2026/27 BRA IRM, FPR, and ELCC Class Ratings
Shift Towards More Winter Risk

Josh Bruno, Molly Mooney, Patricio Rocha Garrido

Resource Adequacy Planning
Special Planning Committee
March 13, 2025

Presentation Overview

- Summary of 2026/27 BRA Results
  - Installed Reserve Margin
  - Forecast Pool Requirement
  - ELCC Class Ratings
- Drivers of winter risk shift
  - Demand and Supply side analysis

2026/27 BRA Results

Highlights on Data Inputs

1. **Resource Mix**
   a. **Notice of Intent to Offer (NOI):**
      Planned resources that submitted a Notice of Intent for the 2026/2027 BRA were included in the Assumed Resource Mix
   b. **Installed Capacity Ratings (ICAP Ratings):**
      Resources ICAP Ratings were updated to reflect any 2026/2027 transitional system capability awarded
   c. **Announced Deactivations:**
      All resources with announced deactivations scheduled to occur before June 1st, 2027 were removed from the assumed resource mix
2. **Load Scenarios:**
   Hourly load profiles were derived using the 2025 PJM load forecast
3. **Performance Data:**
   Based on data from June 1st, 2012 through May 31st, 2024

2026/27 Assumed Resource Portfolio

ELCC Class	Effective Nameplate (MW)	Installed Capacity (MW)
Onshore Wind	11,650	3,549
Offshore Wind	Small Sample Size	Small Sample Size
Fixed-Tilt Solar	2,367	1,189
Tracking Solar	13,321	8,713
Intermittent Landfill Gas	167	118
Intermittent Hydropower	736	519
Capacity Storage Resource (4, 6, 8, 10 Hour Duration)	5,834	5,834
Solar-Storage Hybrid	Small Sample Size	Small Sample Size
Demand Resource	n/a	8,184
Nuclear	n/a	32,144
Coal	n/a	35,779
Gas Combined Cycle + Gas Combined Cycle Dual Fuel	n/a	57,664
Gas Combustion Turbine	n/a	11,030
Gas Combustion Turbine Dual Fuel	n/a	13,158
Diesel Utility	n/a	329
Steam	n/a	10,004
Hydropower with Non-Pumped Storage	2,034	1,969
Other Unlimited Resource	n/a	3,041

2026/27 ELCC Class Ratings

ELCC Class	Class Rating
Onshore Wind	41%
Offshore Wind	69%
Fixed-Tilt Solar	8%
Tracking Solar	11%
Intermittent Landfill Gas	50%
Intermittent Hydropower	38%
Capacity Storage Resource (4-Hour Duration)	50%
Capacity Storage Resource (6-Hour Duration)	58%
Capacity Storage Resource (8-Hour Duration)	62%
Capacity Storage Resource (10-Hour Duration)	72%
Demand Resource	69%
Nuclear	95%
Coal	83%
Gas Combined Cycle	74%
Gas Combustion Turbine	60%
Gas Combustion Turbine Dual Fuel	78%
Diesel Utility	91%
Steam	73%

2025/26 3IA Final ELCC Class Ratings vs 2026/27 BRA Ratings

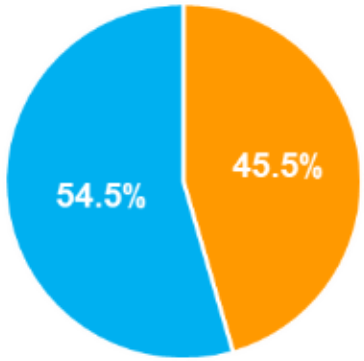
ELCC Class	2025/26 3IA Rating	2026/27 BRA Rating	Change (%)
Onshore Wind	38%	41%	+3
Offshore Wind	62%	69%	+7
Fixed-Tilt Solar	10%	8%	-2
Tracking Solar	14%	11%	-3
Intermittent Landfill Gas	51%	50%	-1
Intermittent Hydropower	37%	38%	+1
Capacity Storage Resource (4-Hour Duration)	55%	50%	-5
Capacity Storage Resource (6-Hour Duration)	65%	58%	-7
Capacity Storage Resource (8-Hour Duration)	68%	62%	-6
Capacity Storage Resource (10-Hour Duration)	77%	72%	-5
Demand Resource	77%	69%	-8
Nuclear	95%	95%	-
Coal	83%	83%	-
Gas Combined Cycle	78%	74%	-4
Gas Combustion Turbine	63%	60%	-3
Gas Combustion Turbine Dual Fuel	79%	78%	-1
Diesel Utility	92%	91%	-1
Steam	74%	73%	-1

- Changes in Class Ratings are consistent with a greater share of winter risk
- In addition to the winter risk, Gas Combined Cycle Class Rating is also being driven by changes in class membership
  - About 3,800 MW shifted from the Gas Combined Cycle Class to the Gas Combined Cycle Dual Fuel Class which contributed ~1-2% in the decrease of the Gas Combined Cycle Class Rating

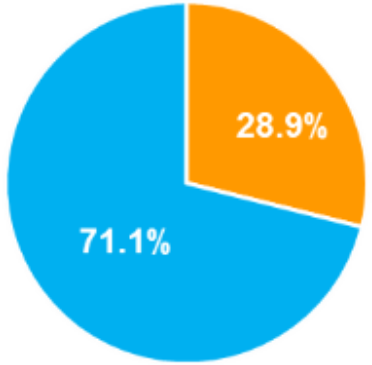
Seasonal Changes in 25/26 3IA vs 26/27 BRA

