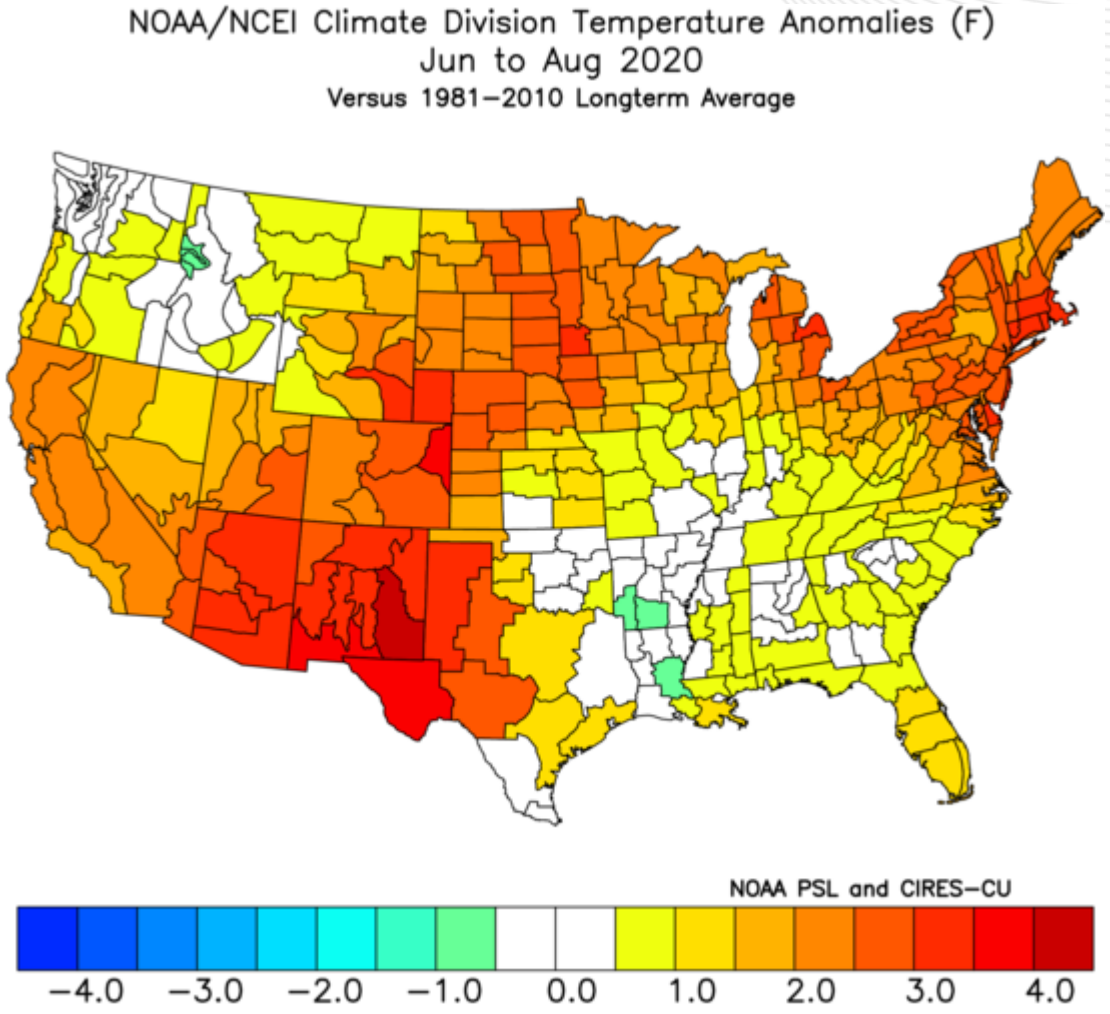
Summer Operations of the PJM Grid: June 1, 2020 – September 15, 2020

