



# INCREASING RENEWABLE RELIABILITY

BRUCE REW, SR. VICE PRESIDENT, OPERATIONS

*Working together to responsibly and economically  
keep the lights on today and in the future.*



SouthwestPowerPool



SPPorg

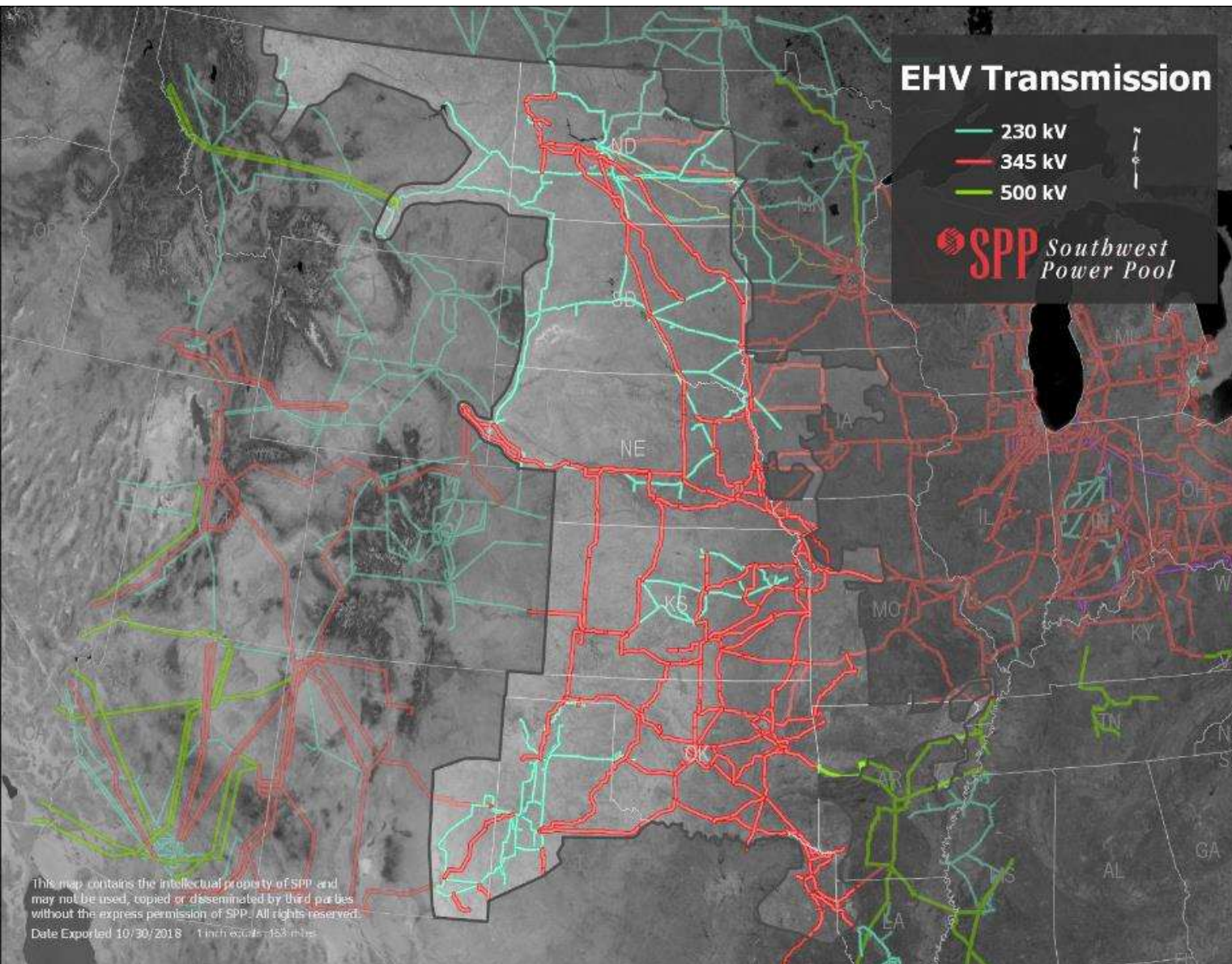


southwest-power-pool

