

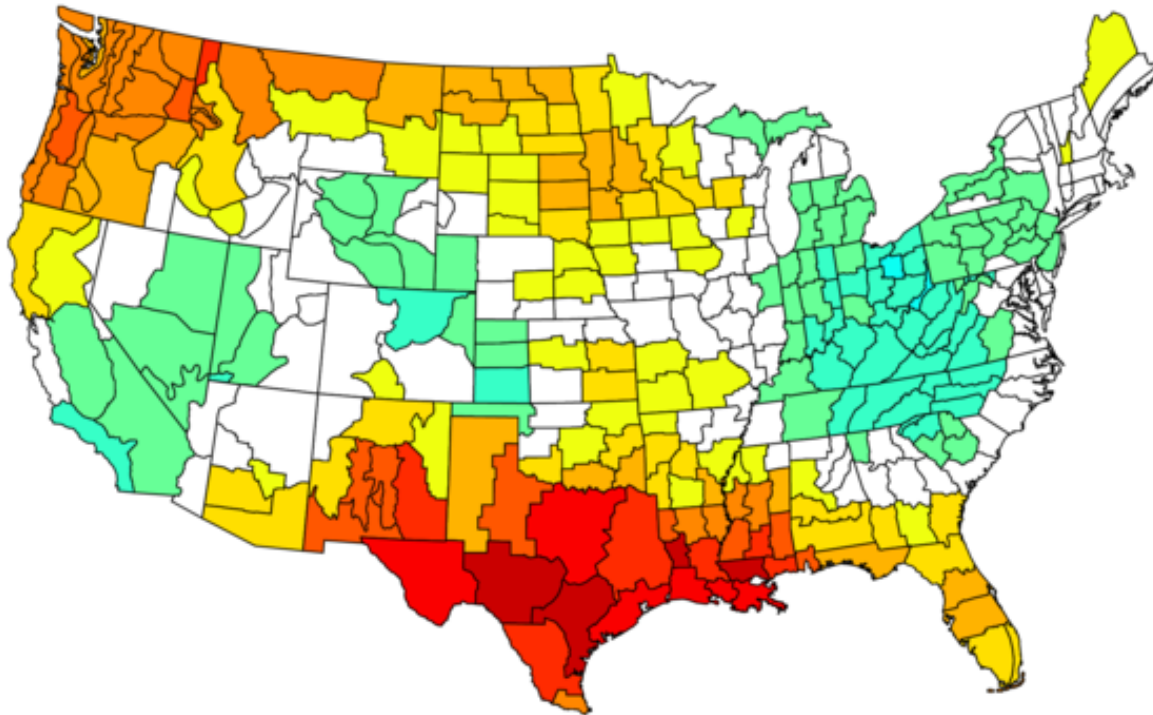


Summer Operations of the PJM Grid: June 1, 2023 – August 31, 2023

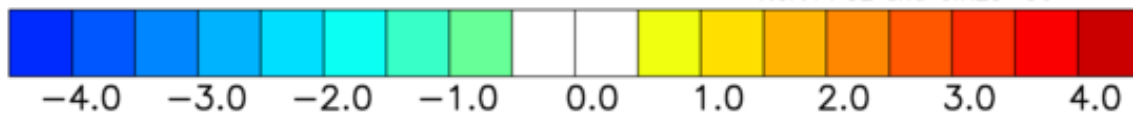
Operating Committee
October 5, 2023

Summer 2023 Overview

NOAA/NCEI Climate Division Temperature Anomalies (F)
 Jun to Aug 2023
 Versus 1991–2020 Longterm Average



NOAA PSL and CIRES-CU



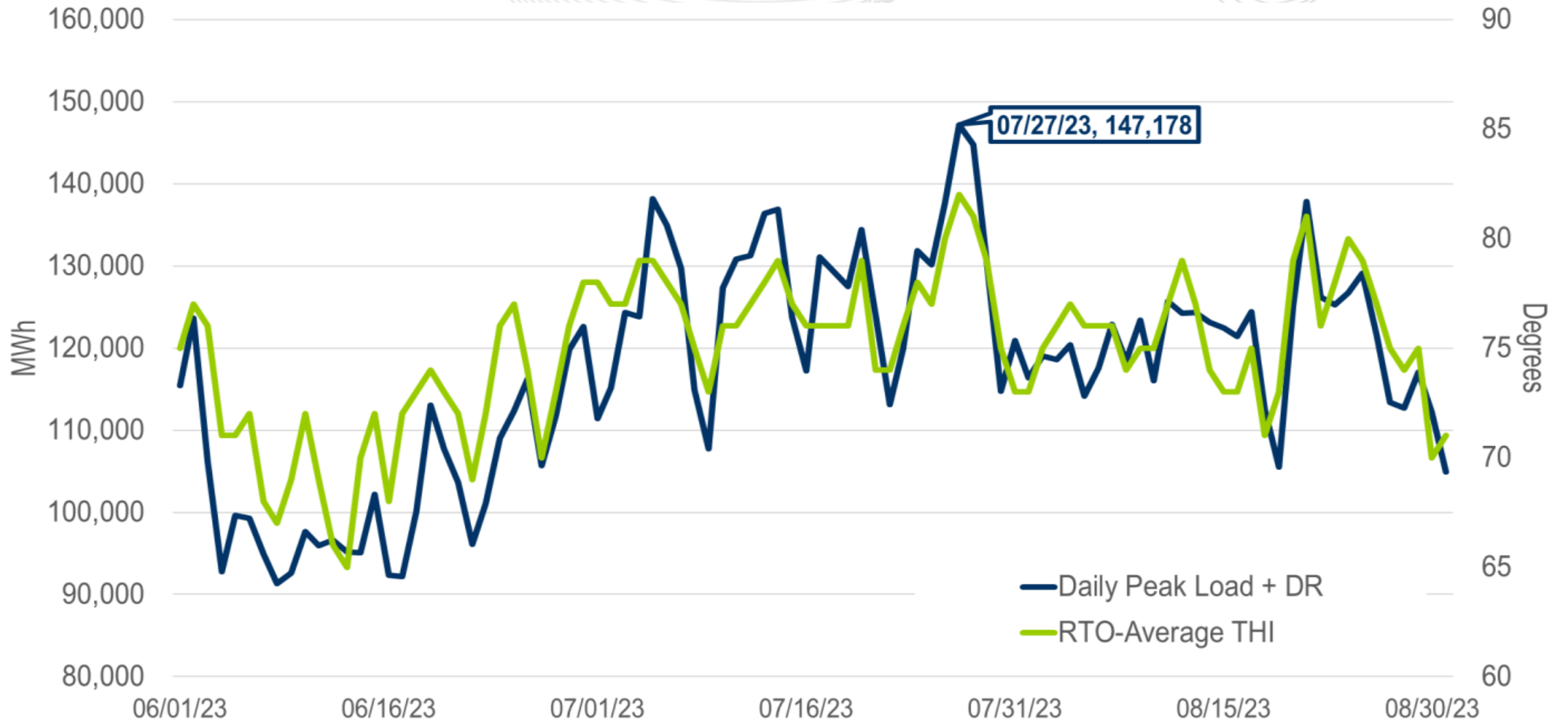
Source: [NOAA/NCEI U.S. Climate Division Data Plots: NOAA Physical Sciences Laboratory](https://www.noaa.gov/data/monitoring-assessments/temperature-anomalies)

