



**TEXAS RE**

Ensuring electric reliability for Texans

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# **Texas RE 2019 Assessment of Reliability Performance**

**ERCOT Reliability and Operations  
Subcommittee**

**June 4, 2020**

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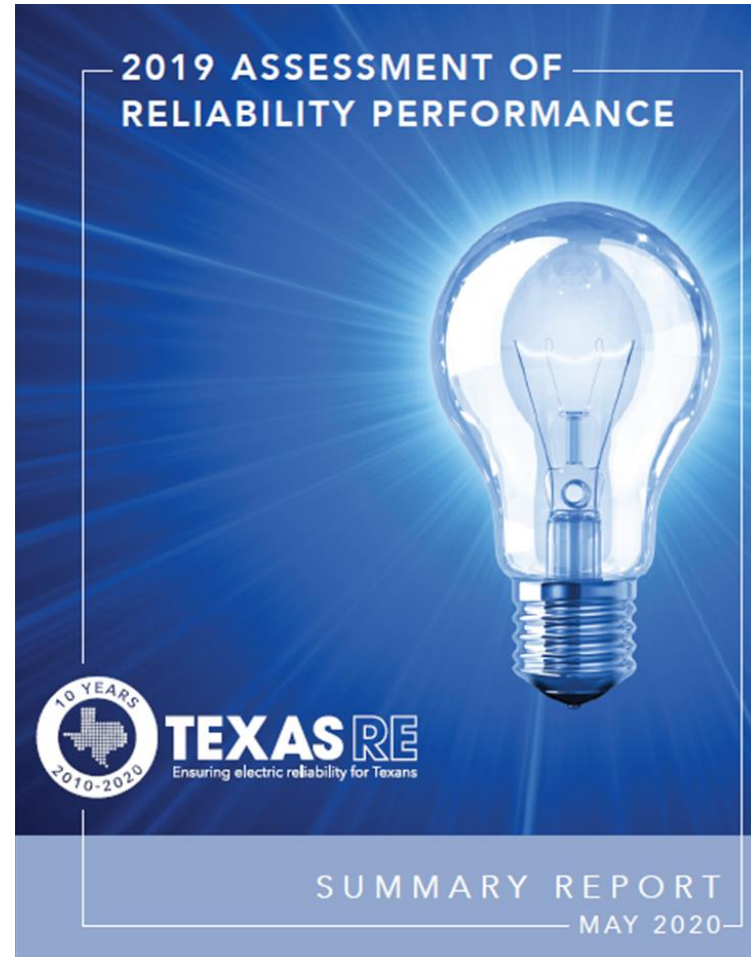
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# Objectives

Texas RE periodically assesses and reports on the reliability and adequacy of the bulk power system (BPS) within the Texas Interconnection.

The Assessment of Reliability Performance annually compiles analyses for the previous year.

Goals of this report are to paint the overall BPS reliability picture with historical context, identify current and future risk areas, and prioritize and create actionable results for reliability improvement.



# Focus Areas

Event Analysis Review

Resource Adequacy and Performance

System Resilience

Changing Resource Mix

Human Performance

Bulk Power System Planning

Loss of Situational Awareness

Protection and Control Systems

Physical and Cyber Security

# Summary of 2019 Performance Trends

Key Performance Indicator	Watch/Action Trend	Stable Trend	Notable Positive Trend *
Resource Adequacy	Two EEA level events. Improved 2020 reserve margin, still below reference in future years.	Sufficient operating reserves maintained during summer and winter peaks	Natural gas curtailments reduced in 2019 due to milder winter
Transmission Performance		345 kV outage rates per circuit & per 100 miles increased but are within 5-year average	0 IROL exceedances; transmission performance on extreme days improved significantly
Resource Performance	Gas generation EFOR rates increasing	No Balancing Contingency event failures	Primary frequency response
System Inertia	Increasing net load and solar ramping magnitudes	Stable inertia trends during all hours	
Misoperation Rate	Multiple events with misoperations		Decreased rate and 5-year overall improving trend
Human Performance (HP)	HP errors remain primary causal factor in misoperations		2019 generator outages tied to HP decreased significantly
Situational Awareness	4 Loss of EMS events	State Estimator convergence rate	