# NORTH AMERICAN INDEPENDENT SYSTEM OPERATORS (ISO) AND REGIONAL TRANSMISSION ORGANIZATIONS (RTO)







## MILES OF TRANSMISSION: 70,025

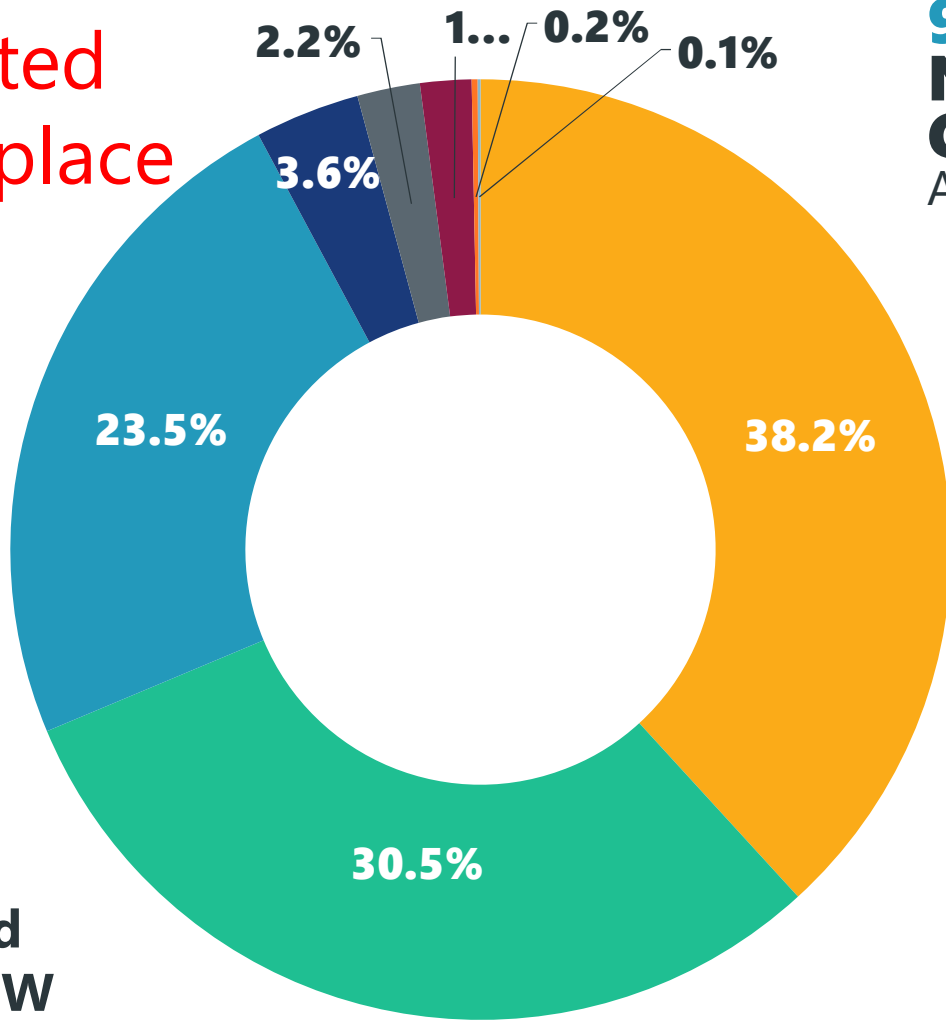
- 69 kV 17,982
- 115 kV 16,677
- 138 kV 9,942
- 161 kV 5,677
- 230 kV 7,604
- 345 kV 12,052
- 500 kV 91