2025/26 3rd IA

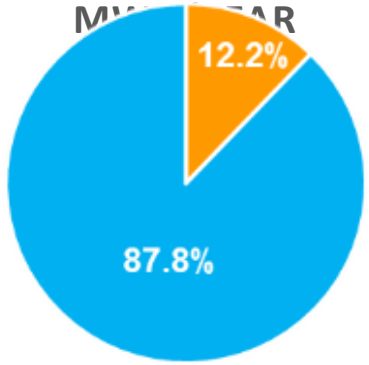
SEASONAL SHARE OF LOLE = 0.1 DAYS/YEAR



SEASONAL SHARE OF LOLH = 0.336 HOURS/YEAR

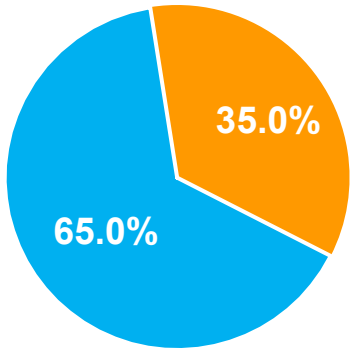


SEASONAL SHARE OF EUE = 1474.2 MW[illegible]AR

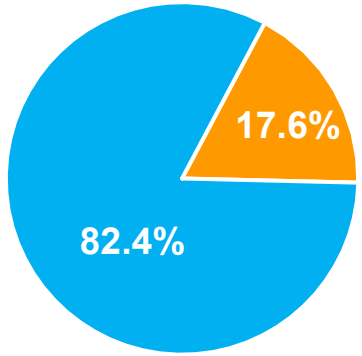


2026/27 BRA

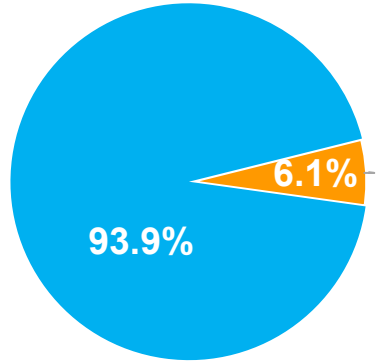
SEASONAL SHARE OF LOLH = 0.1 DAYS



SEASONAL SHARE OF LOLH = 0.397 HOURS/YEAR



SEASONAL SHARE OF EUE = 1963.3 MWH/YEAR



Summer

Winter

2026/27 BRA IRM and FPR

- The total amount of **ICAP** in the model is **193,738 MW**
- The **peak load** ("solved load") that the above amount of ICAP can serve while meeting the LOLE criteria of 1 day in 10 years is **160,682 MW**
- The **Capacity Benefit of Ties** (CBOT) is assumed to be **1.5%**, the same value used in previous calculations
- Therefore, the **2026/27 BRA IRM** equals **19.1%**:
  - IRM = [(193,738 / 160,682) – 1] – 1.5%
  - IRM = [1.206 – 1] – 0.015 = 19.1%
- The total amount of **Accredited UCAP** in the model is **149,149 MW**
- The **Pool-Wide Average AUCAP Factor** is 149,149 / 193,738 = **0.7699**
- Therefore, the **2026/27 BRA FPR** equals **0.9170**
  - FPR = (1 + 0.191) x 0.7699 = 0.9170

2025/26 3IA IRM and FPR vs 2026/27 BRA

Parameter	3rd IA Value	BRA Value	Change	Driving Factor
ICAP (MW)	188,920	193,738	4,818	Resource Mix Changes (primarily NOIs)
“Solved Load” (MW)	158,357	160,682	2,325	Higher ICAP offset by Higher Extreme Winter Loads
CBOT (%)	1.5%	1.5%	0%	n/a
Installed Reserve Margin (IRM)	17.8%	19.1%	1.3%	Resource Mix Changes and Higher Extreme Winter Loads
Accredited UCAP (MW)	150,438	149,149	-1,289	Higher Extreme Winter Loads
Pool-Wide Average UCAP Factor	0.7963	0.7699	-0.0264	Higher Extreme Winter Loads
Forecast Pool Requirement (FPR)	0.9380	0.9170	-0.021	Lower UCAP Factor

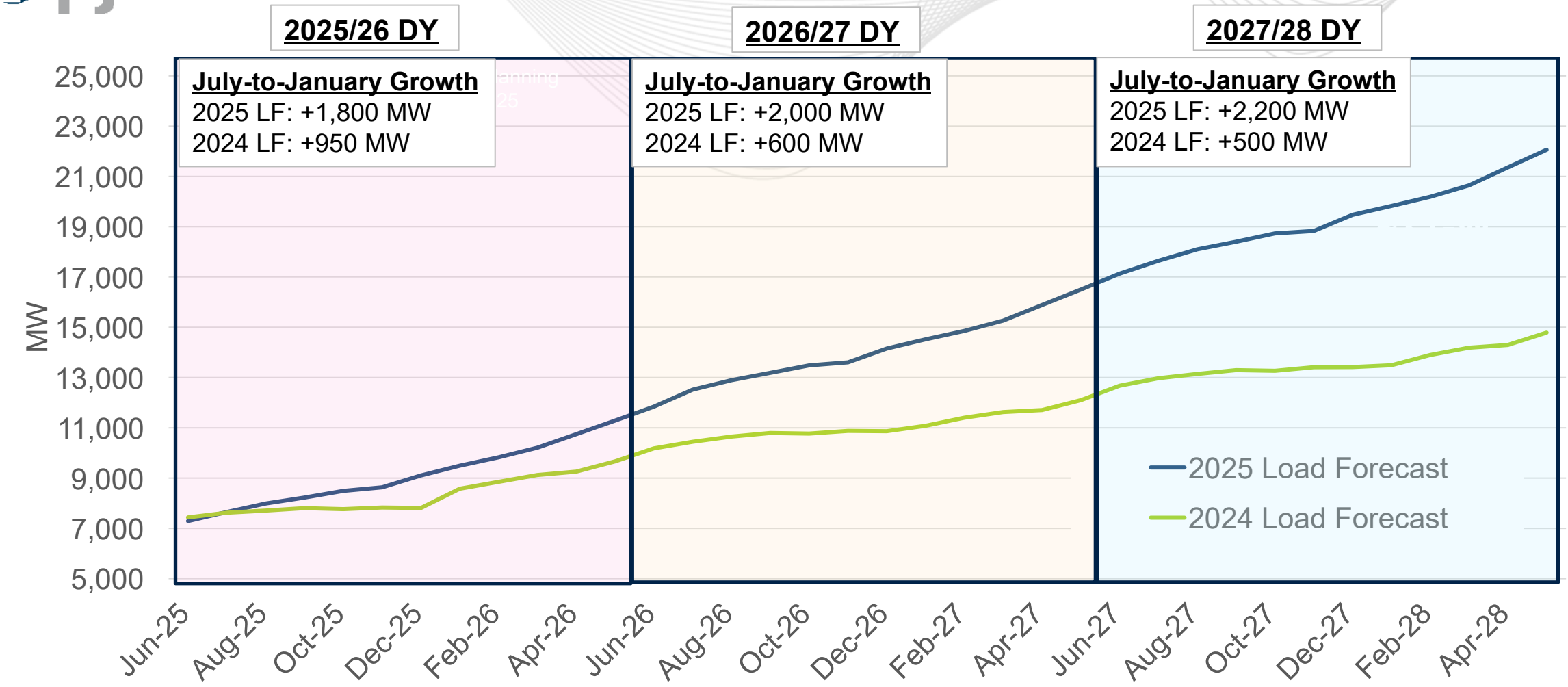
Drivers Towards Winter Risk

- The PJM ELCC Model has the following objective
  - Accredit resources based on the expected performance during expected hours and days of risk during a future Delivery Year
- To accomplish that, it is necessary to:
  1. Identify the **expected hours and days** of risk given expected hourly patterns of supply and demand for a delivery year
  2. Identify the **expected marginal performance of resources** during the hours and days identified in #1