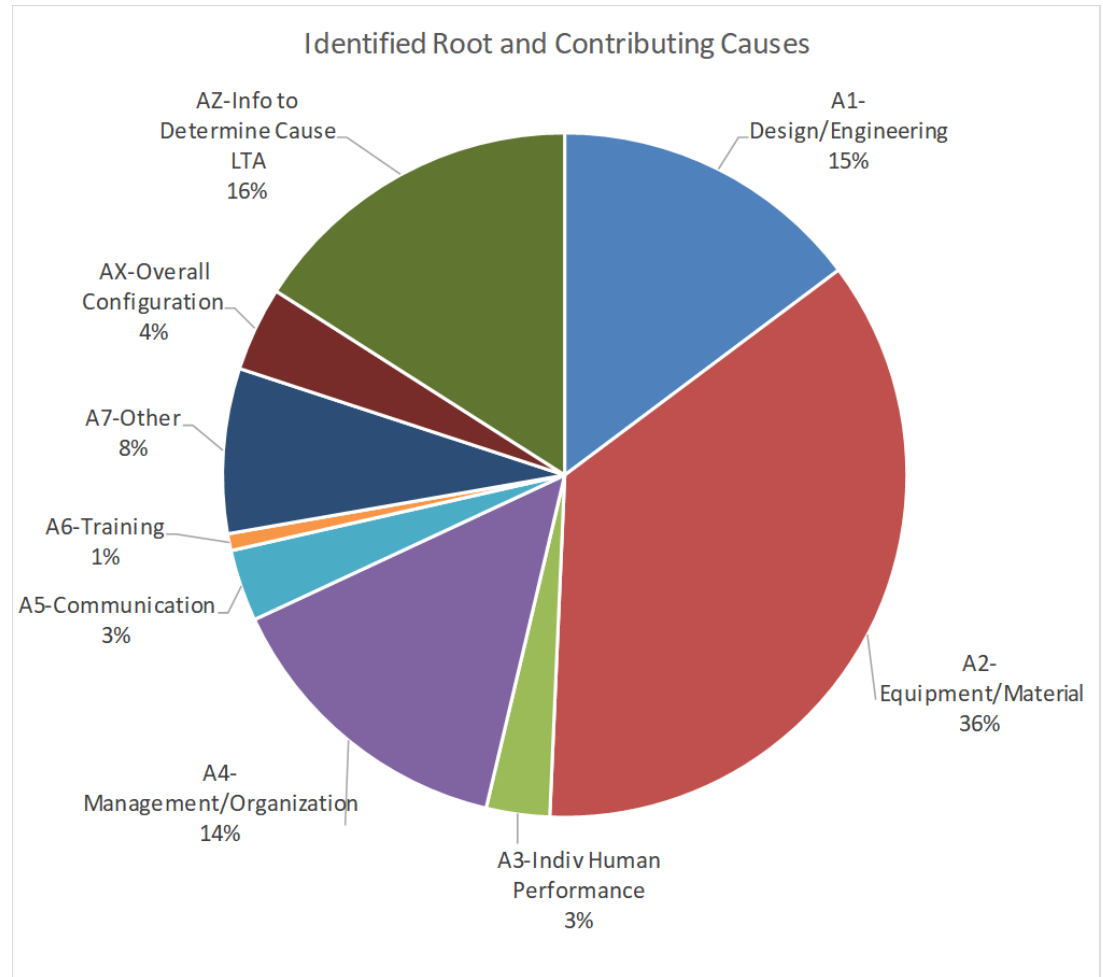
# Event Analysis Review

## 2019 Highlights

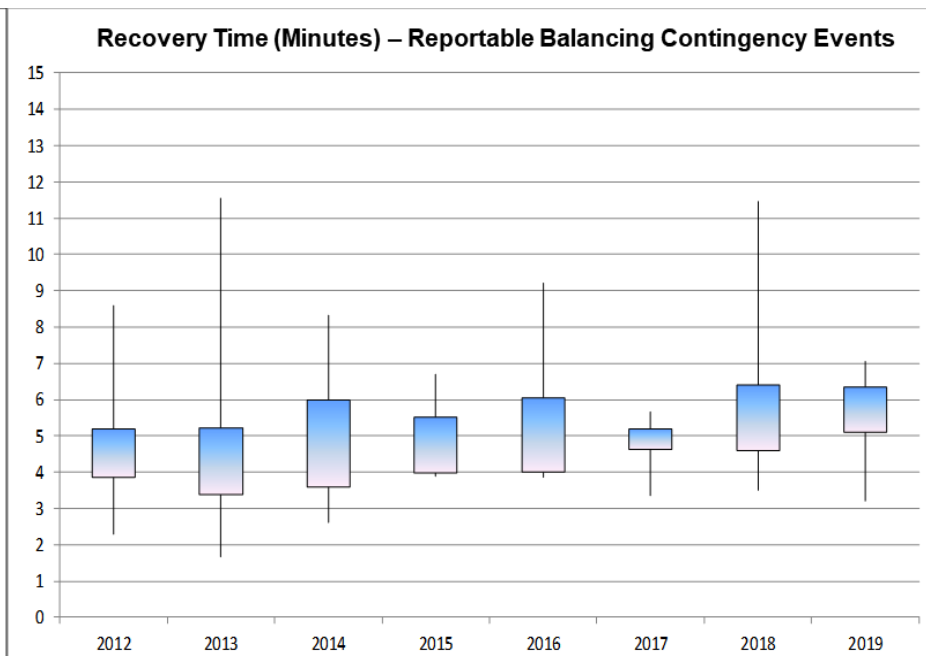
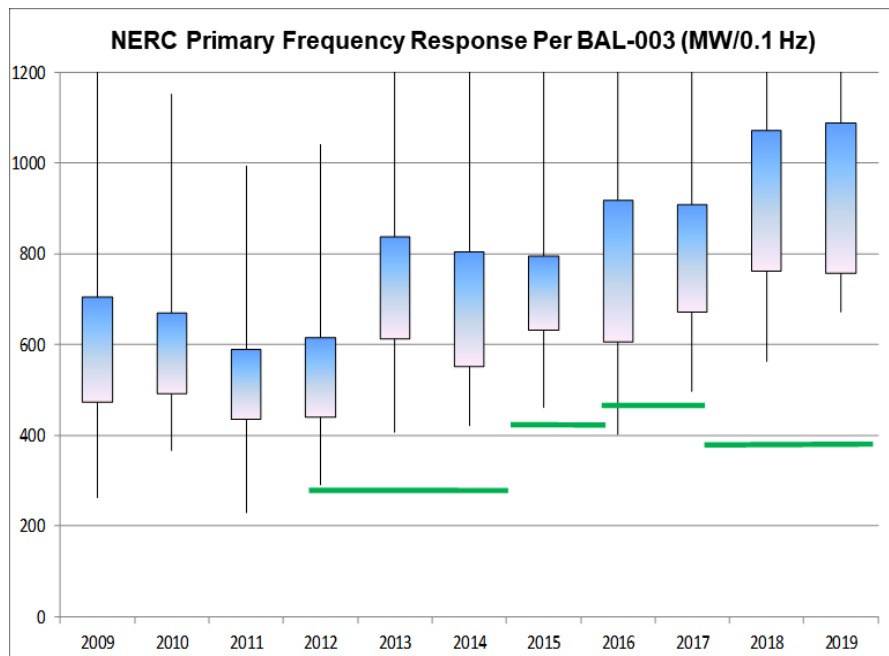
- 31 OE-417 reports
- 6 EOP-004 reports
- 55 FNET (frequency-related) notifications
- 14 Event Analysis reports