- It was not a hot summer overall, but there were a few periods of 90 degree and higher temperatures
- The hottest temperatures in the west occurred in late August
- The hottest temperatures in the east occurred in early September
- Wildfire smoke in June led to reduced temperatures and solar generation output
- Sixteen Hot Weather Alerts were issued between June and August

- There is a strong relationship between load and Temperature Humidity Index (THI), a measure that accounts for the combined effects of temperature and relative humidity.
- In the summer, as THI goes up, the load goes up (and vice versa), exhibiting a strong, positive relationship.
- The following slide shows the close tracking between load and THI.



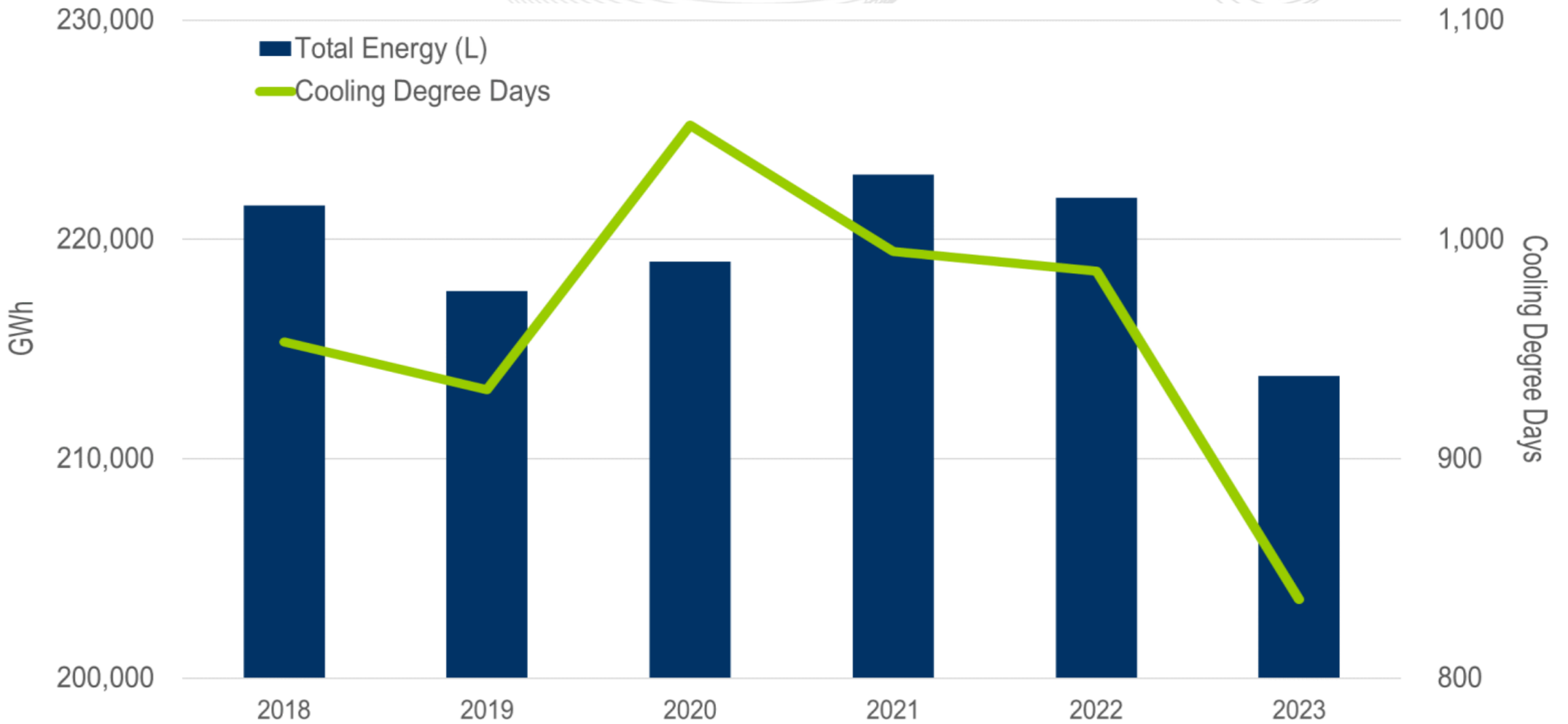
Daily RTO Peak Load and Temperature Humidity Index