# WIND AND SOLAR IN THE SPP REGION



# SPP Integrated Marketplace

**98,608 MW  
NAMEPLATE  
GENERATING CAPACITY**  
AS OF JAN. 1, 2023

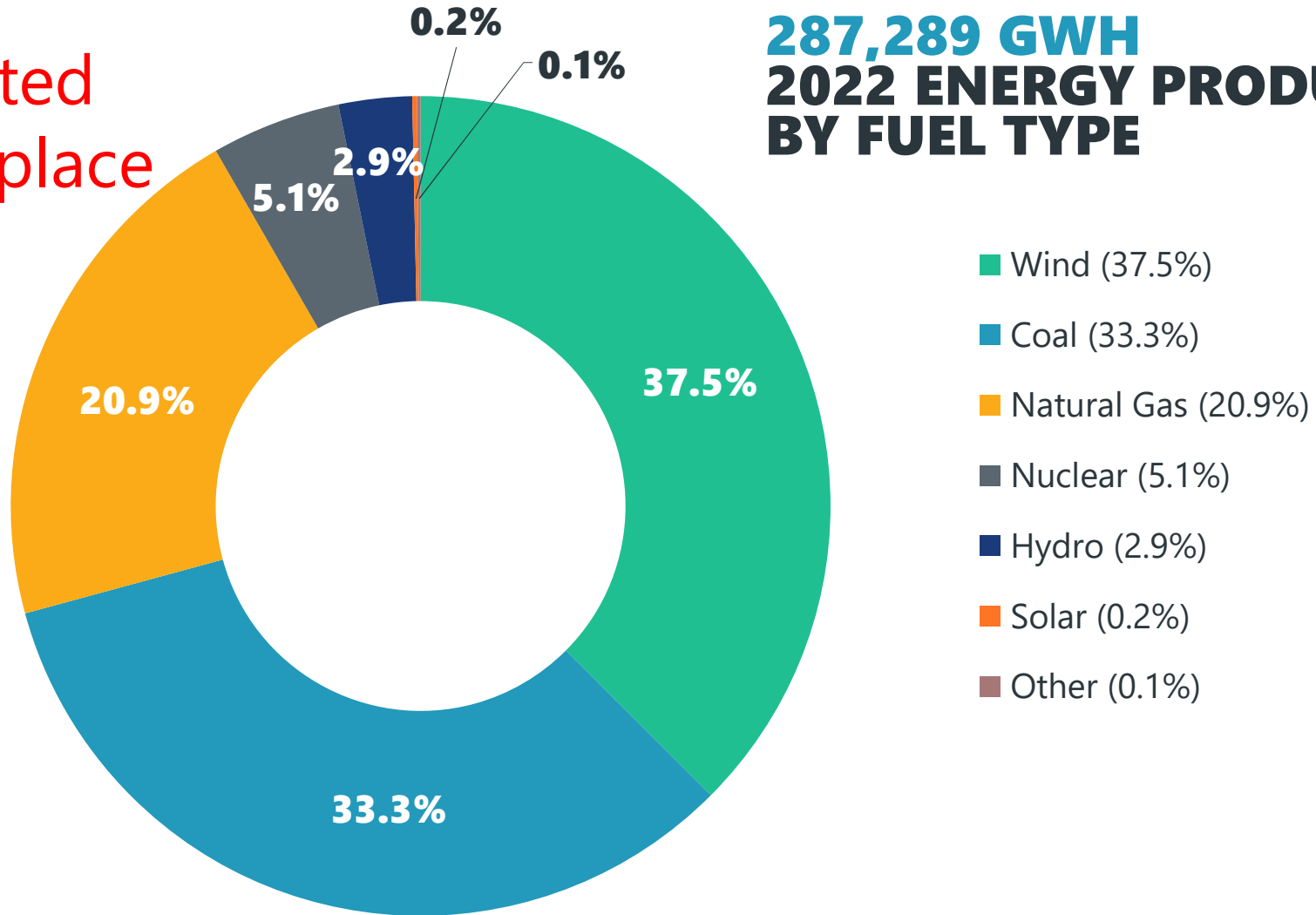


**Peak Load  
56,184 MW**

- Natural Gas (37.1%)
- Wind (32.5%)
- Coal (22.8%)
- Hydro (3.5%)
- Nuclear (2.1%)
- Fuel Oil (1.7%)
- Solar (0.2%)
- Other (0.1%)