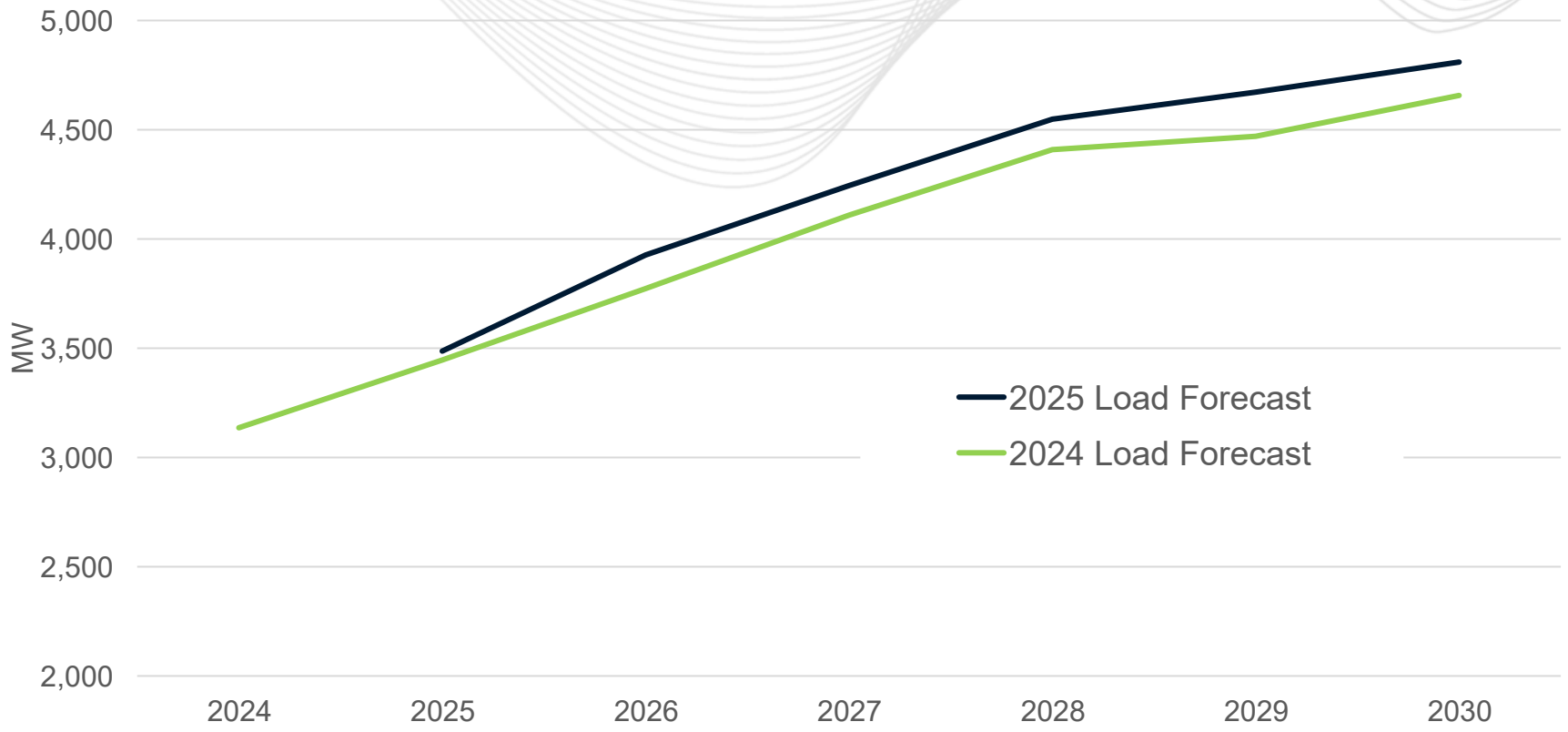
Demand – Load Growth in Winter vs. Summer

- **Narrowing Gap**: For the RTO, the gap between winter and summer peaks is narrowing.
- **Primary Reasons**:
  - Delivery Year: Runs from June to May.
  - Data Centers: Rapid growth is causing more load in January than the preceding summer. (approximately 60%)
  - Rooftop Solar: Growth in rooftop solar reduces summer peaks, but has minimal impact on winter peaks. (approximately 20%)
  - Forecasted trends: Effects of electrification of heating on the system (heat pumps). (approximately 20%)