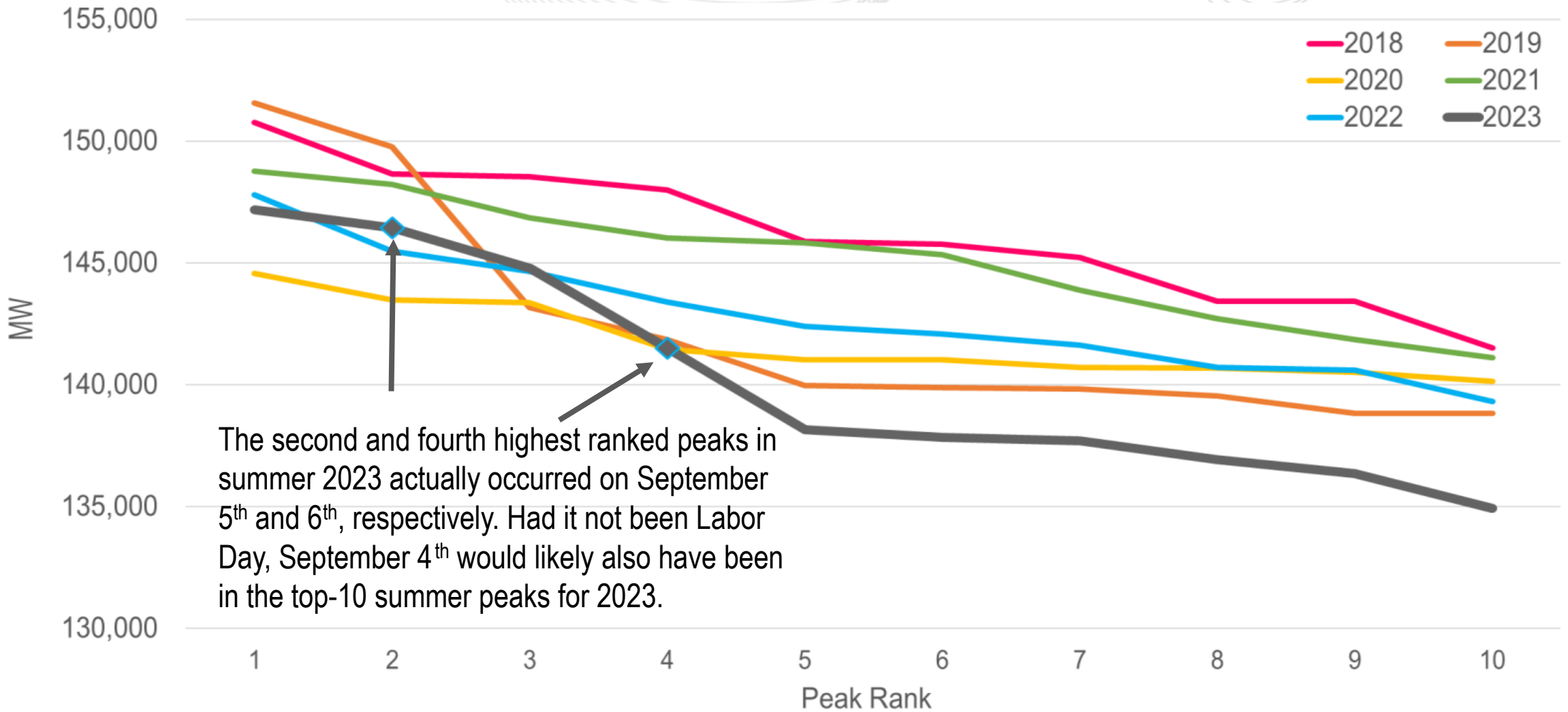


- The following slides show the historic relationship between cooling degree days and total energy, and historic summer peak loads, respectively.
- Cooling degree days measure the temperature's cumulative deviation from a base point, in this case 65 degrees, over a specified time period.
- In general, total energy and cooling degree days are closely tied with the exception of 2020 when load levels were dampened as a result of the Corona Virus.



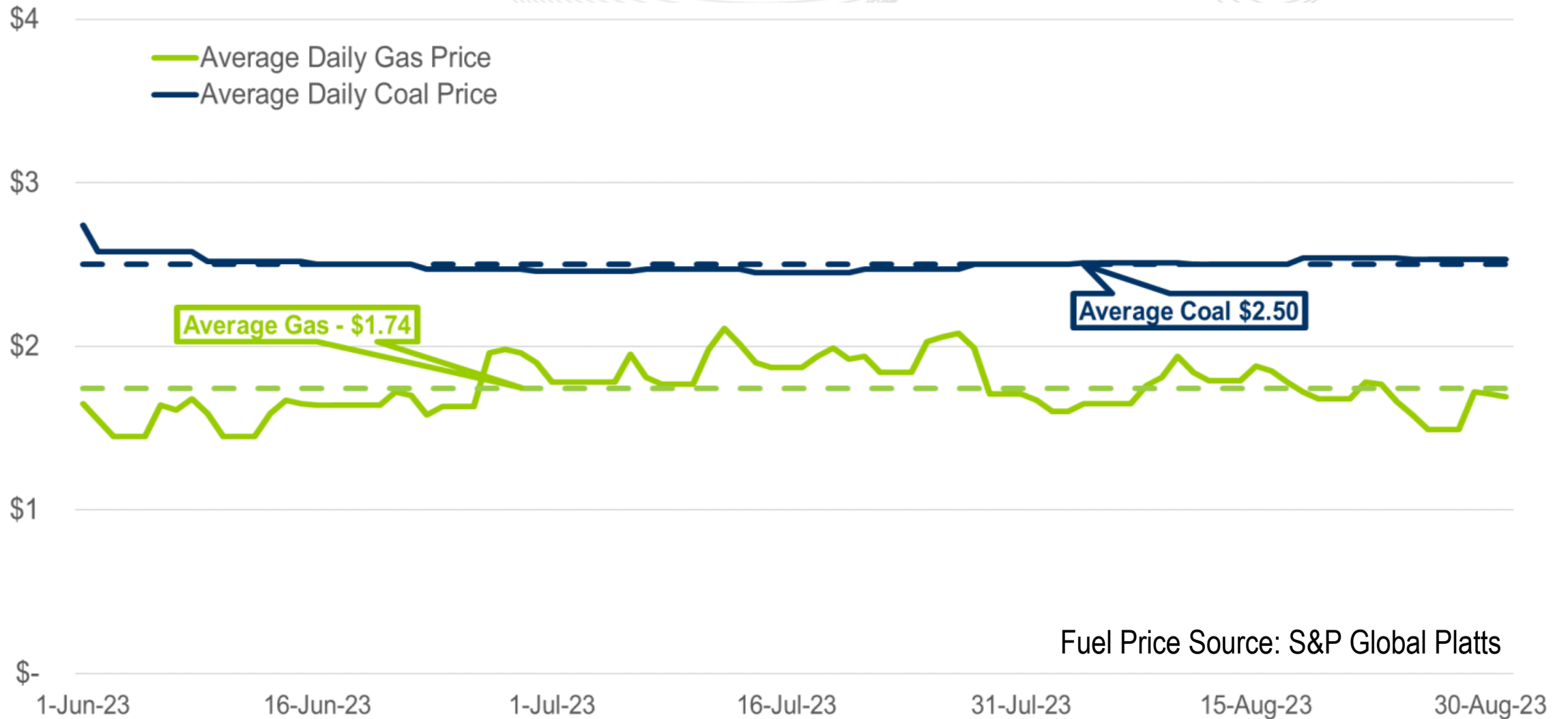
Historic Total Energy and Cooling Degree Days





The second and fourth highest ranked peaks in summer 2023 actually occurred on September 5th and 6th, respectively. Had it not been Labor Day, September 4th would likely also have been in the top-10 summer peaks for 2023.