Operating Committee

November 6, 2020

Summer 2020 Overview

Average Temperature Jun. 1 – Sep. 15



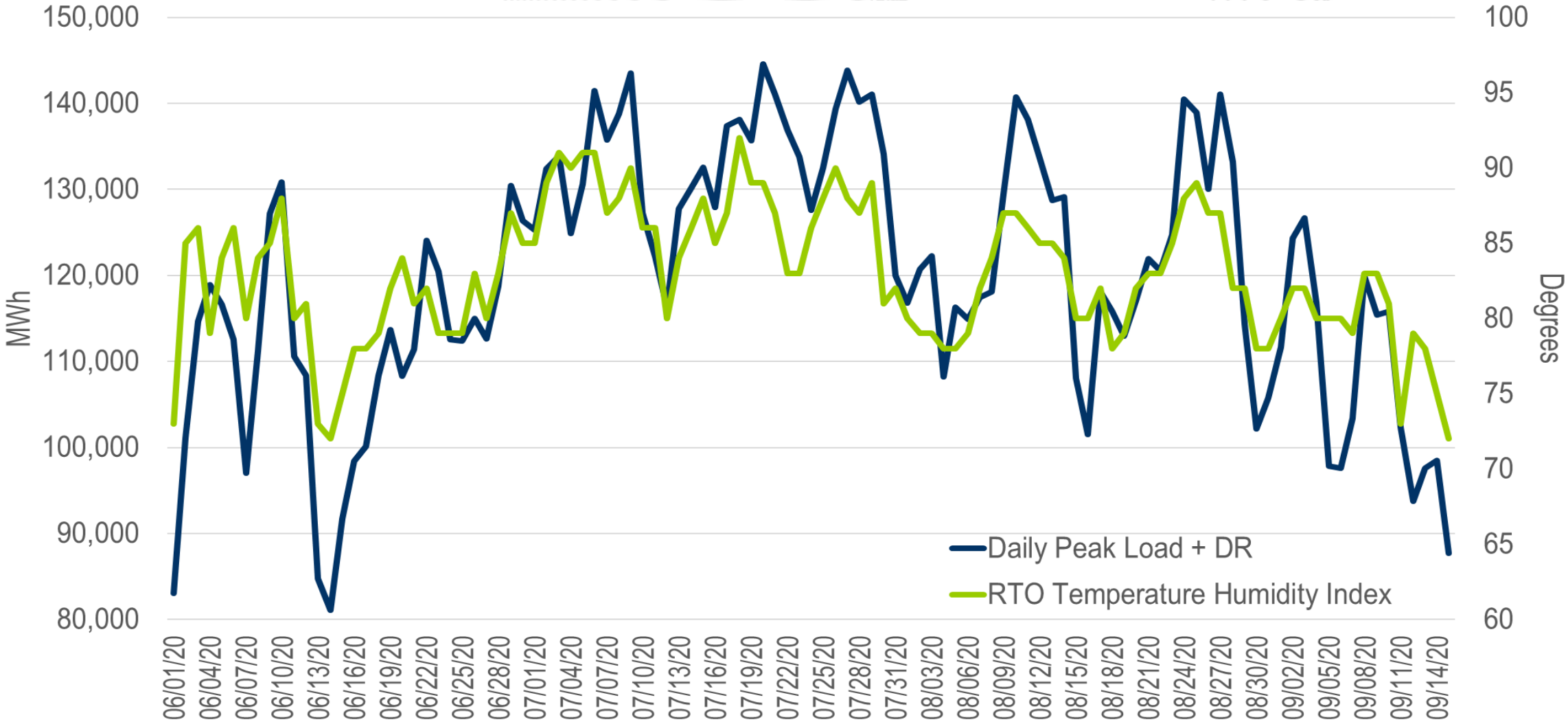
Source: https://www.esrl.noaa.gov

- Temperatures were above normal across the RTO this summer.
- While temperatures were above normal in general, PJM did not experience any periods of extreme heat.
- Twenty Hot Weather Alerts were issued this summer.
- Fifteen of the Hot Weather Alerts occurred in July.

Daily RTO Peak Load and Temperature Humidity Index

- 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.

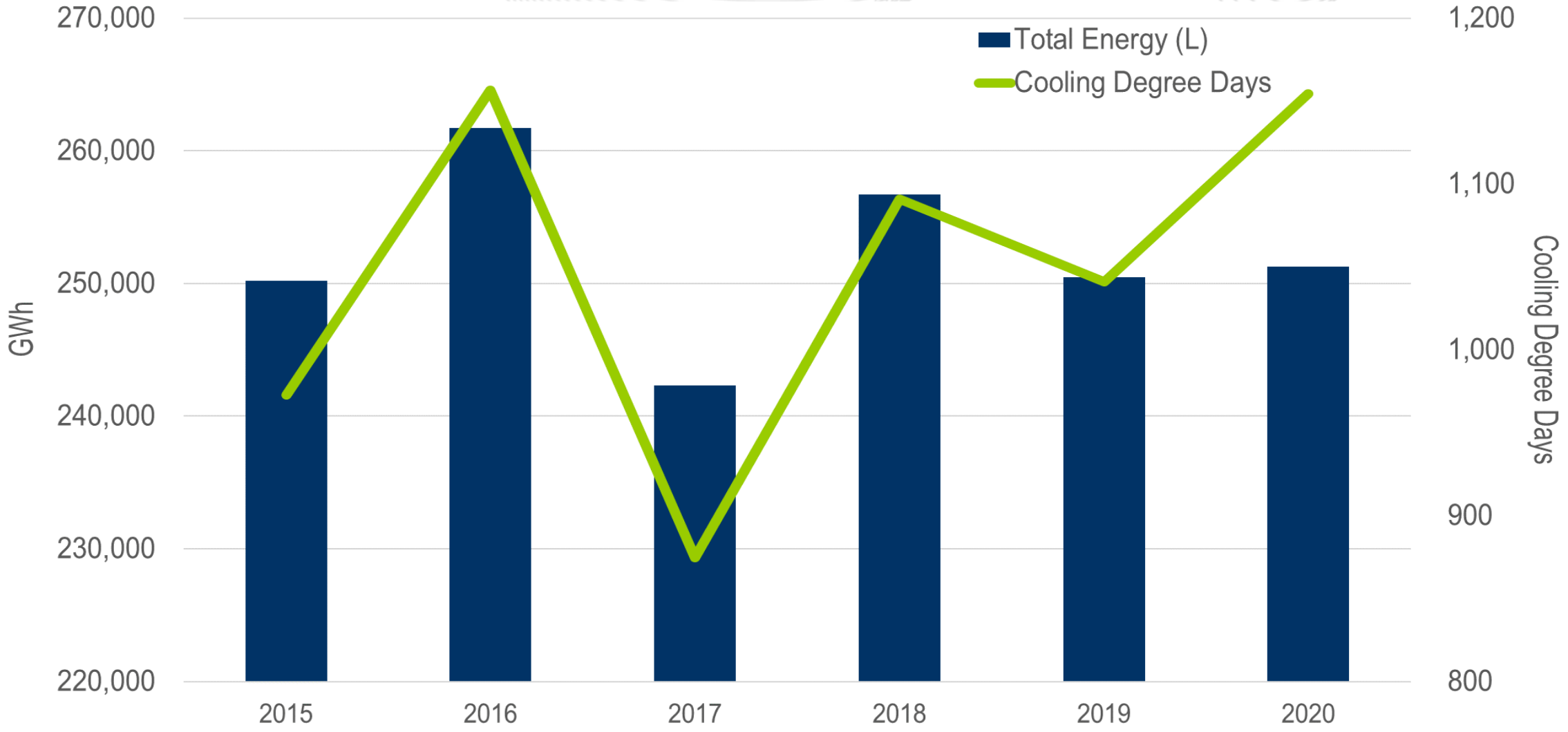
Daily RTO Peak Load and Temperature Humidity Index