Load Adjustment Impact on Load Shape – 2025LF vs 2024LF

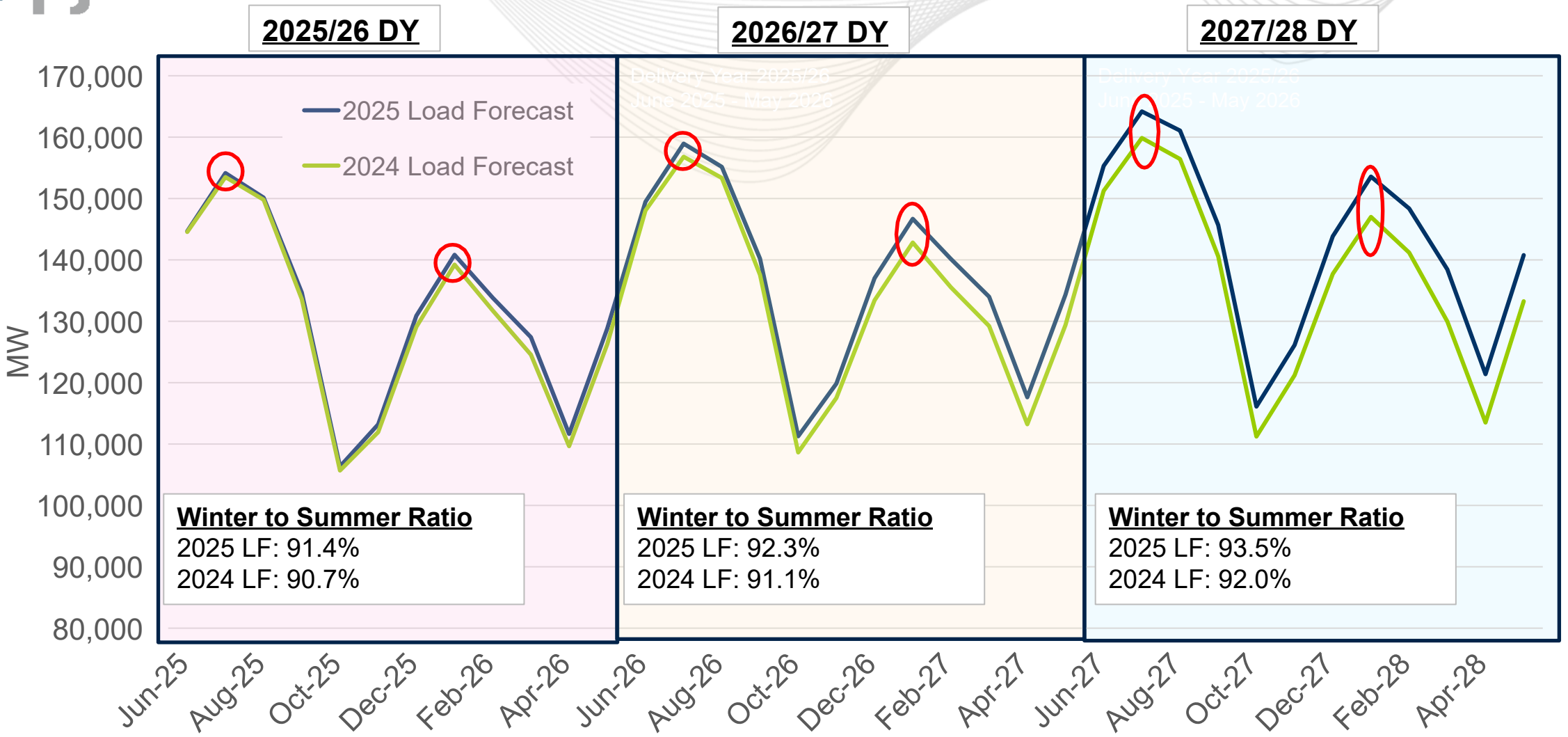


Distributed Solar – Impact at Summer Peak

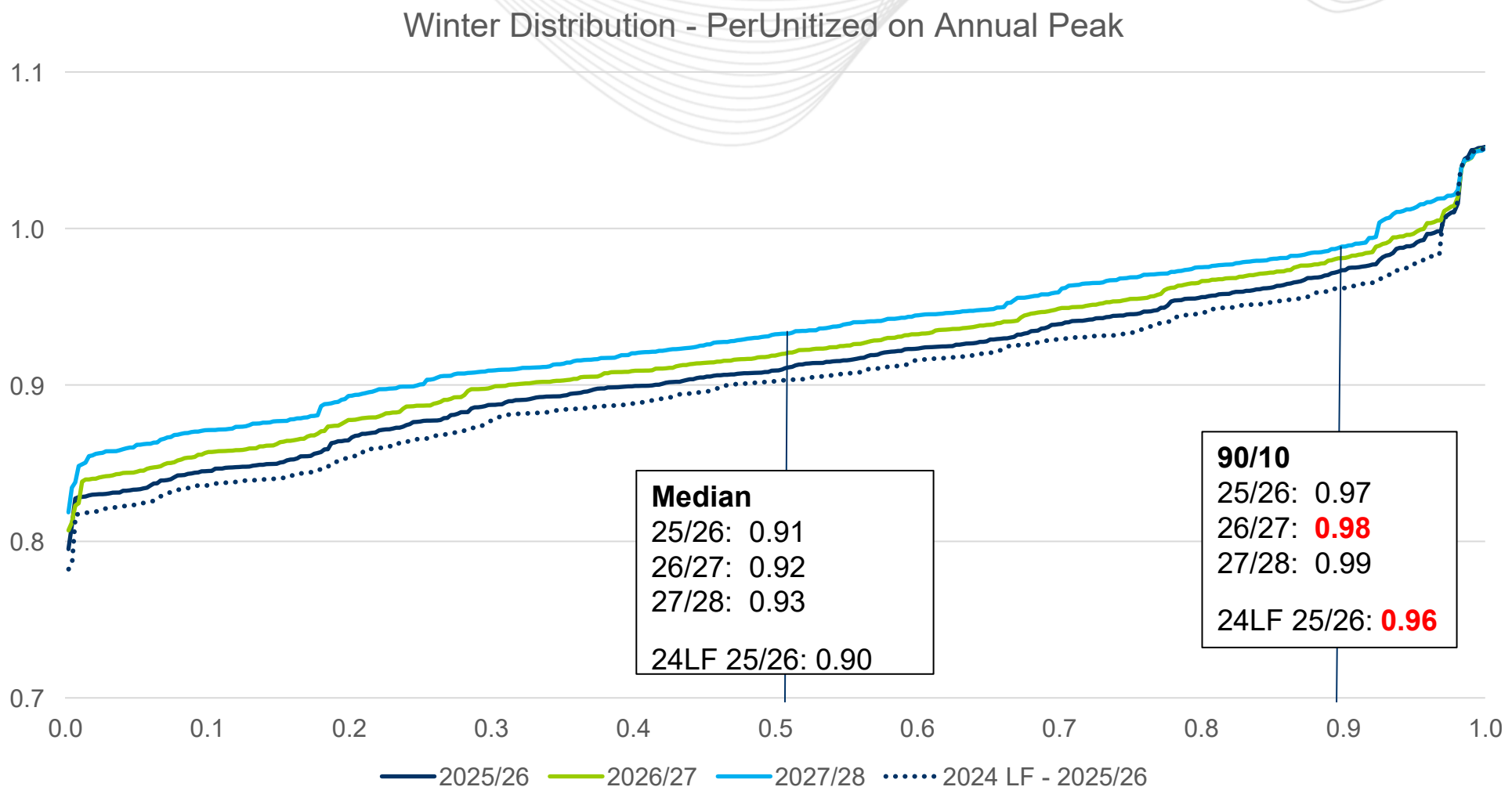


Winter impact from distributed solar is essentially zero due to time of peak.