- The following slide shows the daily average fuel prices for coal and natural gas.
- These fuel prices are straight averages of a selection of representative fuel pricing hubs in PJM's footprint. Averages are not load weighted, nor are they meant to represent the price that any particular market participant may have experienced.
- Both coal and natural gas prices have decreased dramatically since summer 2022 when the average natural gas price was \$7.50 and the average coal price was \$7.00.

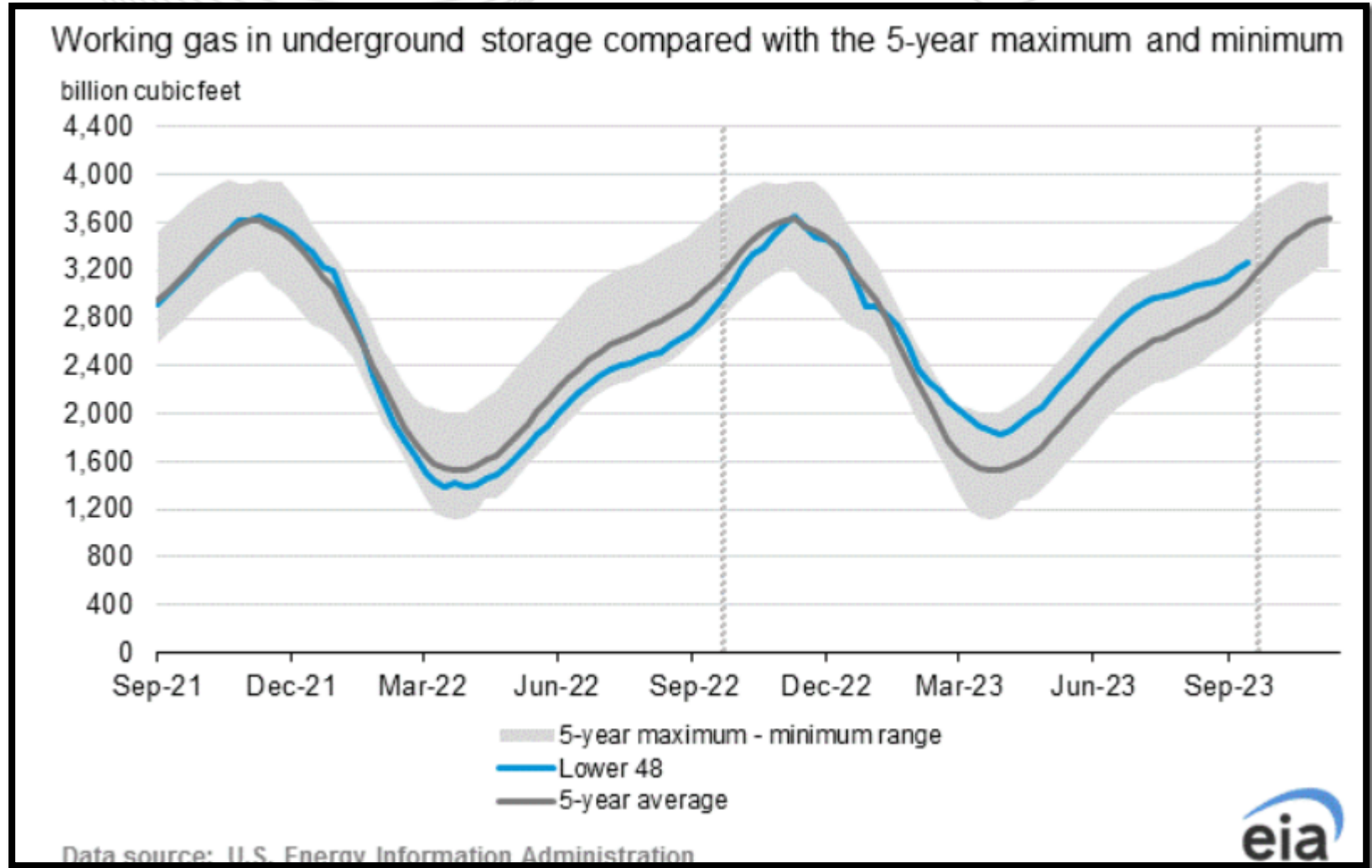


Fuel Price Source: S&P Global Platts

- Summer 2023 has seen a stark drop in natural gas prices when compared to Summer 2022. This is not only true domestically, but also internationally where even greater price drops were observed year-over-year. This has been driven by several factors including:
 - a much warmer than average winter in the U.S., Europe and Asia,
 - increased natural gas production (2 to 3 billion cubic feet per day higher than last summer)
 - higher natural gas storage inventories
 - lessening risk of additional Russian supply cuts in Europe

Despite recent decreases due to higher gas fired power generation this summer, the natural gas storage surplus remains around 6% above the five-year average inventory.

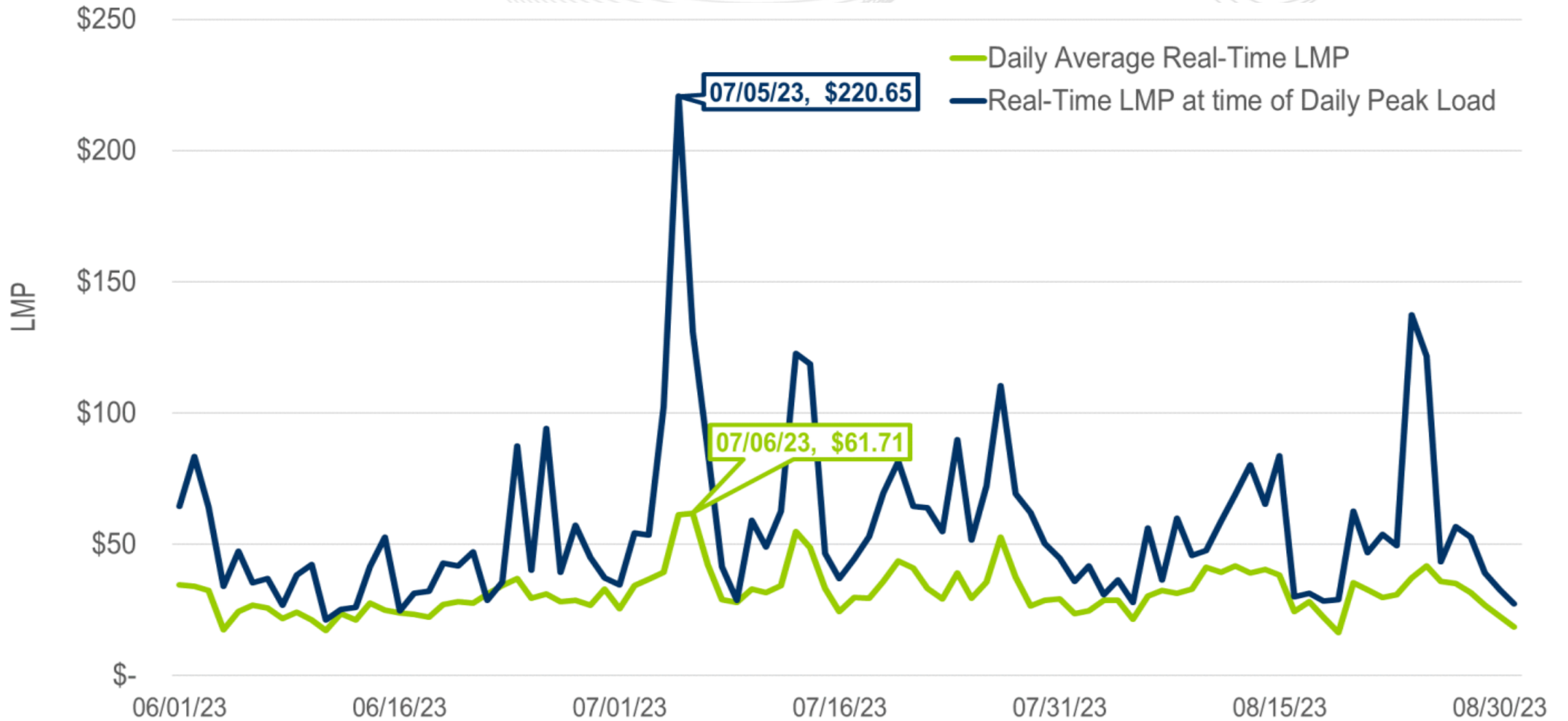
In comparison, storage was approximately 6% below the five-year average last year at this time.



