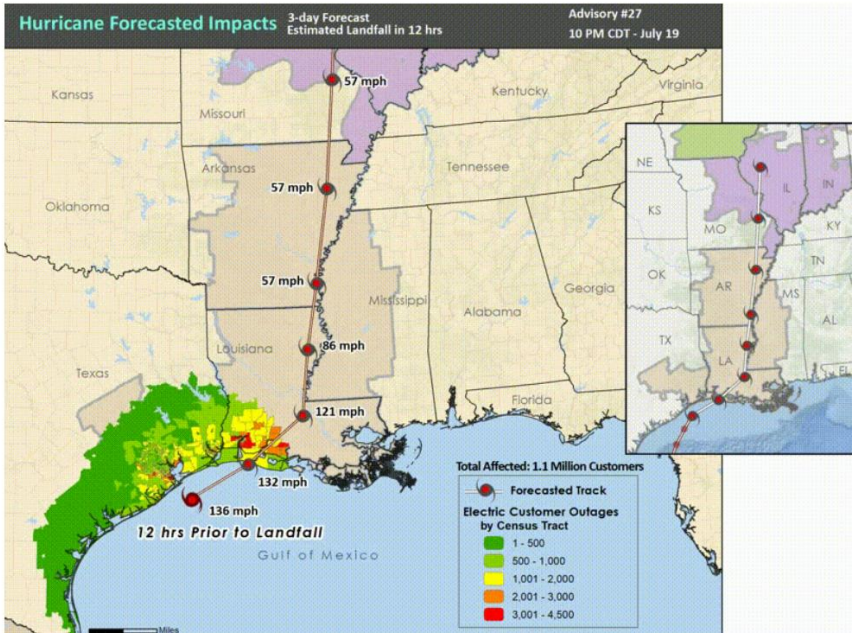
What will happen in 2024?
In 2017, MISO had 0.56 GW solar.

Other extreme weather affecting MISO

Ice Storms

Tornados

Hurricanes
(training simulation from Argonne Ntl. Lab)



MISO's forecasting "wish list"

1. Improved forecasts of extreme load and wind events
    a) Probabilistic forecasts?
2. Distributed solar
    1. Better information to coordinate and manage DER operations for positive distribution and bulk-grid outcomes
3. Improved forecasts of novel events