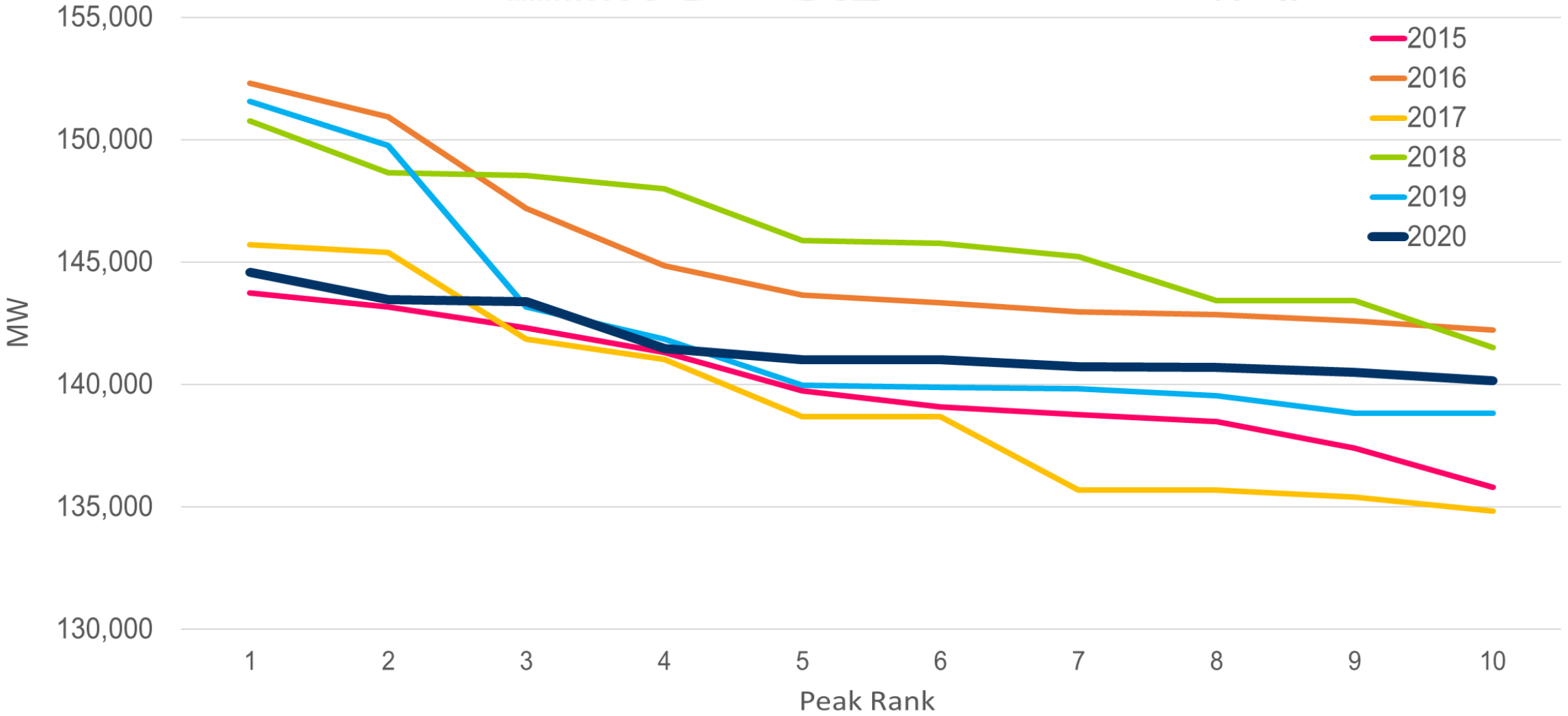
Historic Load and Weather

- 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.
- Cooling degree days were higher in 2020 than in recent summers, but total energy use was dampened due to Corona Virus impacts.

