



2021 Fuel Security Analysis at “1 in 10” UCAP Reserves

Patricio Rocha Garrido
Resource Adequacy Planning
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- The 2021 Fuel Security (FS) Analysis, whose results were presented at the OC and MRC a few months ago, was modified to simulate the performance of a portfolio that just meets the 1 in 10 LOLE criterion from a UCAP reserves perspective under extreme winter weather conditions

(Modified) Fuel Security Methodology Overview

Inputs

- Winter hourly load shapes derived from historical cold snaps
- Forced outage rates (winter/fuel-related and random)
- Wind/solar hourly shapes
- ~~Generic disruptions of variable impact~~

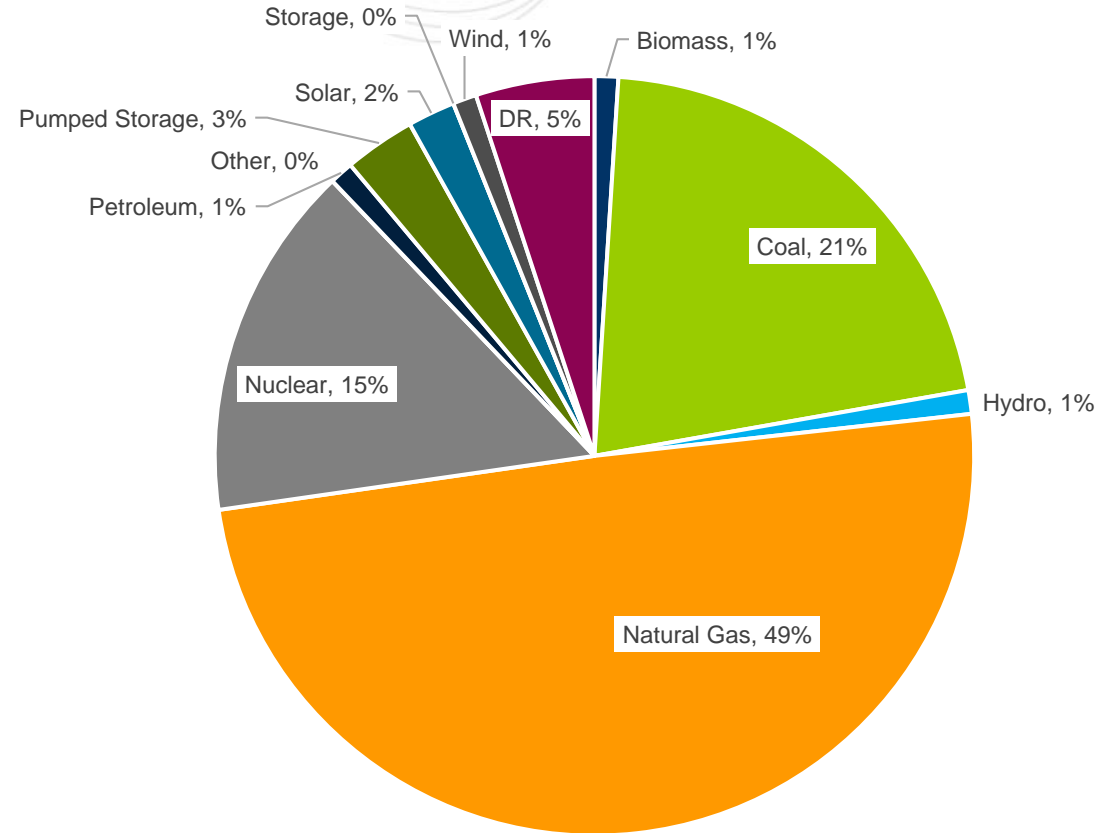
Output

- Calculate conditional LOLE based on each historical cold snap

- The total UCAP in the 2026/27 RTEP Portfolio adjusted for deactivations is 191,365 MW
- The “FPR” that puts the case at 1 in 10 based on the 2021 Reserve Requirement Study is 1.1027
- Therefore, the annual peak load in the analysis should be $191,365 / 1.1027 = 173,542$
- Since the annual peak load used in the FS Analysis was 152,290, all loads in the 1 in 10 analysis were multiplied by $173,542 / 152,290 = \mathbf{1.13955}$

4,561 UCAP MW removed from 2026/27 RTEP Portfolio to reflect Deactivation Requests (as of 6/28/2021)