## 2015-2019

- 433 Events Analyzed
- > 270 Event reports
- 302 root and contributing causes identified
- Qualified event attributes dominated by Generation Loss, Protection System Misoperations, and Loss of Situational Awareness



# Resource Adequacy and Performance

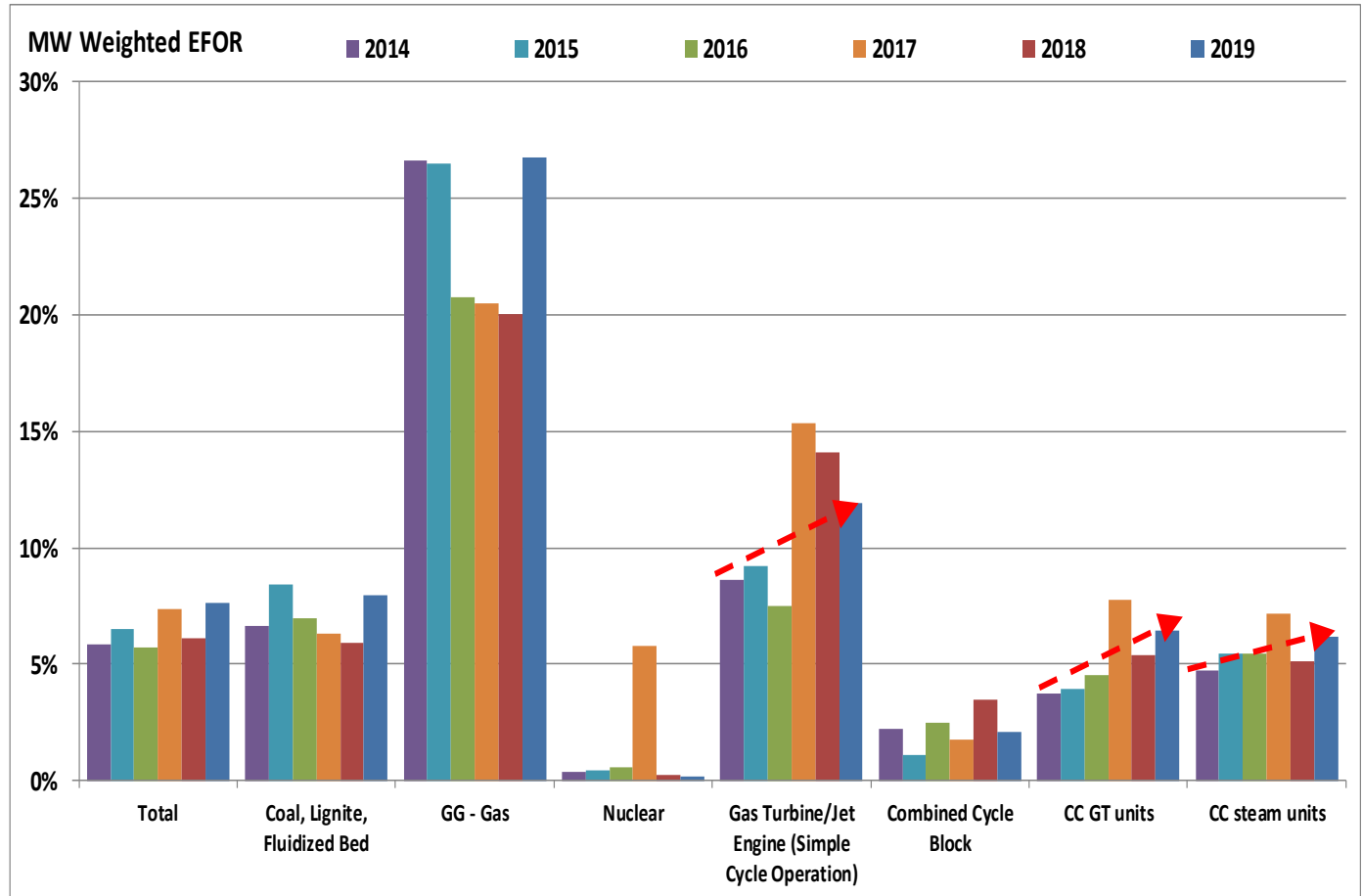


- Primary frequency response metrics continue to be maintained at high levels.
- Average recovery time from generation loss events was 5.1 minutes in 2019 versus 6.2 minutes for 2018; long-term gradual upward trend since 2012.

# Resource Adequacy and Performance

## Fossil Generation Performance Metrics

- From January 2019 through December 2019, there were 2,122 immediate forced outage events, totaling 122,471 hours
- Total outage capacity was 405,724 MW
- Median outage capacity was 171 MW per event