Historic Total Energy and Cooling Degree Days



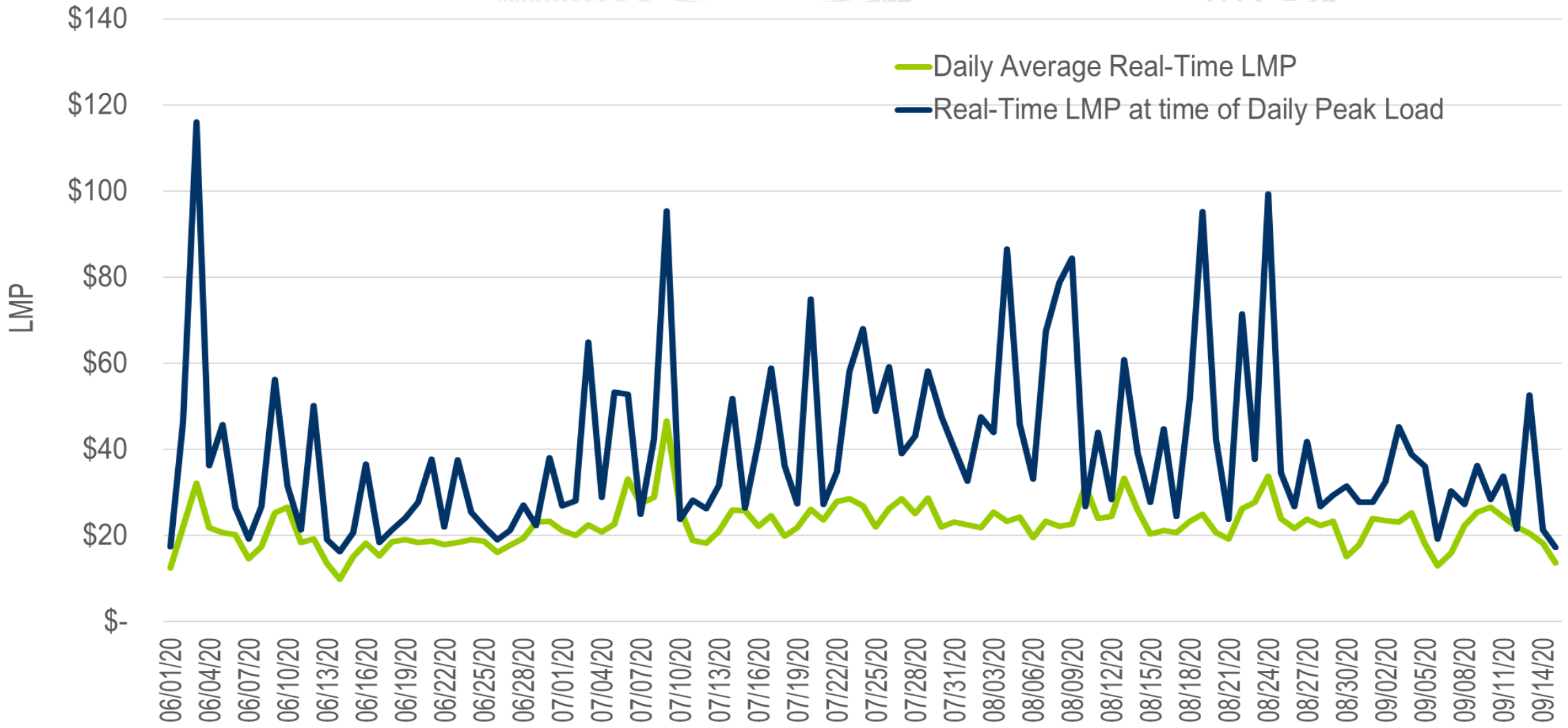
Top 10 Summer Peaks by Year



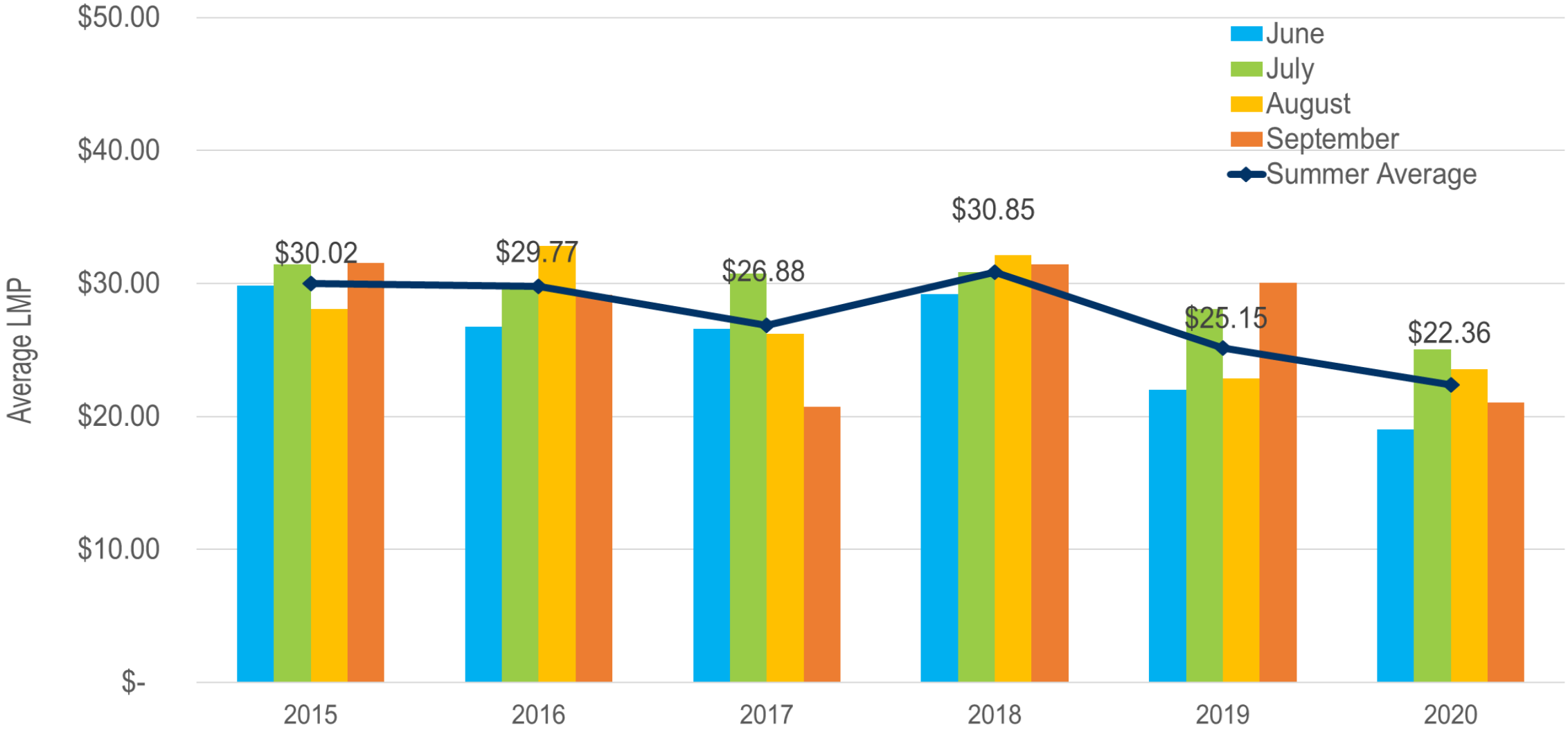
Real Time Locational Marginal Prices

- 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 low all summer. Only six hours over the course of the entire summer, considering all hours, exceeded $100.
- Lower loads due to Corona Virus impacts contributed to low LMPs.

Daily Average and Peak Real Time LMPs



Historic Summer Average Real Time LMPs



Summer Uplift

- The following slide shows uplift for the past six summers.