- Nuclear removed: 2,305 MW; Coal removed: 2,206 MW

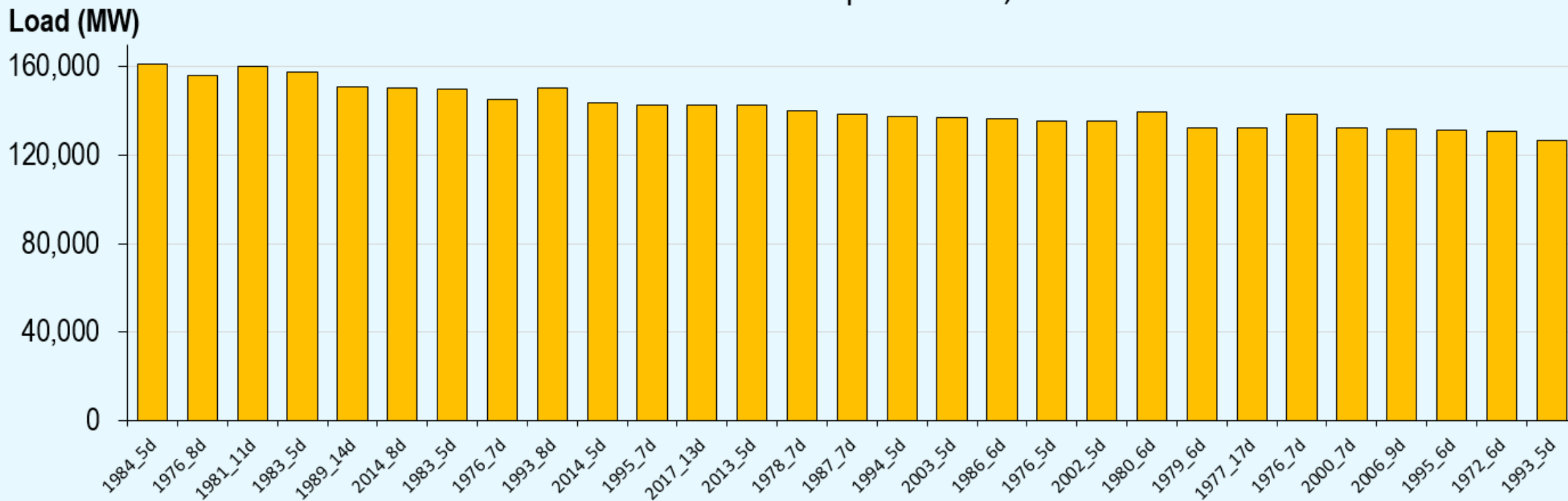


- Load Shapes: 48 winter load shapes (one for each year in the period 1972-2019) are examined.
 - Hourly load shapes are only derived for cold snap periods
 - Shape seeks to answer the question, if the weather pattern that occurred during a historical cold snap were to repeat itself, what would be the 2026/27 RTO hourly loads?
 - Based on 2021 PJM Load Forecast

Analyzed 29 Cold Snap Scenarios, Consistent with 2021 PJM Load Forecast:

Cold snap peaks range from 126,000 MW to 161,000 MW

All-time PJM winter peak is 142,856 MW



1. Random Forced Outages for thermal units: modeled using Monte Carlo based on GADS metrics calculated using cause codes not associated with fuel/weather issues
2. Weather (inc. Fuel) Related Forced Outages for thermal units: modeled using hourly profiles derived by fuel type (using cause codes associated with fuel/weather issues) from 4 most recent cold snaps
3. Wind/solar: modeled using hourly profiles from 4 most recent cold snaps
4. Demand Response: modeled assuming 100% availability during performance window, 6 AM – 9 PM (0% outside window)

- **Base Case – All 4 unavailability types are modeled**
 - 7 cold snaps show a Conditional LOLE greater than 0
 - Cold snaps with more risk:
 - Winter 84/85: Conditional LOLE 1.81 days/winter, Conditional LOLH 8.6 hours/winter, Conditional EUE: 41,228 MWh/winter
 - Winter 81/82: Conditional LOLE 1.26 days/winter, Conditional LOLH 5.5 hours/winter, Conditional EUE: 19,298 MWh/winter
- **Sensitivity Cases show that**
 - Fuel/weather Related Forced Outages are the most significant source of loss of load risk
 - The limited performance window of DR resources during winter is an important source of loss of load risk

- Base case results produce high winter Conditional LOLE values; this risk is **in addition** to the summer season LOLE, which is 0.1 days/year
 - Under some of the most extreme cold snaps the expected amount of unserved energy is very high (greater than 20,000 MWh)
- The major contributor to the winter LOLE is the modeled Fuel/Weather related forced outages of thermal units
- Another important contributor to the winter LOLE is the limited performance window of Demand Resources

- Key considerations for interpreting this analysis:
 - Portfolio at 1 in 10 UCAP reserves
 - Fuel/weather related FO from 4 most recent cold snaps
 - Load shapes derived from cold snaps back to 70s, 80s
 - Assumed availability of Demand Resources during performance window (100%) and outside performance window (0%)

SME / Presenter:

Patricio Rocha Garrido,
patricio.rocha-garrido@pjm.com

**2021 Fuel Security Analysis at “1 in 10” UCAP
Reserves**



Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

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