SPP  
Integrated  
Marketplace

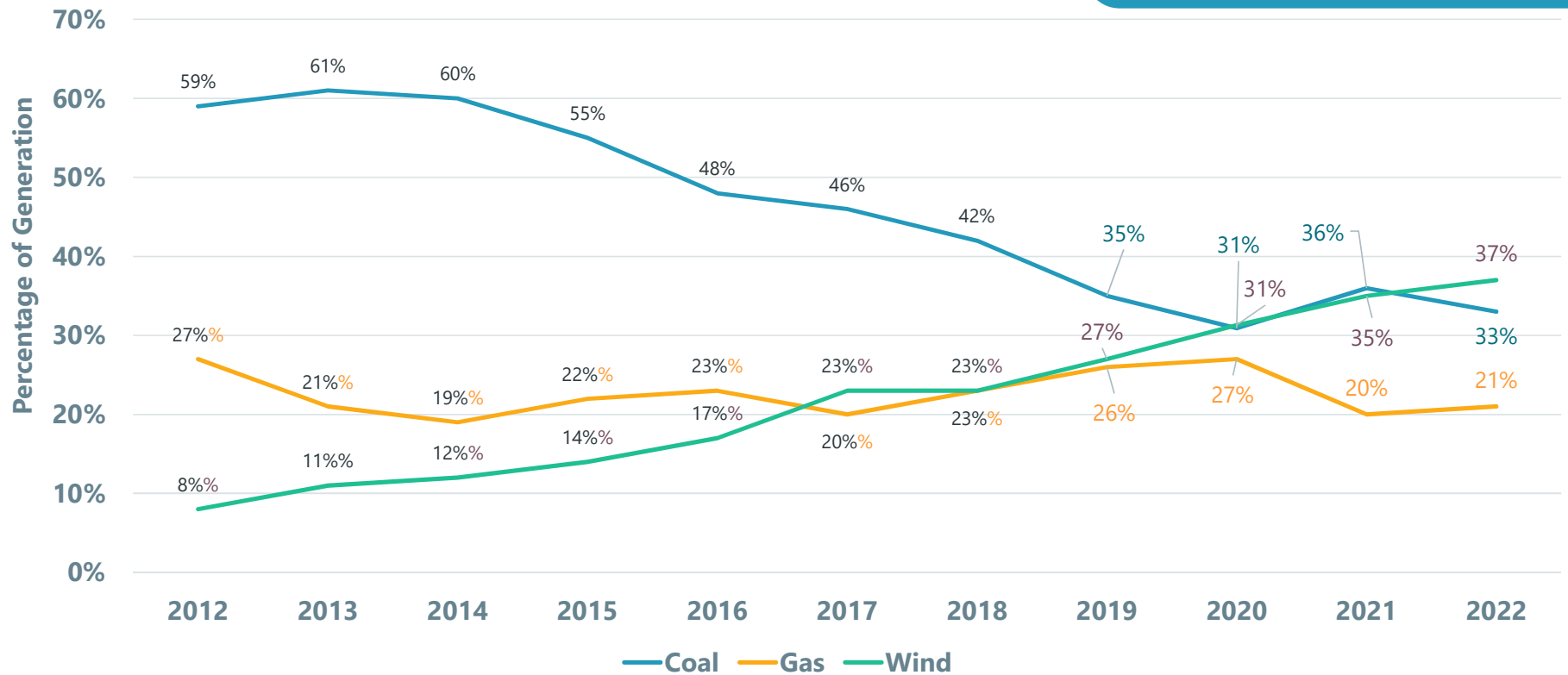
## 287,289 GWH 2022 ENERGY PRODUCTION BY FUEL TYPE