- Despite low loads and LMPs, uplift in the summer of 2020 was higher than in 2019, a year that exhibited historically low levels of uplift.
- Reasons may include load forecast uncertainty due to Corona Virus impacts, and low LMPs not supporting units running economically for the duration of their minimum run times.

Summer Uplift

Operations

Emergency Procedures

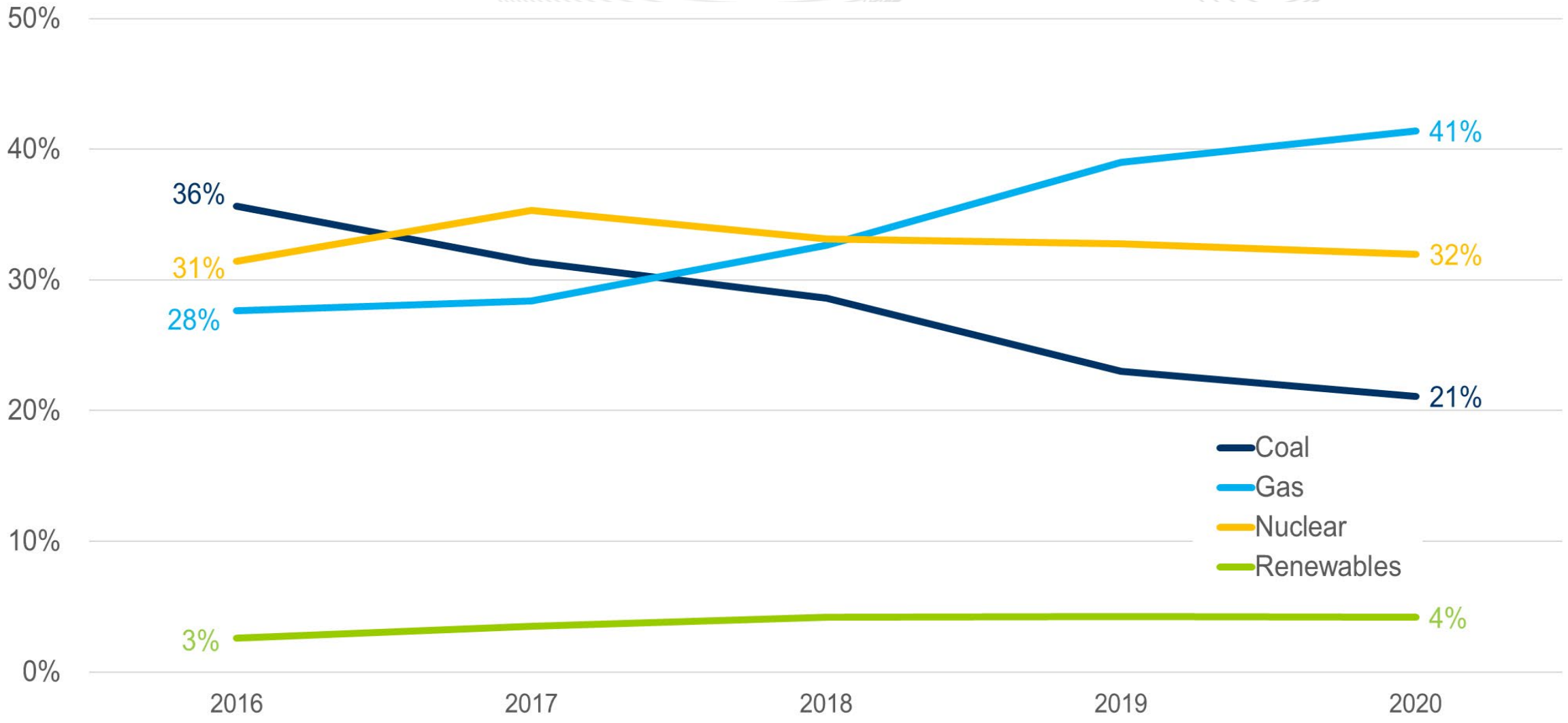
Emergency Procedure	2015	2016	2017	2018	2019	2020
100% Spinning Reserve - RTO and/or MAD	5	7	4	11	3	4
High System Voltages	17	5	8	1	0	1
Minimum Generation Alert	26	12	20	3	0	0
Manual Load Dump Warning or Action	1	0	0	1	0	0
Hot Weather Alert - Any Region	17	23	15	19	13	20
Total	**66**	**47**	**47**	**35**	**16**	**25**