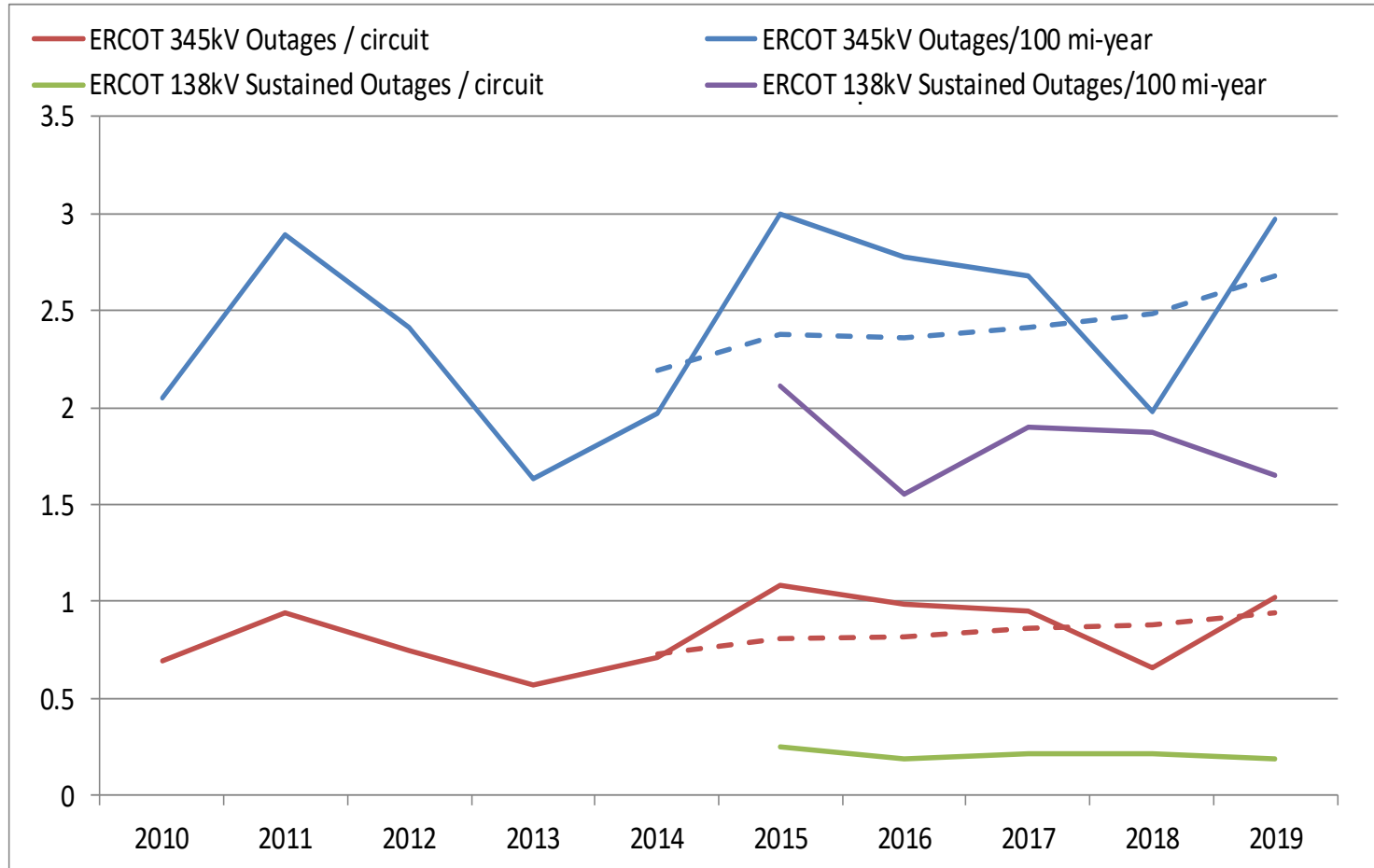
# System Resilience

For 345 kV circuits:

- 487 momentary and sustained forced outages reported on 16,382 circuit miles
- Failed transmission circuit equipment accounted for 20% of cause and 70% of duration.

For 138 kV circuits:

- 374 sustained forced outages reported on 23,224 circuit miles
- Failed substation or transmission circuit equipment accounted for 38% of cause and 75% of duration.





# System Resilience

## Transmission Extreme Day Analysis

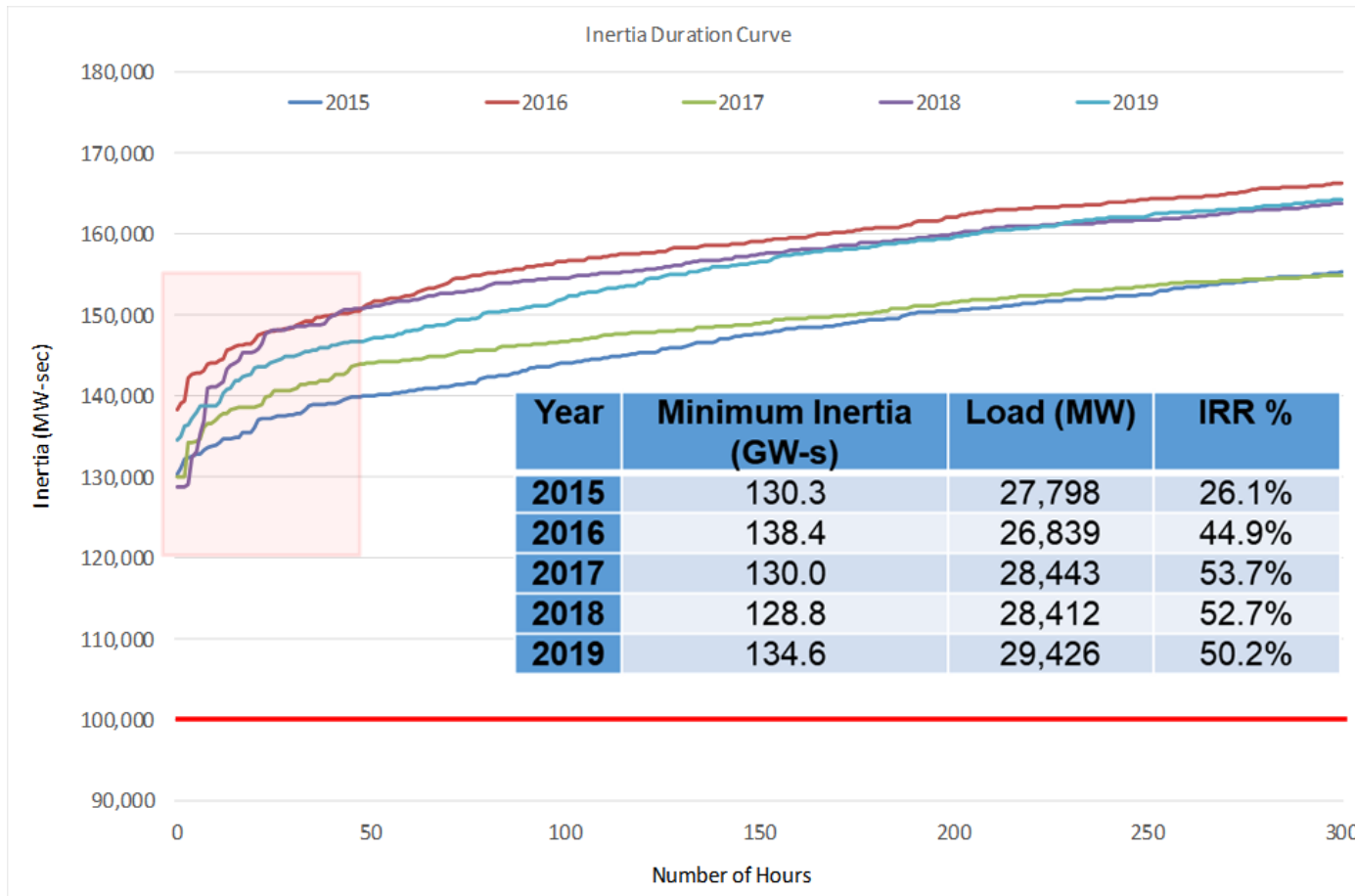
Date	Sustained Transmission Outage Events on Extreme Day	Leading Causes for Extreme Day	Average Sustained Outage Duration on Extreme Day	Longest Sustained Outage on Extreme Day	Average Sustained Outage Duration for Year	Longest Sustained Outage Duration for Year
8/26/2017	40	Weather	80 hours	257 hours	54 hours	7,594 hours
1/16/2018	50	Weather	10 Hours	72 hours	53 hours	6,403 hours
5/18/2019	19	Weather	85 hours	332 hours	31 hours	1,657 hours