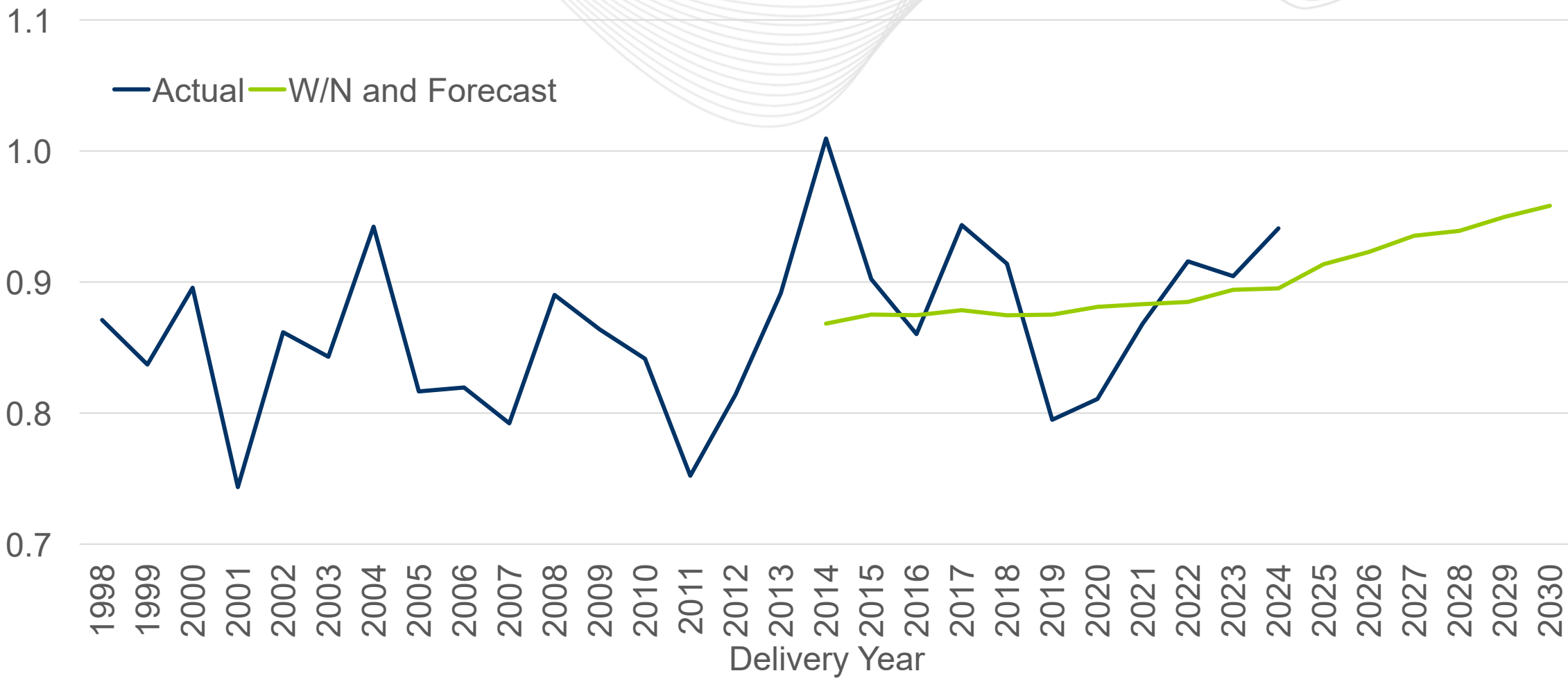
Monthly Demand Shape- 2025LF vs 2024LF



Winter Peak Load Distributions



Winter to Summer Peak Ratio



Understanding the 26/27 BRA Class Ratings relative to 25/26 3IA Class Ratings - Supply

ELCC Class	Installed Capacity (MW) 26/27 BRA	Installed Capacity (MW) 25/26 3IA	Difference (MW)
Onshore Wind	3,549	2,293	+1,256
Offshore Wind	Small Sample Size	Small Sample Size	
Fixed-Tilt Solar	1,189	832	+357
Tracking Solar	8,713	7,152	+1,561
Intermittent Landfill Gas	118	118	0
Intermittent Hydropower	519	519	0
Capacity Storage Resource (4, 6, 8, 10 Hour Duration)	5,834	5,609	+225
Solar-Storage Hybrid	Small Sample Size	Small Sample Size	
Demand Resource	8,184	7,934	+250
Nuclear	32,144	32,147	-3
Coal	35,779	36,044	-265
Gas Combined Cycle + Gas Combined Cycle Dual Fuel	57,664	56,719	+945
Gas Combustion Turbine	11,030	11,122	-92
Gas Combustion Turbine Dual Fuel	13,158	13,117	+41
Diesel Utility	329	333	-4
Steam	10,004	9,851	+153
Hydropower with Non-Pumped Storage	1,969	1,969	0
Other Unlimited Resource	3,041	3,151	-110

Relative to the size of the system the ICAP differences are not that significant.

In addition, some of the additions are likely to drive a reduction in winter risk (e.g. wind) while other additions are likely to drive an increase in winter risk (e.g. solar)

Sensitivity Analysis – Using 25/26 3IA Load Scenarios in 26/27 BRA Case

ELCC Class	2025/26 3IA Rating	2026/27 BRA Rating	Change (%)	2026/27 BRA Sensit. Rating	Change 26/27 Sensit. vs. 25/26 3IA (%)
Onshore Wind	38%	41%	+3	38%	0
Offshore Wind	62%	69%	+7	64%	+2
Fixed-Tilt Solar	10%	8%	-2	10%	0
Tracking Solar	14%	11%	-3	14%	0
Intermittent Landfill Gas	51%	50%	-1	52%	+1
Intermittent Hydropower	37%	38%	+1	37%	0
Capacity Storage Resource (4-Hour Duration)	55%	50%	-5	57%	+2
Capacity Storage Resource (6-Hour Duration)	65%	58%	-7	65%	0
Capacity Storage Resource (8-Hour Duration)	68%	62%	-6	68%	0
Capacity Storage Resource (10-Hour Duration)	77%	72%	-5	77%	0
Demand Resource	77%	69%	-8	76%	-1
Nuclear	95%	95%	0	95%	0
Coal	83%	83%	0	84%	+1
Gas Combined Cycle	78%	74%	-4	77%	-1
Gas Combustion Turbine	63%	60%	-3	64%	+1
Gas Combustion Turbine Dual Fuel	79%	78%	-1	80%	+1
Diesel Utility	92%	91%	-1	92%	0
Steam	74%	73%	-1	75%	+1

If the 25/26 3IA Load Scenarios would have been used in the 26/27 BRA Case, the ELCC Class Ratings would have been very similar to those in the 25 3IA. The changes are plus/minus 1 or 2 percentage points or no changes (see far-right column).