- Aside from Hot Weather Alerts, there were relatively few Emergency Procedures enacted this summer.
- The high number of Hot Weather Alerts corresponds with the high number of Cooling Degree Days on slide 7.

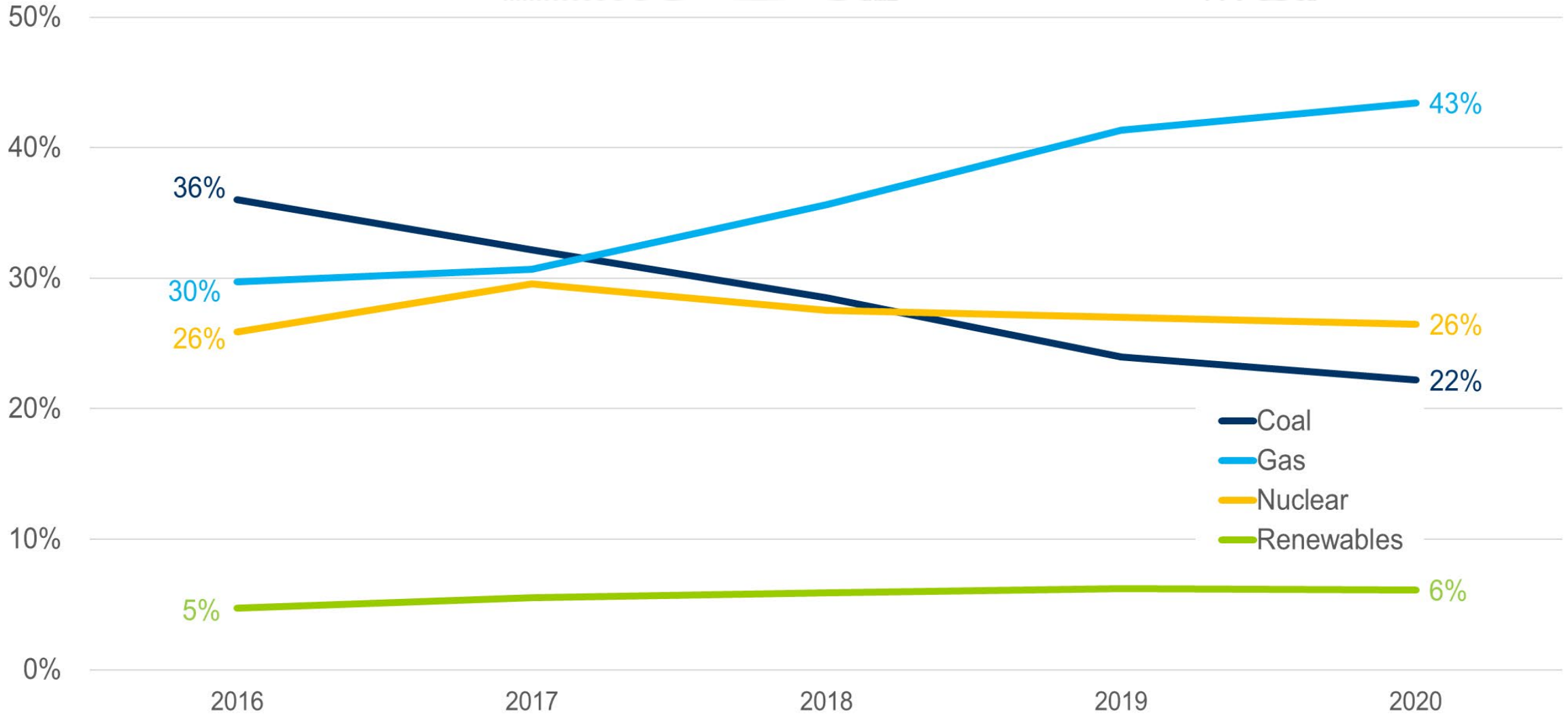
On-line Generation

- The following slides show the fuel mix of on-line generation for the past five summers for all hours, and for the daily peak hours, respectively. Following this, are slides breaking out average wind and solar performance for the same categories.
- Since the summer of 2016, natural gas has overtaken coal as the most utilized online fuel across all hours of the summer.
- Since the summer of 2016, renewables have increased their share of the on-line fuel mix both during peak hours and all other hours.