## Generation Extreme Day Analysis

Date	Generation Outage Events on Extreme Day	Leading Causes for Extreme Day	Cumulative Outage Duration on Extreme Day	Cumulative MW Impact on Extreme Day	Cumulative GWH Impact on Extreme Day
8/27/2017	41	Weather	22,798 hours	10,107 MW	2,917.5 GWH
1/16/2018	84	Balance of Plant/Fuel	2,891 hours	11,893 MW	517.8 GWH
5/11/2019	36	Turbine Generator	1,626 hours	6,449 MW	282.5 GWH

- Transmission and generation performance on extreme days improved compared to previous years
- From 2015-2019, 11% of sustained 345 kV outage events involved multiple elements

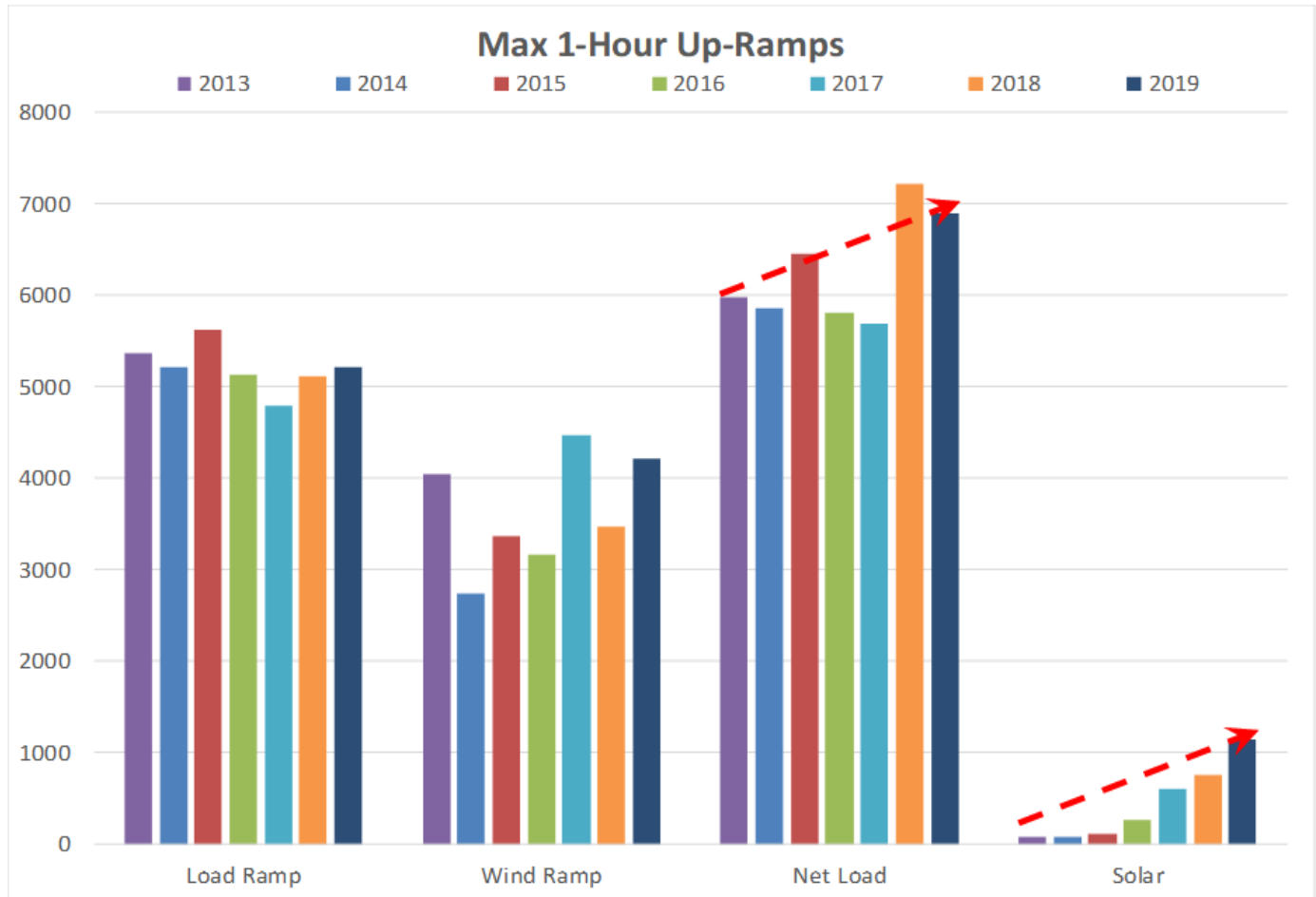
# Changing Resource Mix



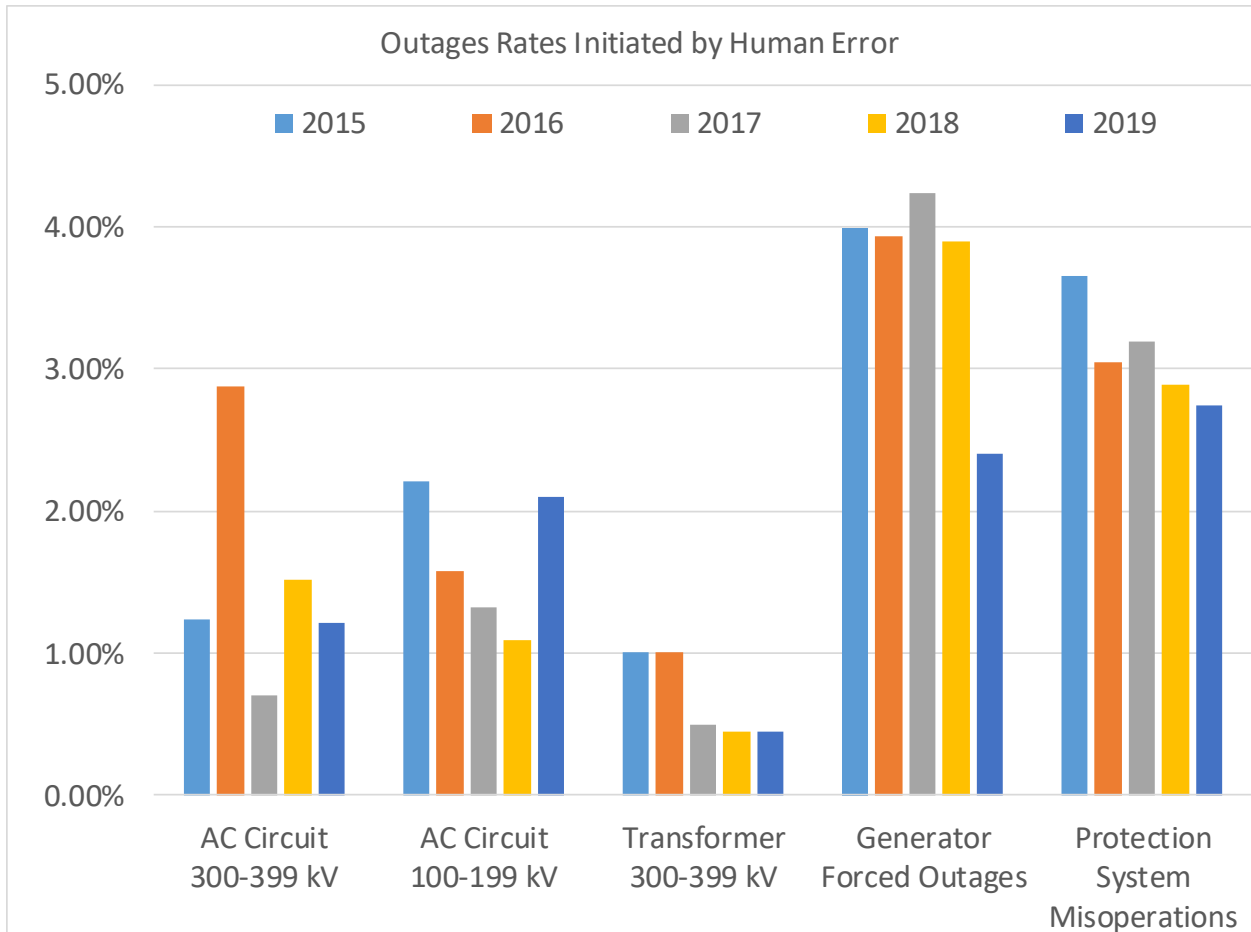
Inertia data shows risk of approaching critical inertia level less than 50 hours per year

# Changing Resource Mix

- Long-term increasing trend in maximum one-hour up-ramp magnitudes for net load and solar