This also allows to conclude that the change to the 26/27 BRA resources portfolio is not a large driver of the change in the 26/27 ELCC Class Ratings

Sensitivity Analysis – Using 25/26 3IA Portfolio in 26/27 BRA Case

ELCC Class	2025/26 3IA Rating	2026/27 BRA Rating	Change (%)	2026/27 BRA Sensit. Rating	Change 26/27 Sensit. vs. 25/26 3IA (%)
Onshore Wind	38%	41%	+3	42%	+4
Offshore Wind	62%	69%	+7	69%	+7
Fixed-Tilt Solar	10%	8%	-2	8%	-2
Tracking Solar	14%	11%	-3	12%	-2
Intermittent Landfill Gas	51%	50%	-1	49%	-2
Intermittent Hydropower	37%	38%	+1	39%	+2
Capacity Storage Resource (4-Hour Duration)	55%	50%	-5	48%	-7
Capacity Storage Resource (6-Hour Duration)	65%	58%	-7	58%	-7
Capacity Storage Resource (8-Hour Duration)	68%	62%	-6	62%	-6
Capacity Storage Resource (10-Hour Duration)	77%	72%	-5	72%	-5
Demand Resource	77%	69%	-8	69%	-8
Nuclear	95%	95%	0	95%	0
Coal	83%	83%	0	82%	-1
Gas Combined Cycle	78%	74%	-4	75%	-3
Gas Combustion Turbine	63%	60%	-3	60%	-3
Gas Combustion Turbine Dual Fuel	79%	78%	-1	78%	-1
Diesel Utility	92%	91%	-1	91%	-1
Steam	74%	73%	-1	72%	-2

If the 25/26 3IA Resource Portfolio would have been used in the 26/27 BRA Case, the ELCC Class Ratings would have been very similar to those in the 26 BRA. The changes in the far-right column are very similar to the changes observed in the 26/27 ELCC Class Ratings.

This also allows to conclude that the 26/27 BRA load scenarios are the largest driver of the change in the 26/27 ELCC Class Ratings.

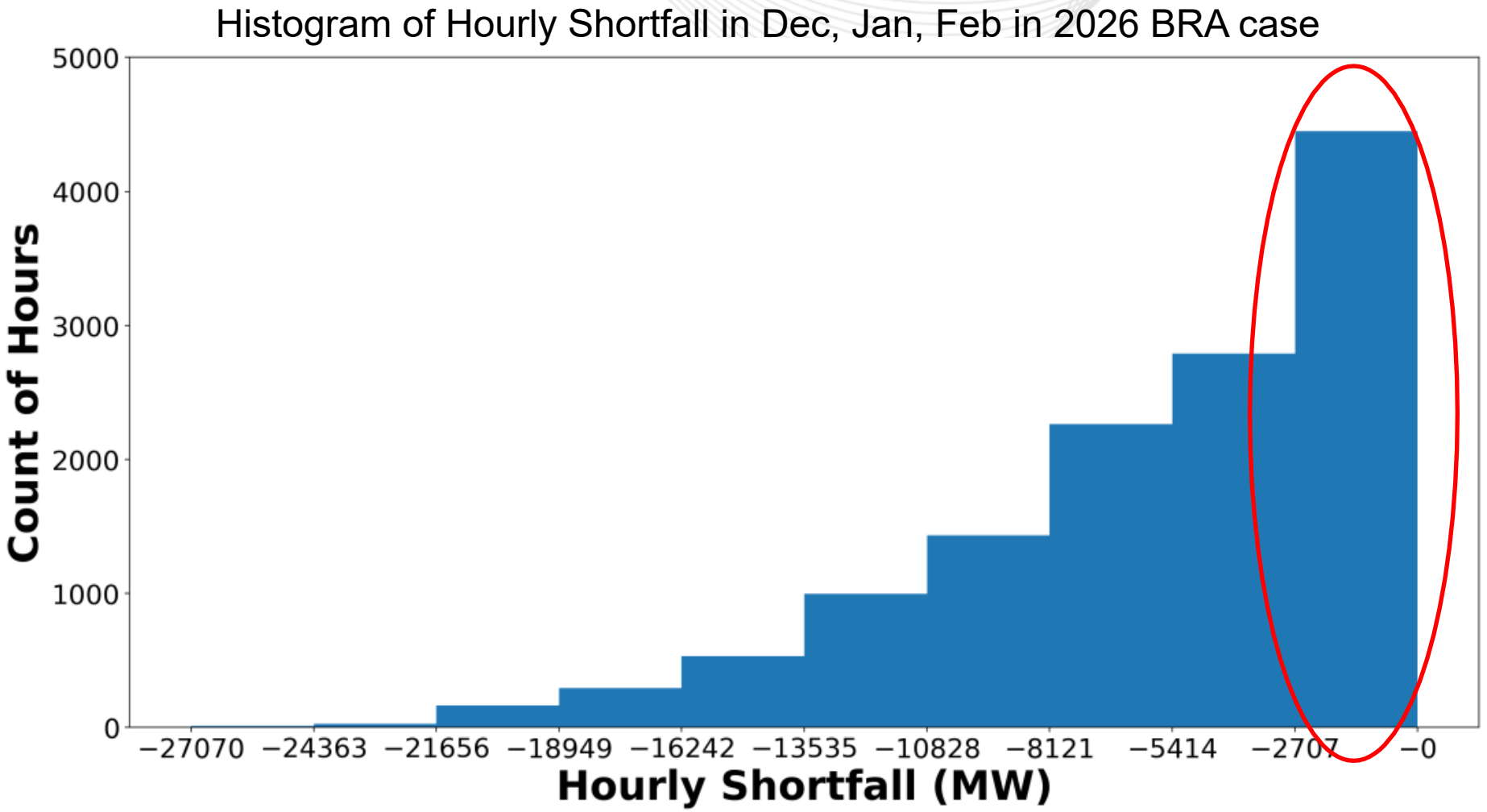
Why is the 2025 LF having this impact on the 26/27 analysis