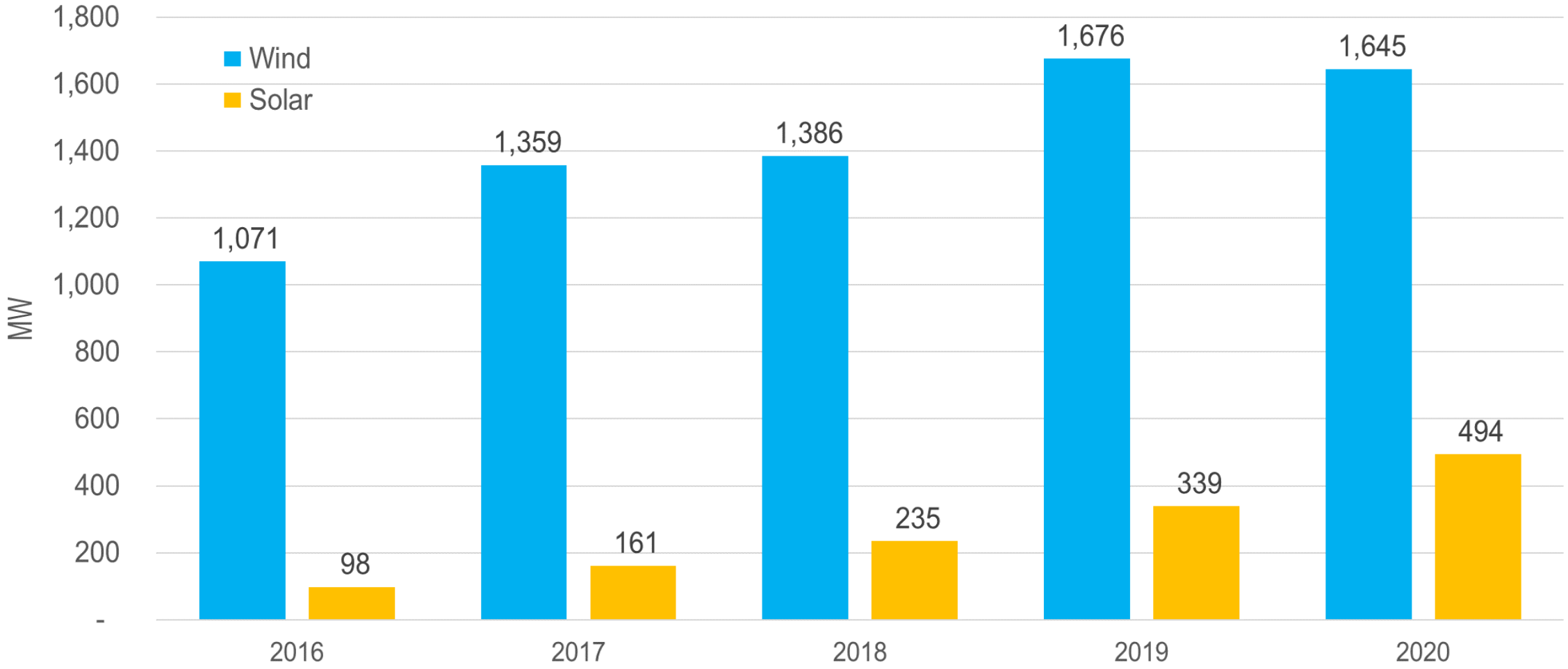
Historic Online Fuel Mix for all Summer Hours



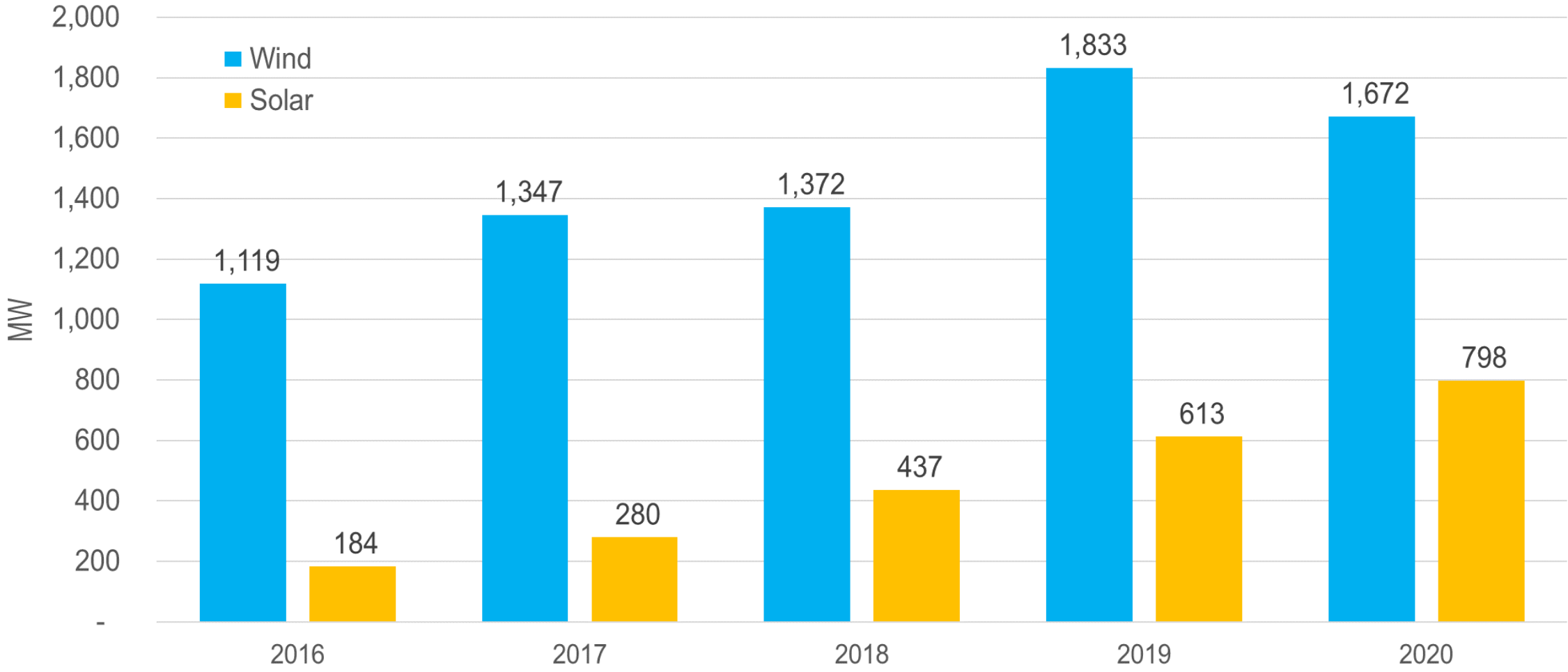
Historic Online Fuel Mix for Summer Daily Peak Hours