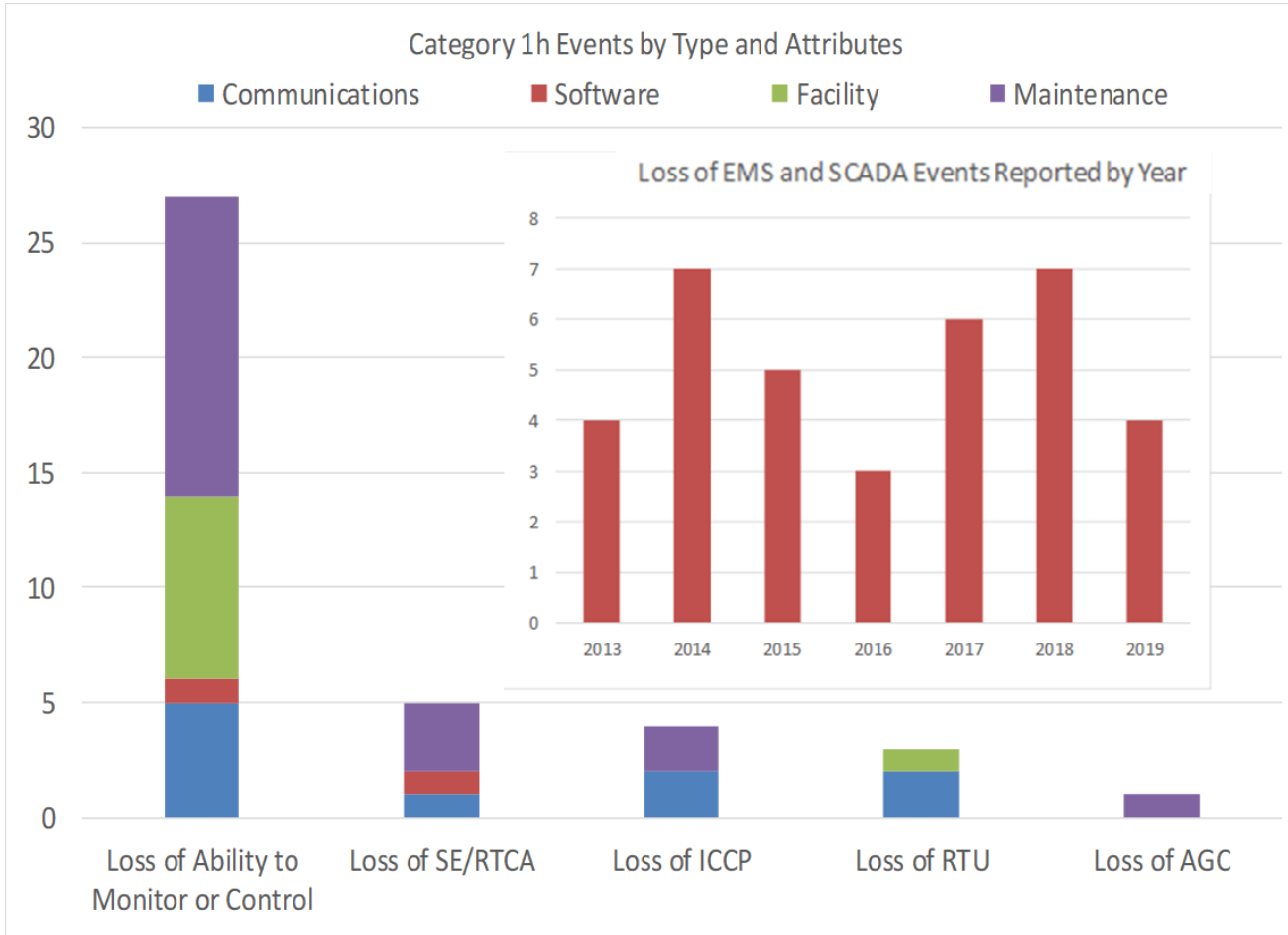


# Human Performance



- Protection system misoperations caused by human error show an improving downward trend
- Causal analysis of human errors in protection system misoperations shows continuing, repeated issues due to lack of adequate error-checking processes
- Since 2015, 462 ERCOT generator immediate forced outages had a human error cause.
- Generator forced outages caused by human error dropped significantly in 2019

# Loss of Situational Awareness



Loss of EMS/SCADA events continue to be a focus point at the NERC and regional levels.

Event count in 2019 is about average for the past 7 years.

