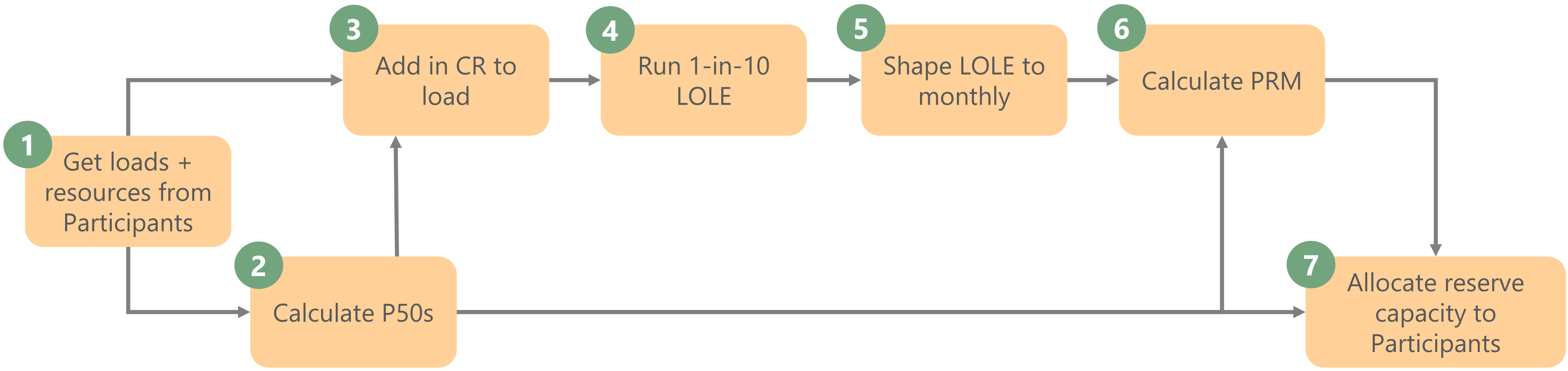
PLANNING RESERVE MARGIN DRIVERS

WESTERN RESOURCE ADEQUACY PROGRAM

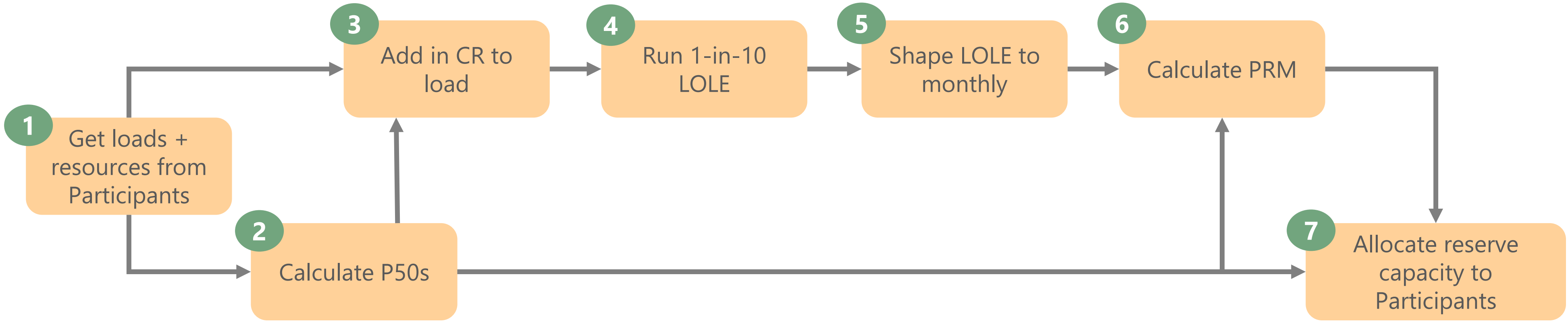
7-22-2025

(Very Simplified) Process to set PRM



DETERMINATION OF PLANNING RESERVE MARGIN

- 4 2 Planning Reserve Margin is set to determine the capacity (margin) necessary to serve the P50 Peak Load Forecast to a measure of loss of load expectation of 1 day in 10 years.
- 4 Loss of load events are tabulated and measured throughout the applicable season
- 4 Pure negative capacity (no outages) is added in all hours of the season until the program footprint (or subregion footprint) reached 0.1 LOLE
- 5 Monthly adjustments are made to ensure all months of the season had at least 0.01 LOLE while maintaining 0.1 LOLE across the season
  - Capacity contribution of VERs (wind, solar, ESR) are determined by removing those resources from the model and re-running the simulation.
- 3 Contingency Reserves (approximated at 6% of load) are held to determine LOLE events.