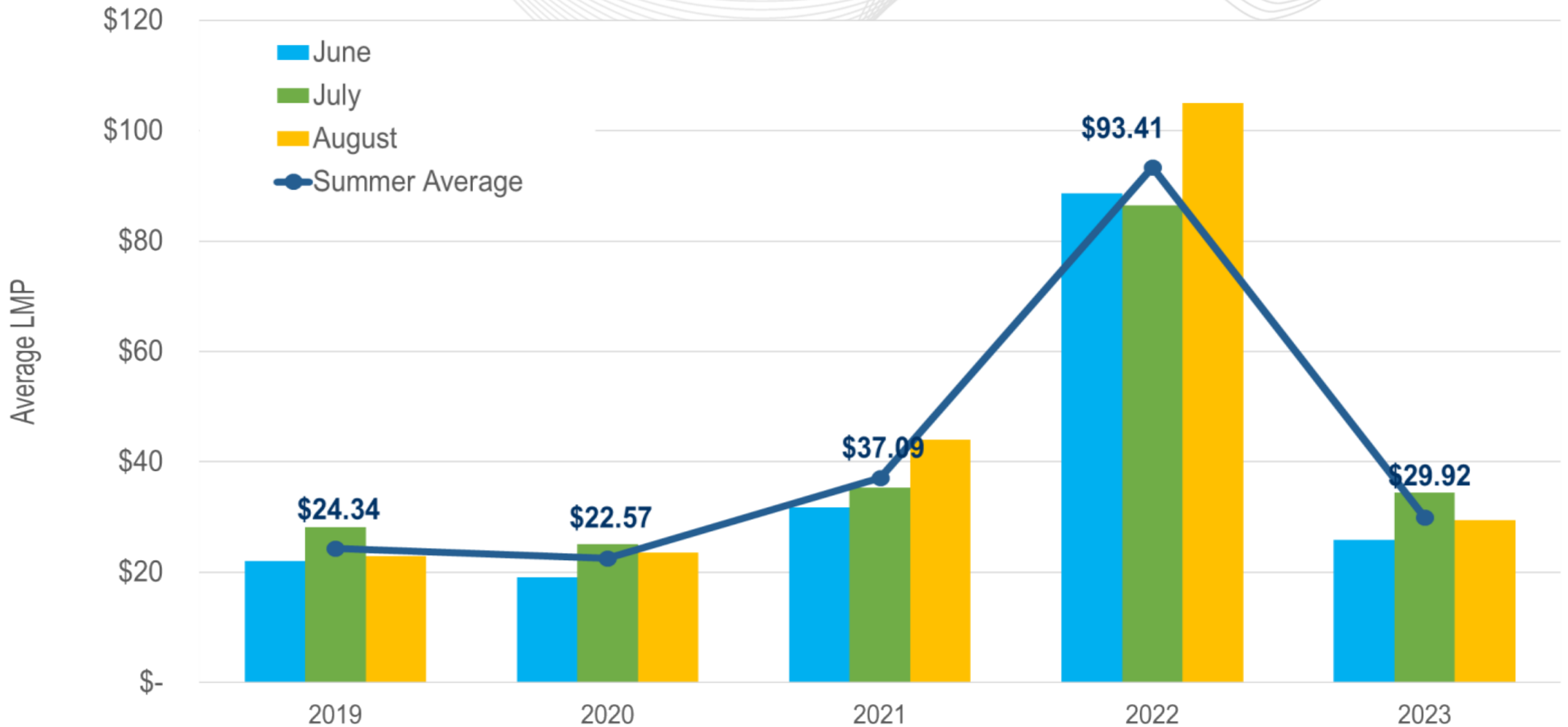
- The following slides show the daily average LMP and the LMP at the time of the daily load peak, and the historic monthly average LMPs, respectively.
- LMPs were very much in line with recent summers, excluding 2022. There were 22 hours during which LMP exceeded \$100 and only one hour when LMP exceeded \$200.
- Lower natural gas and coal prices were the primary contributing factors to lower LMPs this summer.