Renewable Performance for all Summer Hours



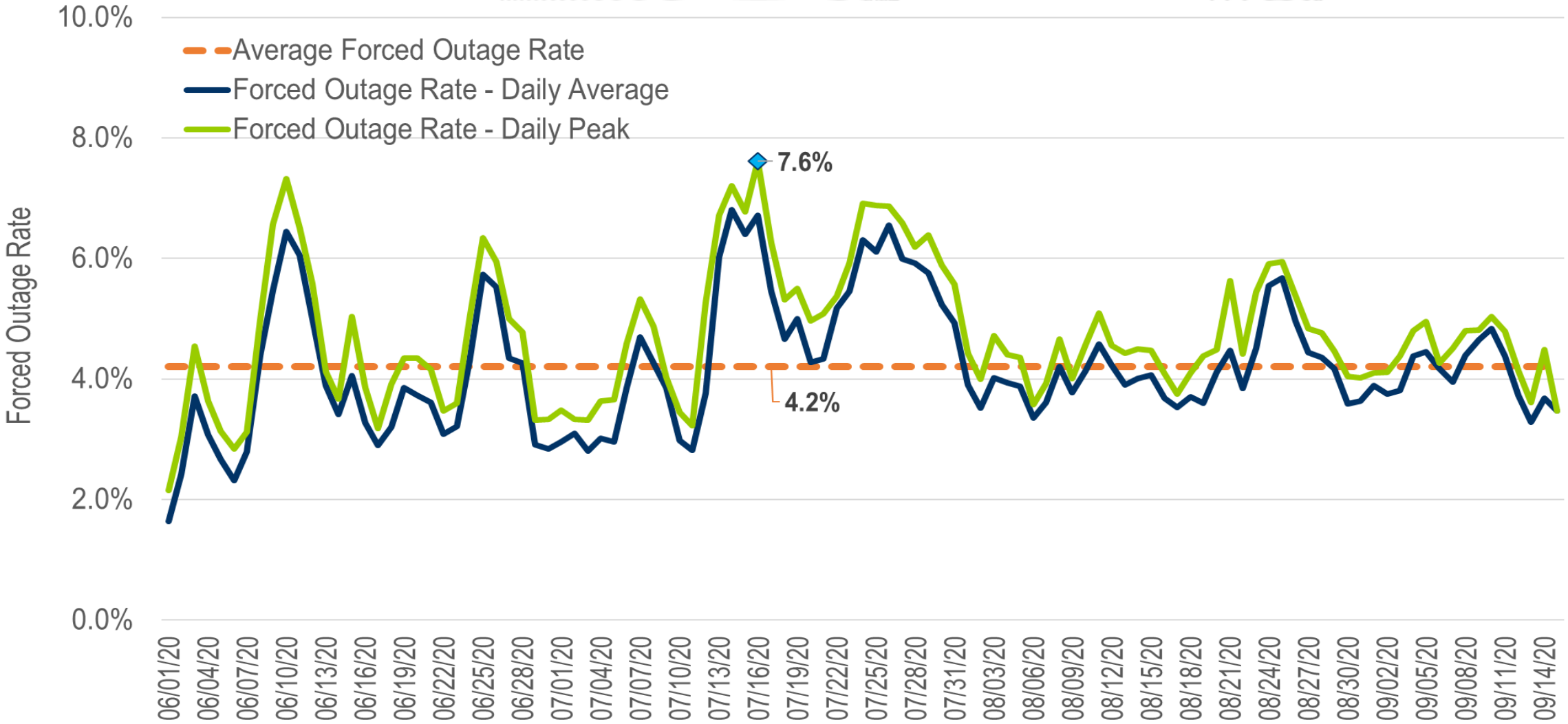
Renewable Performance for Summer Daily Peak Hours



Forced Outage Rates

- The following slides show the daily average and daily maximum forced outage rates, as well as the historic average forced outage rates, respectively.
- The 2020 daily data is sourced from eDART, however, historical data is from GADS.
- GADS data for September is for the entire month of September, not just September 1-15.
- Final GADS data for September 2020 is not yet available.

Daily Forced Outage Rates - eDART



Historical Forced Outage Rates - GADS