- From Slide #14, it can be seen that extreme winter loads in the 2025 LF have higher magnitude even after controlling for annual peak load increases
  - For example, the 90/10 winter peak in the 2025 LF for DY 26/27 (used in the 26/27 BRA ELCC run) is 0.98 of the annual peak while the 90/10 winter peak in the 2024 LF for DY 25/26 (used in the 25/26 3IA ELCC run) is 0.96 of the annual peak.
    - That corresponds to a 2 percentage point (0.02) difference
  - Assuming an annual peak load of about 159,000 MW the above means that the extreme winter loads in the 26/27 BRA ELCC run are about 3,180 MW (0.02 x 159,000) greater than in the 25/26 3IA case

Why is the 2025 LF having this impact on the 26/27 analysis

- The 25 3IA case has 13,106 hours with loss of load across the 40,300 scenarios
  - 9,247 in Dec, Jan, Feb and 3,687 in Jun, Jul, Aug
- The 26 BRA case has 15,999 hours with loss of load across the 40,300 scenarios
  - 12,961 in Dec, Jan, Feb and 2,745 in Jun, Jul, Aug
- The increase in the number of Dec, Jan, Feb loss of load hours in the 26 BRA is
  - 12,961 – 9,247 = 3,714
- The decrease in the number of Jun, Jul, Aug loss of load hours in the 26 BRA is
  - 2,745 – 3,687 = - 942

Why is the 2025 LF having this impact on the 26/27 analysis



Approximately 4,000 winter hours in the 26 BRA case have a shortfall that is less than 2,707 MW. These hours are likely to have become new loss of load hours (relative to the 25 3IA case) due to the increase in extreme winter loads of about 3,180 MW.

Also, 4,000 roughly matches the increase in winter loss of load hours in the 26 BRA case discussed in the previous slide.

Impact of Seasonal Risk Share on ELCC Class Rating volatility

Estimated Seasonal 26/27 ELCC Class Ratings

ELCC Class	Summer	Winter
Onshore Wind	10%	46%
Offshore Wind	22%	77%
Fixed-Tilt Solar	22%	6%
Tracking Solar	32%	7%
Intermittent Landfill Gas	58%	49%
Intermittent Hydropower	37%	39%
Capacity Storage Resource (4-Hour Duration)	94%	43%
Capacity Storage Resource (6-Hour Duration)	98%	52%
Capacity Storage Resource (8-Hour Duration)	93%	57%
Capacity Storage Resource (10-Hour Duration)	97%	68%
Demand Resource	108%	63%
Nuclear	96%	95%
Coal	86%	82%
Gas Combined Cycle	95%	71%
Gas Combustion Turbine	96%	54%
Gas Combustion Turbine Dual Fuel	96%	75%
Diesel Utility	96%	90%
Steam	88%	70%

Annual ELCC Class Rating can be ***approximated*** by using the weighted average of the Seasonal Ratings, where the weights correspond to the seasonal LOLH shares.

For example, using the Offshore Wind class and the 26/27 BRA LOLH shares (0.82 and 0.18)

Approx. Annual Rating: 0.82 x 77% + 0.18 x 22% = 67%

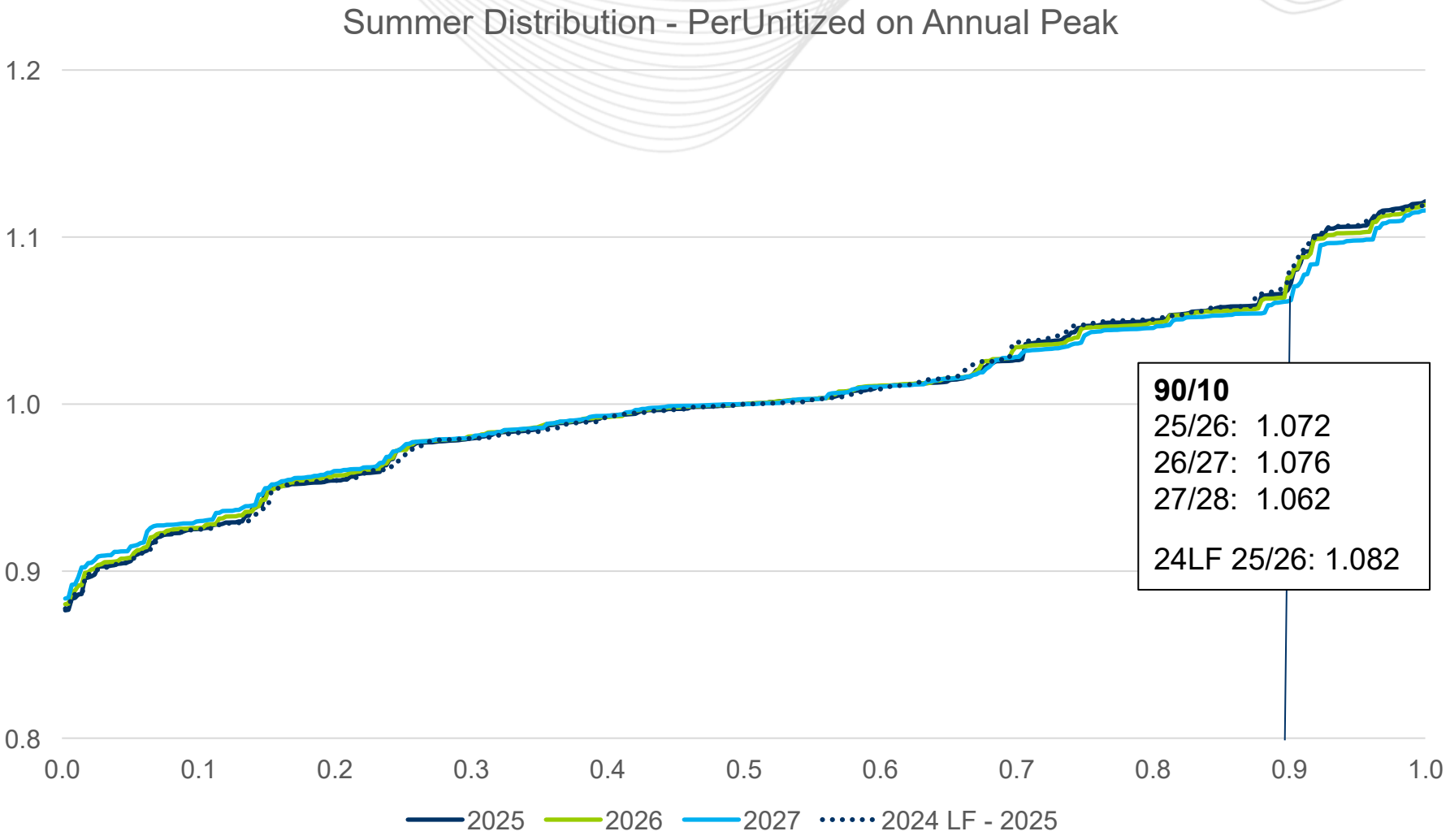
If instead we use the 25/26 3IA LOLH shares (0.71 and 0.29):