# OUR EVOLVING ENERGY MIX

Coal and gas use has decreased, while wind has increased

Trend By Year





## WIND IN SPP'S SYSTEM

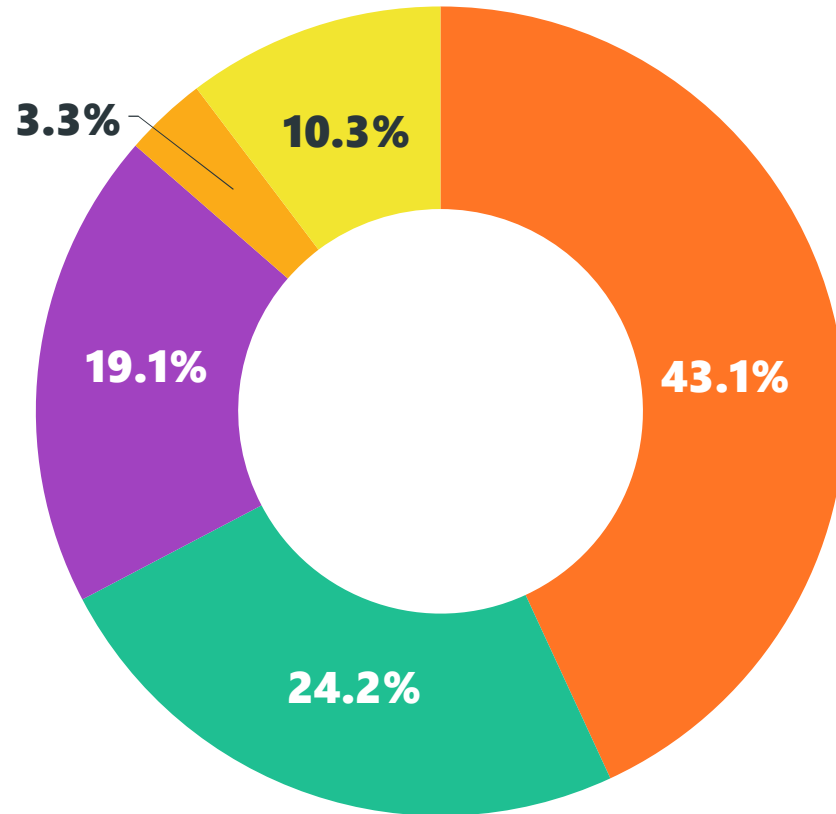
- **32,020 MW** Wind installed today
  - 14,758 turbines at 244 wind resources in the eastern interconnection (most are 80m hub height)
- **23,838 MW** Maximum wind output (3/16/23)
- **110.6 MW** Minimum wind output (last 12 mos.): (6/6/23 @ 9:42 a.m.)
- **88.51%** All-time maximum wind penetration (3/29/22)
- **37.4%** Average wind penetration (2022)