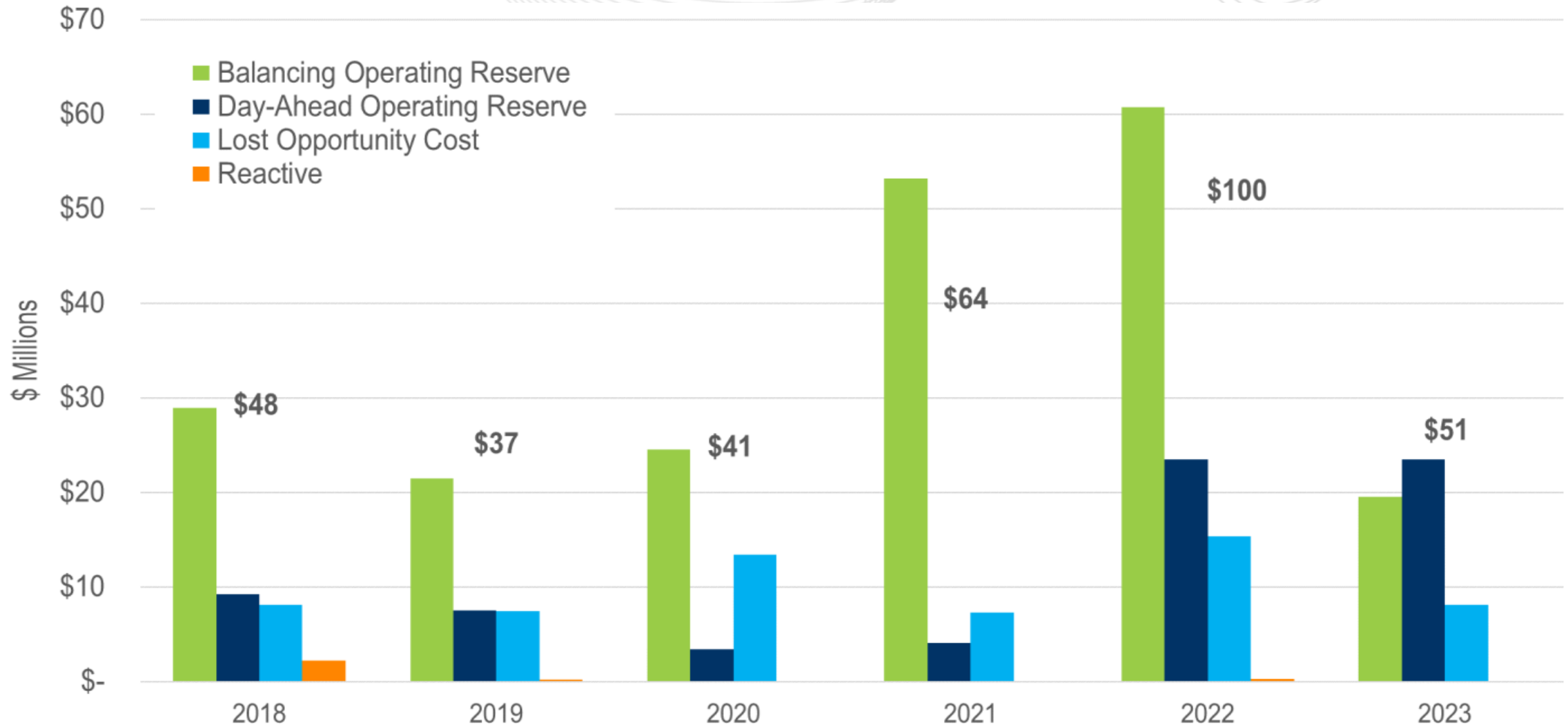
Daily Average and Peak Real Time LMPs



Historic Summer Average Real Time LMPs



- The following slide shows uplift for the past six summers.
- Total uplift is just over half of what it was in 2022, however, Day-Ahead Operating Reserve levels remained higher than in other recent summers.
- The higher DA OR numbers in 2023 have come from a combination of steam that was needed to support north to south flows and a conservative approach to higher load days.



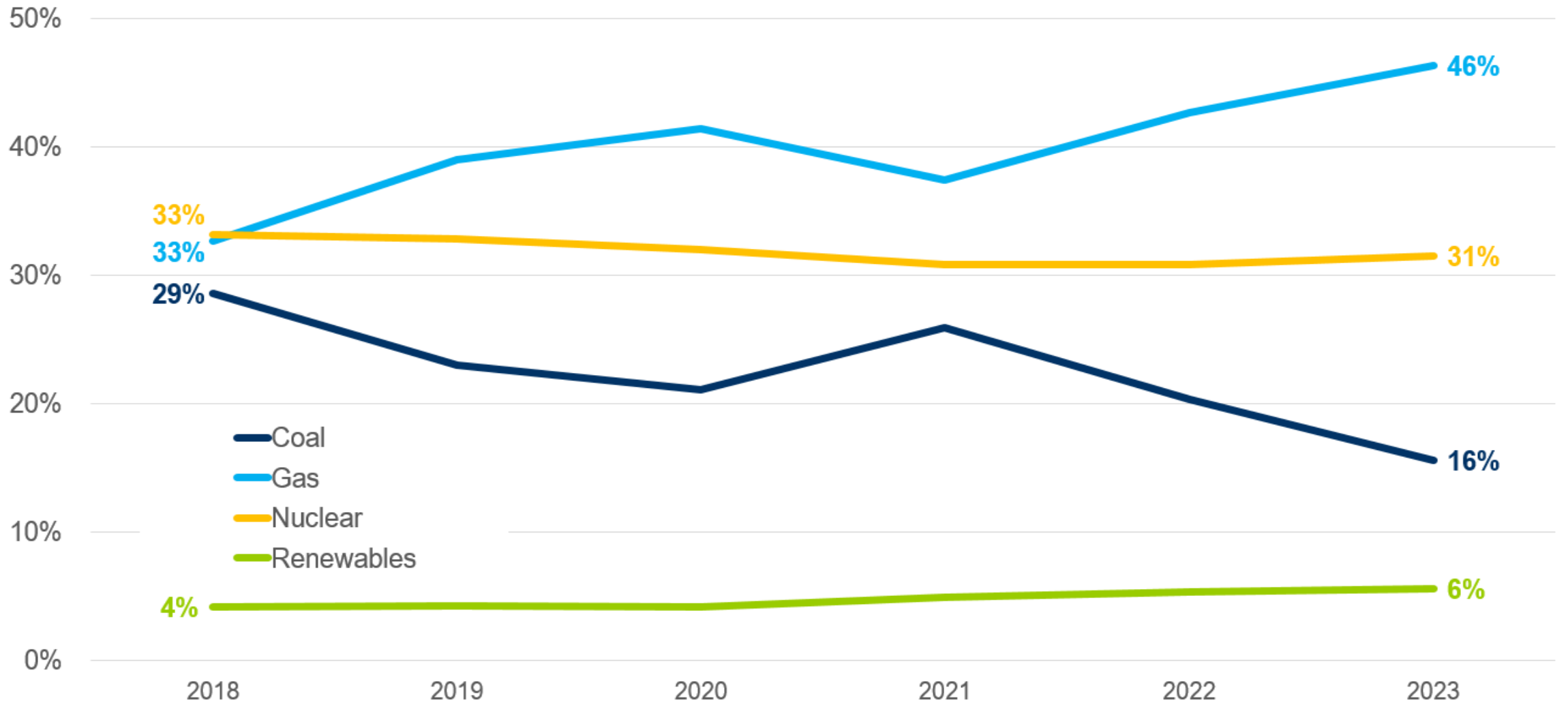
Operations

Emergency Procedure	2018	2019	2020	2021	2022	2023
100% Spinning Reserve - RTO and/or MAD	9	2	3	6	3	3
High System Voltages	0	0	1	3	0	0
Minimum Generation Alert	2	0	0	0	0	0
Load Shed Directive	0	0	0	0	6	0
Manual Load Dump Warning or Action	1	0	0	0	0	0
Hot Weather Alert - Any Region	16	12	20	20	27	16
Total	28	14	24	29	36	19