Approx. Annual Rating: 0.71 x 77% + 0.29 x 22% = 61%

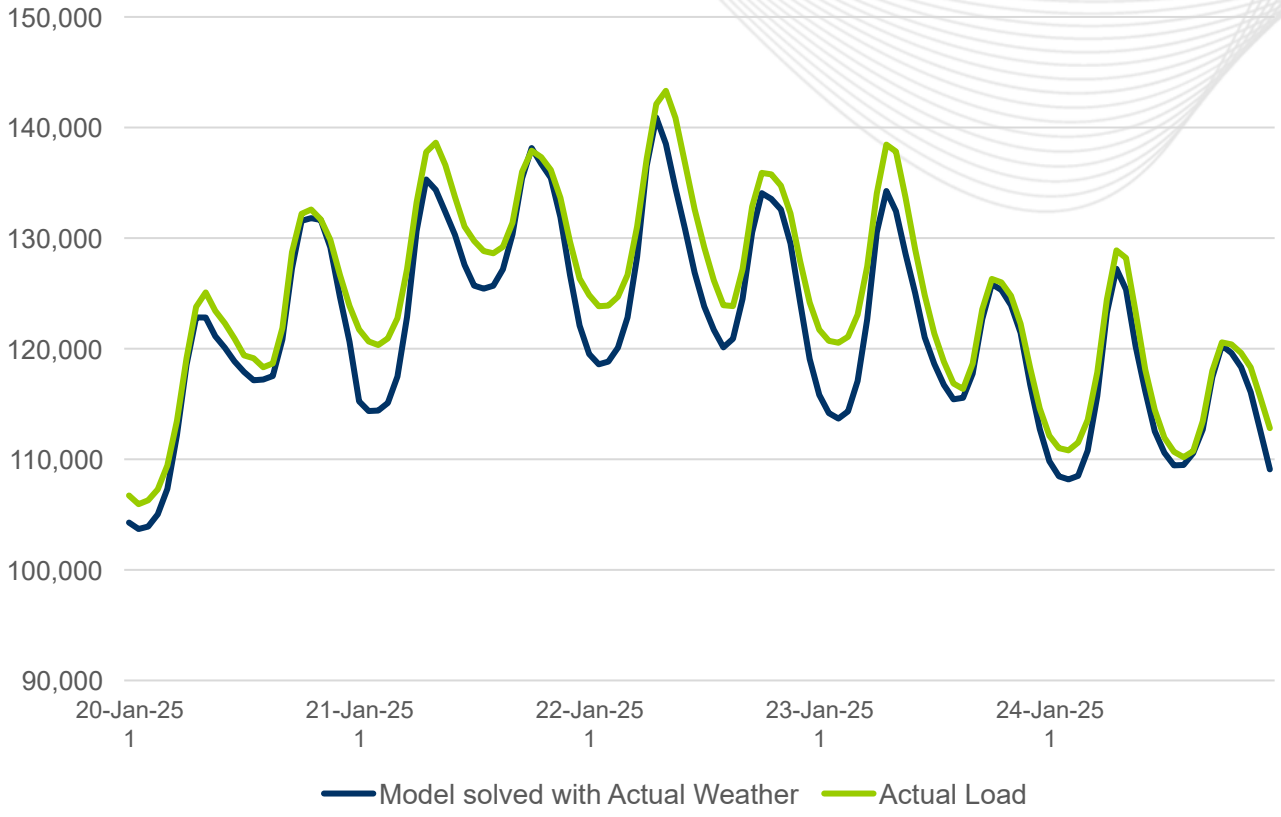
While the two values above do not necessarily match the 26/27 BRA and 25/26 3IA ratings for Offshore Wind, the difference between the two values above (67% vs 61%) provides a sense of how Class Ratings can vary based on seasonal risk shares shifting from one run to another run.

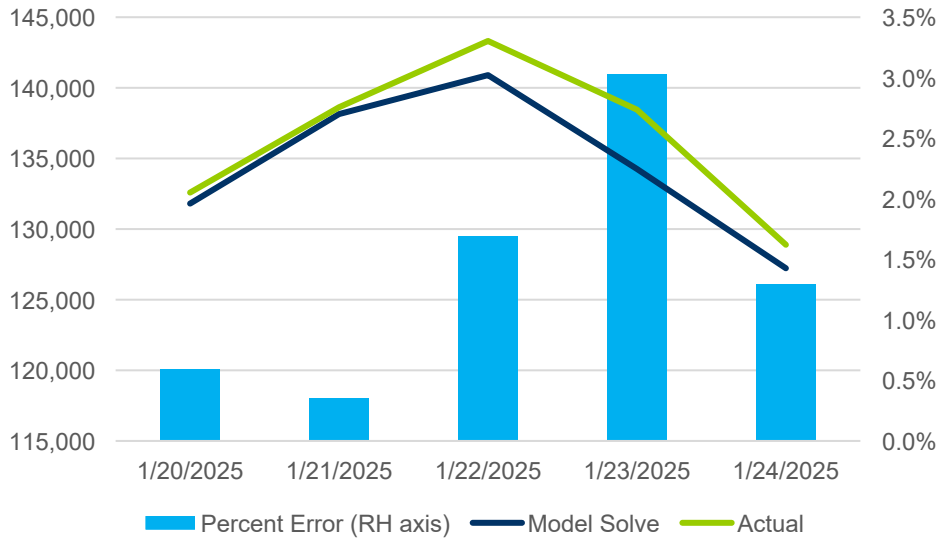
Appendix Slides

Summer Distributions



January 2025 – Model vs. Actual





Contact

SME/Presenters:

Josh Bruno, Joshua.Bruno@pjm.com

Molly Mooney, Molly.Mooney@pjm.com

Patricio Rocha Garrido,

Patricio.Rocha-Garrido@pjm.com

2026/27 BRA IRM, FPR, and ELCC Class Ratings

Shift Towards More Winter Risk

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.

pjm

Report suspicious email activity to PJM.

(610) 666-2244 / it_ops_ctr_shift@pjm.com