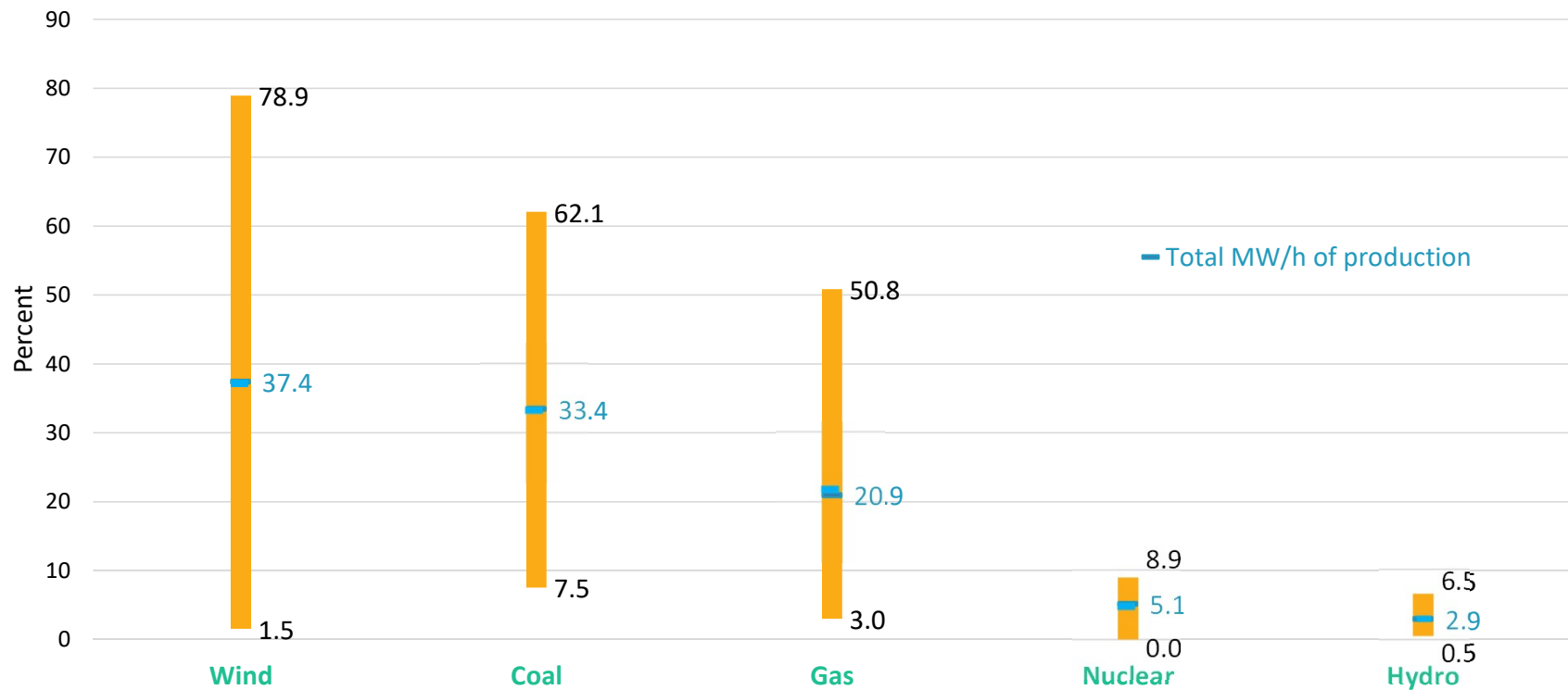
# 104.0 GW GENERATOR INTERCONNECTION REQUESTS UNDER STUDY

AS OF JULY 26, 2023

- Solar (44,798 MW)
- Wind (25,216 MW)
- Storage (19,852 MW)
- Gas/Thermal (3,461 MW)
- Hybrid: renewables + storage (10,675 MW)