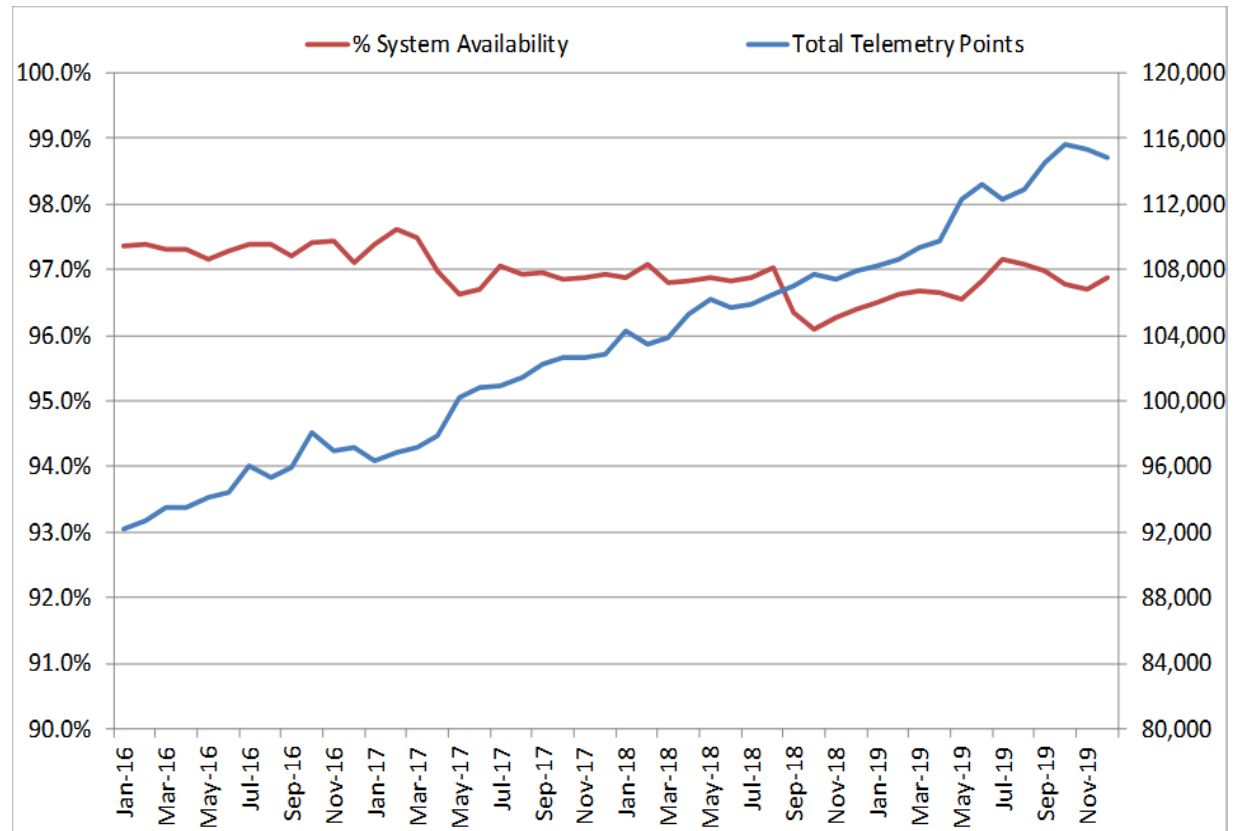
# Loss of Situational Awareness

ERCOT telemetry performance criteria - 92% must achieve 80% quarterly availability.

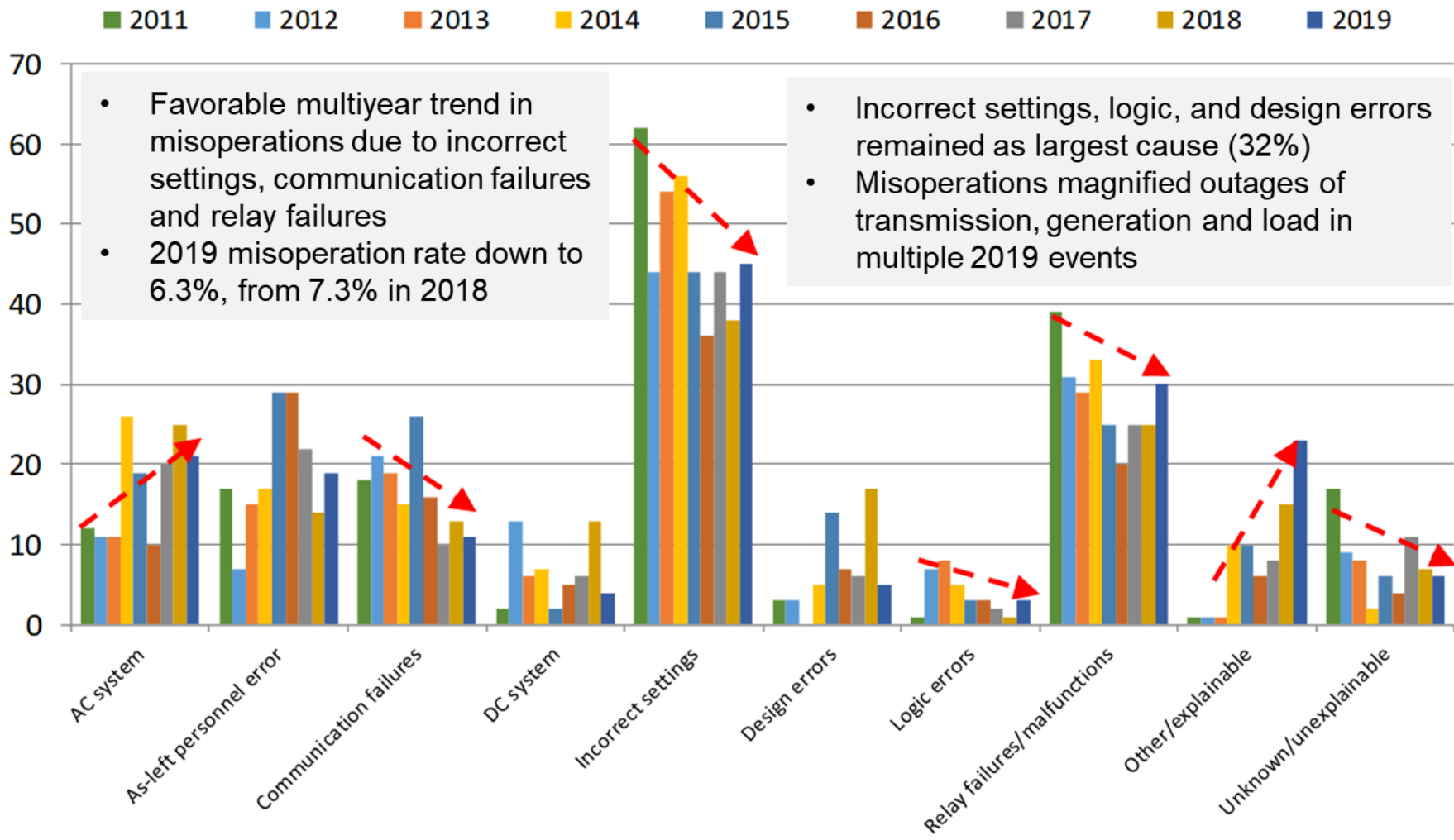
- For 2019, points failing availability metric averaged 4,422 each month, or approximately 3.9% of total system telemetry points

ERCOT's goal for State Estimator convergence is 97% or higher.

- In 2019, convergence rate was 99.99%, continuing improvement since 2016.



# Increasing Complexity in Protection and Control Systems



- Favorable multiyear trend in misoperations due to incorrect settings, communication failures and relay failures
- 2019 misoperation rate down to 6.3%, from 7.3% in 2018

- Incorrect settings, logic, and design errors remained as largest cause (32%)
- Misoperations magnified outages of transmission, generation and load in multiple 2019 events

# Questions?

[2019 Assessment of Reliability Performance](#) – Summary

[2019 Assessment of Reliability Performance](#) – Full Report

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with any questions.