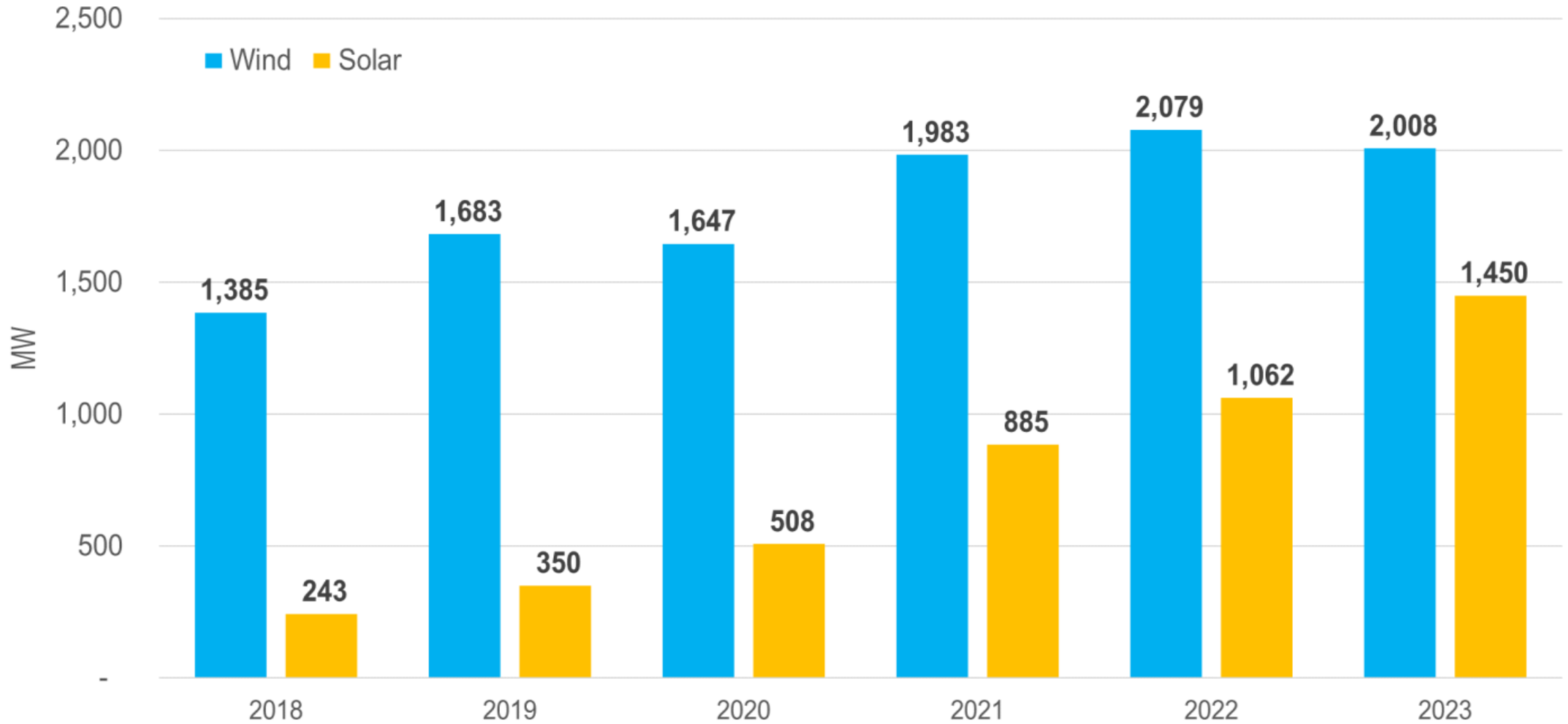
- Hot Weather Alerts accounted for the majority of the Emergency Procedures enacted this summer.

- The following slide shows the fuel mix of on-line generation for the past six summers for all hours. Following that is a slide breaking out average wind and solar performance for all hours.
- Patterns are very similar when examining only peak hours.
- Since the summer of 2017, natural gas has overtaken coal as the most utilized online fuel across all hours of the summer.
- Since the summer of 2017, renewables have increased their share of the on-line fuel mix both during peak hours and all other hours.