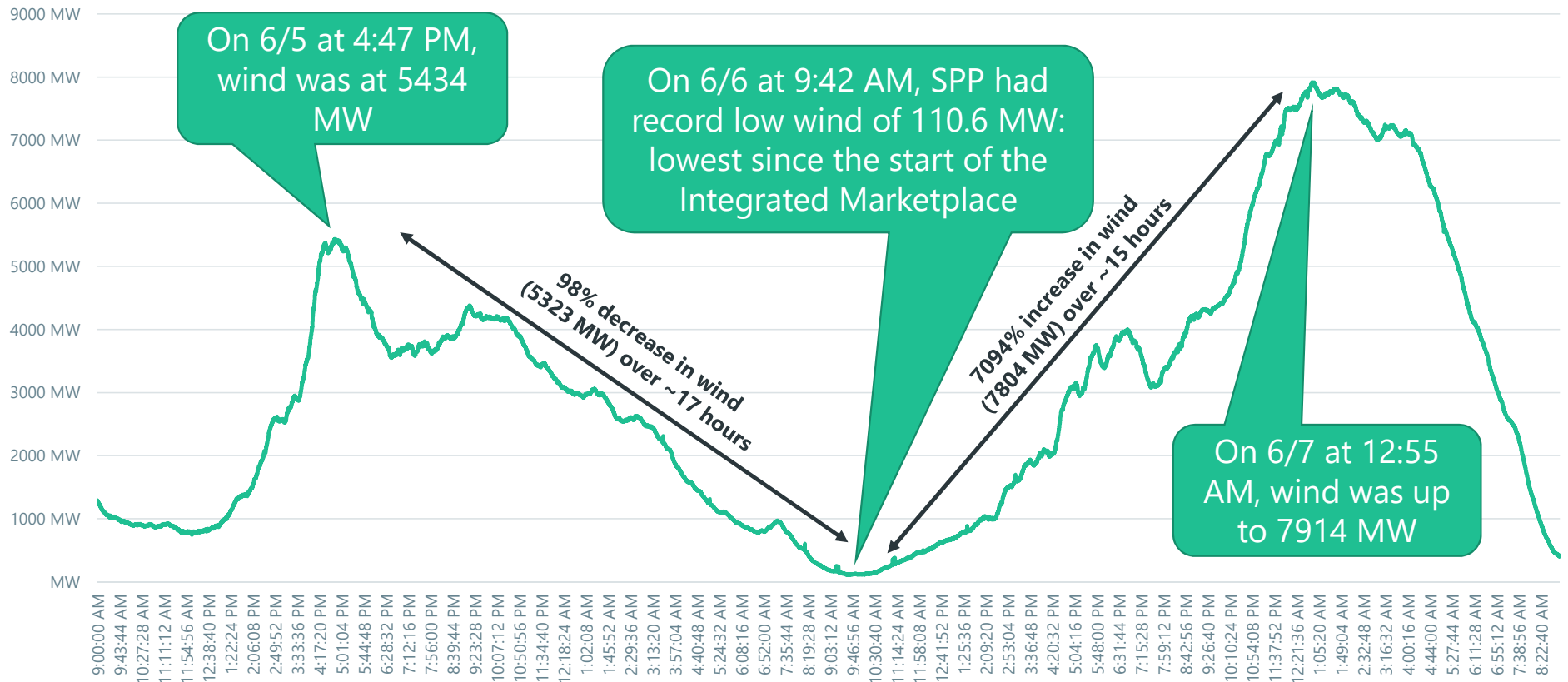


# MIN AND MAX PERCENT OF GENERATION BY FUEL TYPE JANUARY – DECEMBER 2022



Min and Max % based on the highest and lowest percent from individual real-time balancing market (RTBM) intervals for the period.  
Total MW/h of production is based on the sum of RTBM dispatch MW across the period.

# WHY FUEL DIVERSITY MATTERS: WIND RAMP AND RECORD LOW (6/6/23) IN INTEGRATED MARKETPLACE



# GENERATION ASSESSMENT PROCESS (GAP)

- Used for outage scheduling to help ensure BA capacity adequacy
- Long term horizon (next 5 years)
  - Historical data
- Mid term horizon (next 7-10 days)
  - Forecast data (Load Only)
- Short term horizon (next 7 days)
  - Forecast data (Wind, Load, and Outage)
- Inputs:
  - Wind
  - Load
  - Generation
- Maintenance Margin = allowable amount of scheduled outages