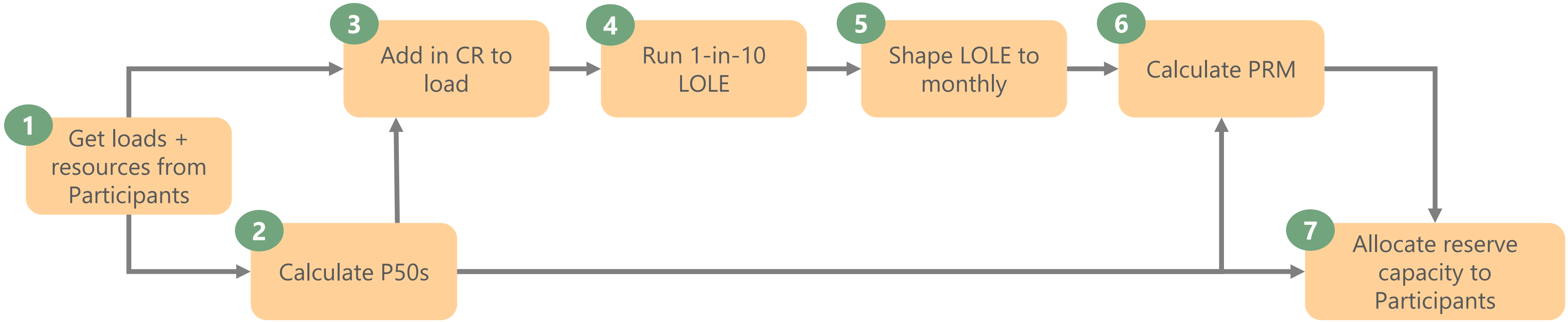
PLANNING RESERVE MARGIN CALCULATION

6 Planning Reserve Margin (Monthly) is calculated per the following equation after all capacity was converted to UCAP values (See BPM 105):

$$Planning\ Reserve\ Margin\ (UCAP) = \frac{UCAP - Region\ Monthly\ Peak}{Region\ Monthly\ Peak} * 100\%$$

2 6 Planning Reserve Margin (UCAP) is calculated for the non coincident peak demand

- Non-Coincident Peak (NCP) Demand is the sum of the monthly single hour peak load forecast for each transmission zone for the region being studied.
- Regional NCP Peak load forecasts use a Load Growth Factor specific to the LOLE Study (See BPM 103 FS Capacity Requirement).



PLANNING RESERVE MARGIN CONCEPTS

2 Peak Demand = P50 Peak Demand Forecast

- Differs every month for a monthly construct.
- Stays constant for the season for a seasonal construct.

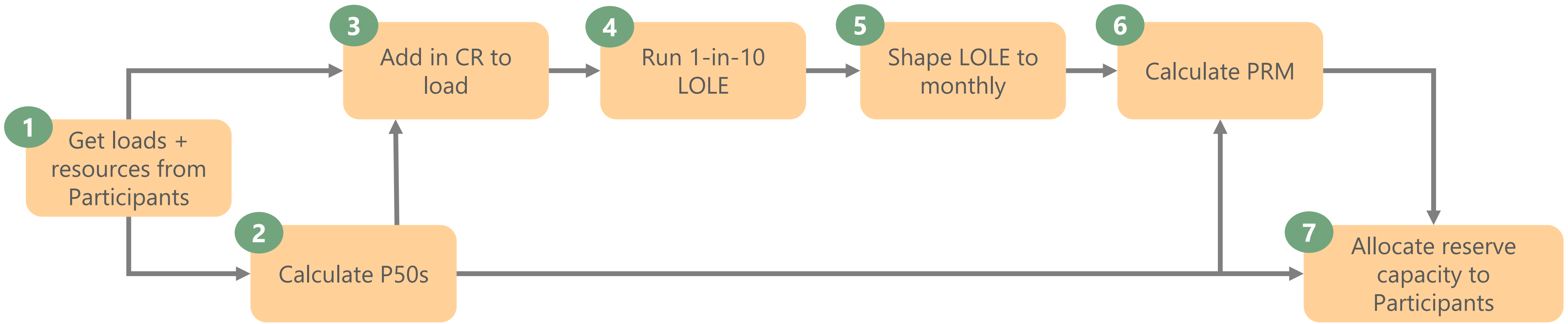
7 Capacity Requirement = Capacity needed to maintain the risk assumed for the Peak Demand

6 PRM = ratio of the Capacity Requirement / Peak Demand

4 5 6 Risk(seasonal) = LOLE metric = proportional to the PRM

- More risk assumed => lower PRM
- Less risk assumed => higher PRM

5 Risk(monthly) = WRAP currently has a seasonal risk metric (1-in-10 seasonal LOLE), but does not have a specific risk metric for individual months beyond the minimal requirement to maintain at least 0.01 seasonal LOLE.