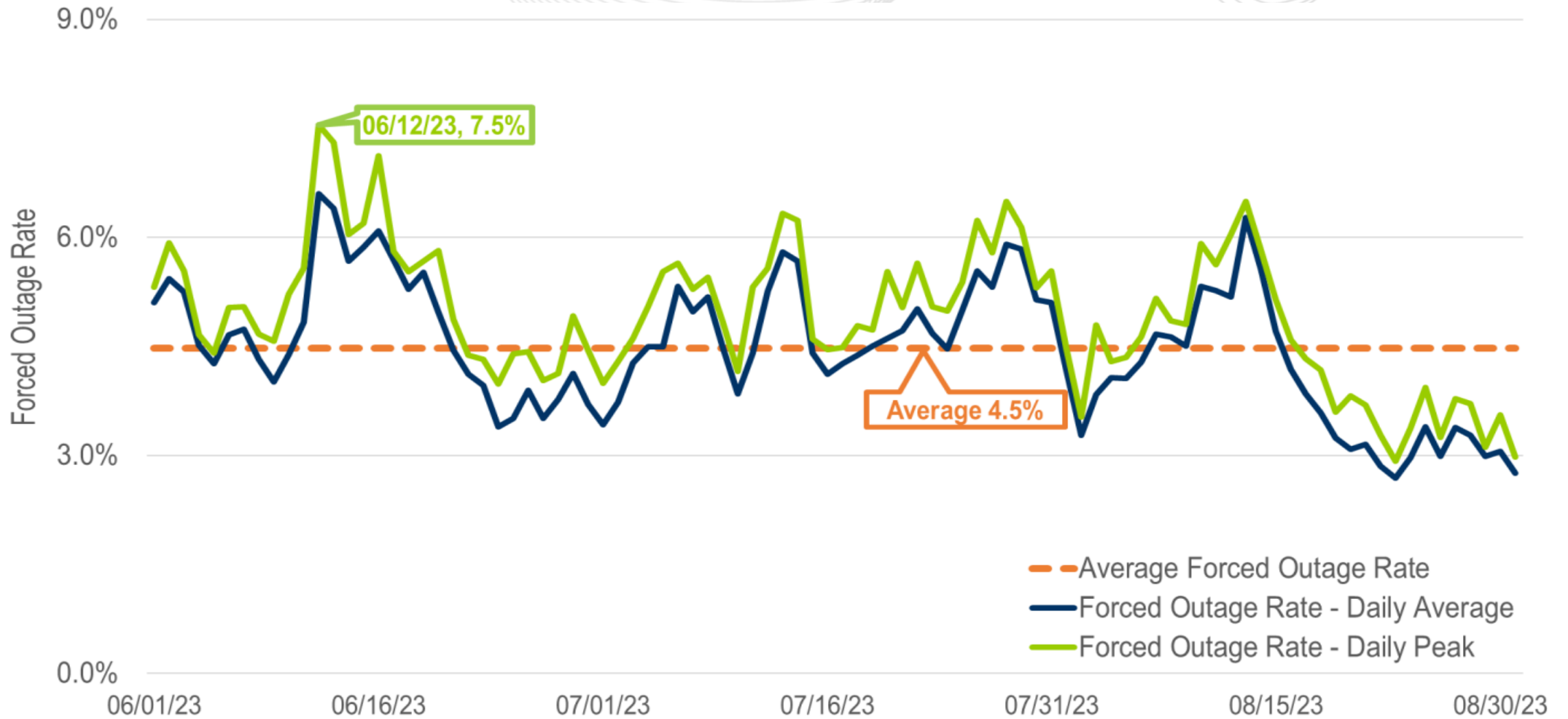
Historic Online Fuel Mix for all Summer Hours



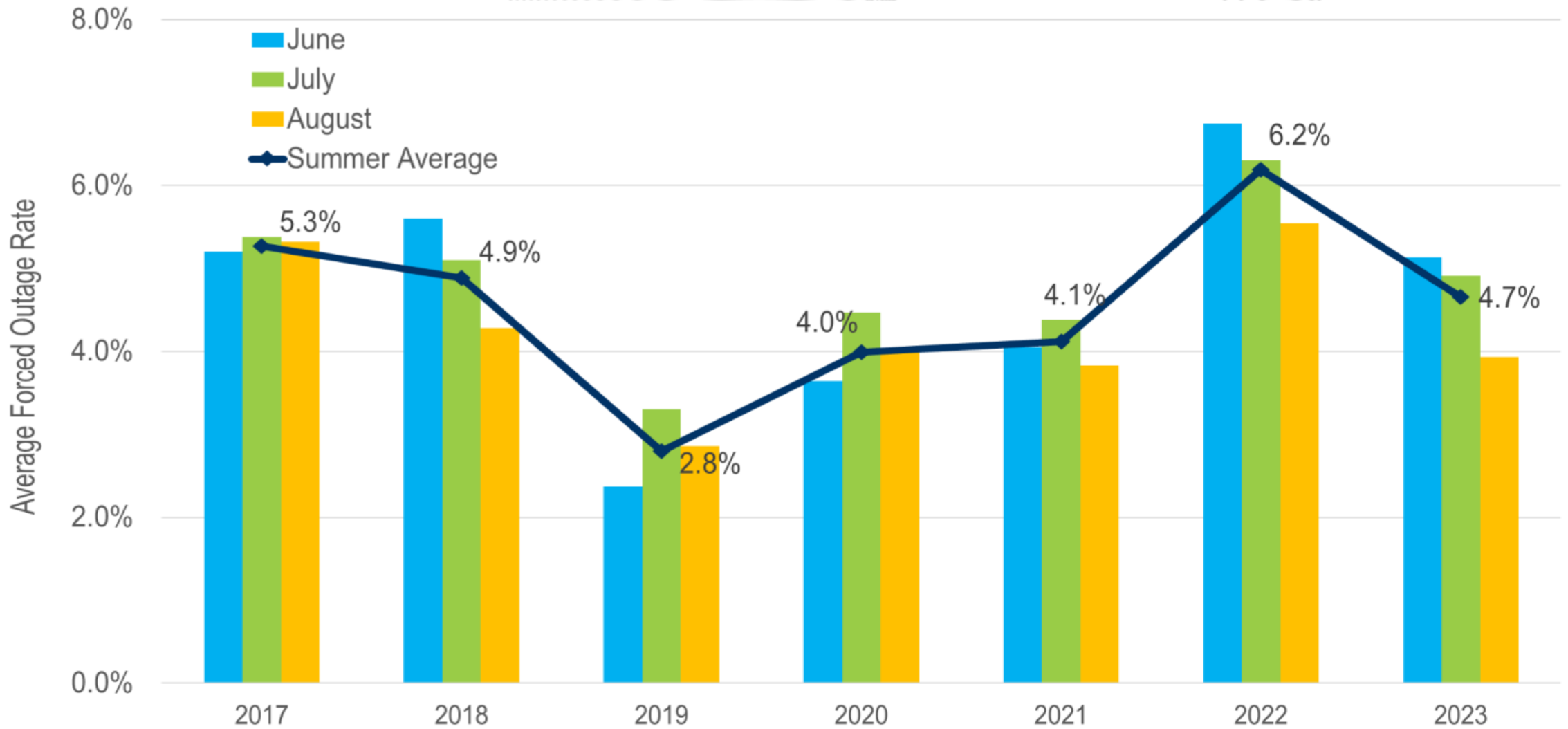
Renewable Performance for all Summer Hours



- The following slides show the daily average and daily maximum forced outage rates, as well as the historic average forced outage rates, respectively.
- The 2023 daily data is sourced from eDART. The historic data is from GADS.
- Overall, forced outage rates for summer of 2023 are very much in-line with recent summers, excluding 2022.



Historical Forced Outage Rates - GADS



Facilitator: Anita Patel
Anita.Patel@pjm.com

Secretary: Vy Le
Vy.Le@pjm.com

SME: Jennifer Warner-Freeman
Jennifer.Freeman@pjm.com

Summer Operations Report



Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

**PROTECT THE
POWER GRID
THINK BEFORE
YOU CLICK!**



Be alert to
malicious
phishing emails.

Report suspicious email activity to PJM.
(610) 666-2244 / it_ops_ctr_shift@pjm.com