# CAPACITY OVERVIEW VS. RISK

**Capacity Overview vs Risk**  
[Action Time: 6/1/2022 10:00:00 AM]  
Net Load Forecast w/ Uncertainty Risk at 99.50%

Days Ahead  
6

Pvalue  
99.50%

Decision Wait Time (hours)  
20

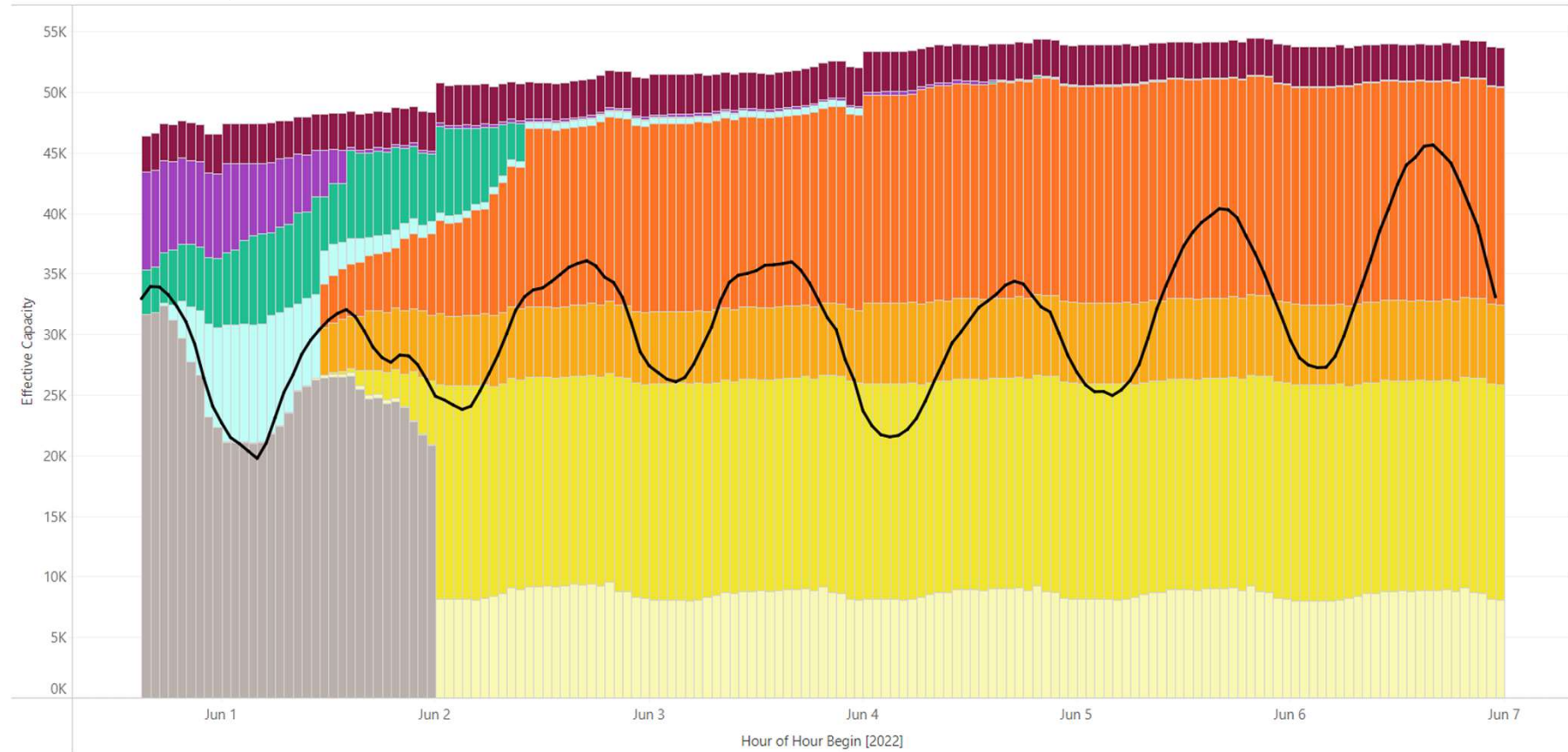
- Use Emergency Maxes?  
 Use EmerMax  
 Use EcoMax Only

- Use Reliability Status?  
 Include Reliability Status  
 Exclude Reliability Status

- Availability (after wait)  
 Reliability Status  
 Unavailable (Lead Time, etc)  
 Start-Up (Unavailable after wait)  
 ShutDown and can't restart  
 Start-Up  
 ShutDown and Available Restart  
 Extension  
 Self Status  
 In COP

- Include Reserves?  
 Include Reserves  
 Exclude Reserves

- Use Coincident Error  
 Coincident  
 Non-Coincident



# WIND PENETRATION: HOW HIGH CAN WE GO?

- Wind generation technology improvements continue to help operations
- Fossil units must provide more flexibility, reduce minimum run output and shorten start times
- Ramp capability will be an important Market design aspect in the future
- Transmission expansion has dramatically helped deliver new resources to load and reduced energy prices
- We must have dispatchable generation available
- Solar/storage is expected to grow fast and we have to manage new resources
- Wind penetration limit is system dependent!!
  - Hundred's of hours a year with potential for over 100% wind penetration
  - Total wind energy approaching 40% today



## **BRUCE REW**

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