PRIMARY CONCEPTS FOR DETERMINING PRM

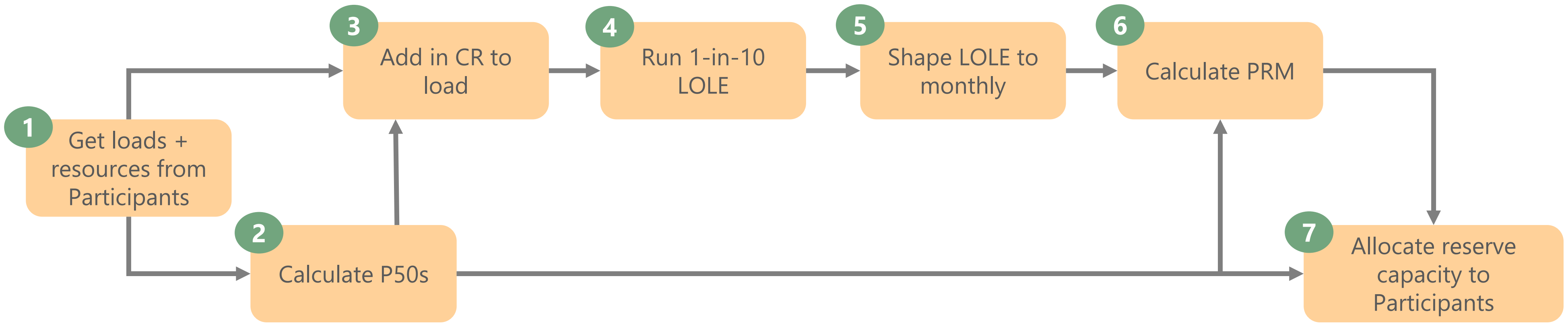
4 Maintain assumed risk (1-in-10 seasonal LOLE)?

5 Maintain optimal amount of capacity requirement across the season to meet the assumed risk?

- Assumes varying risk (i.e. PRM) across different months of the season.
- Requires the lowest total amount of capacity

5 Maintain the same amount of risk (i.e. PRM) across each month of the season?

- Though this requirement will require varying amounts of capacity requirement for each month.
- May not optimize the total amount of capacity required.



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TWO WAYS OF VIEWING PRM (SWEDE 2026 SUMMER)

1. Optimize Capacity

SWEDE	JUNE	JULY	AUGUST	SEPTEMBER
LOLE	0.014	0.054	0.023	0.010
2026 Peak Demand (NCP)	35,858	37,908	36,576	33,619
Final Capacity requirement (with transmission diversity	41,374	41,184	40,622	39,063
UCAP NCP PRM	**15.4%**	**8.6%**	**11.1%**	**16.2%**

Natural LOLE risk – with minimum of 0.01 LOLE/month

Take-away

- **Higher LOLE = less capacity = lower PRM**

2. Stabilize Risk (stable PRM)

SWEDE	JUNE	JULY	AUGUST	SEPTEMBER
LOLE	0.03	0.001	0.005	0.06
2026 Peak Demand (NCP)	35,858	37,908	36,576	33,619
Final Capacity requirement (with transmission diversity)	41,019	42,876	41,481	38,182
UCAP NCP PRM	**14.4%**	**13.1%**	**13.4%**	**13.6%**

Minimize LOLE risk in July and August (Higher PRM) and allow risk in September (lower PRM)

TWO WAYS OF VIEWING PRM (MIDC 2026-27 WINTER)

1. Optimize Capacity

MIDC	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
LOLE	0.010	0.060	0.010	0.010	0.010
2027 Peak Demand (NCP)	36,785	42,002	42,002	42,002	35,807
Capacity requirement	47,604	47,333	47,565	46,462	42,532
UCAP NCP PRM	**29.4%**	**12.7%**	**13.2%**	**10.6%**	**18.8%**

Natural LOLE risk – with minimal 0.01 LOLE per month

Take-away

- **Higher LOLE = less capacity = lower PRM**

2. Stabilize Risk (stable PRM)

MIDC	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
LOLE	0.10	0.00	0.00	0.00	0.005
2027 Peak Demand (NCP)	36,785	42,002	42,002	42,002	35,807
Capacity requirement	44,155	48,261	48,098	47,148	42,952
UCAP NCP PRM	**20.0%**	**14.9%**	**14.5%**	**12.3%**	**20.0%**

Minimize LOLE risk in Dec-Mar (Higher PRM) and allow risk in November (lower PRM)

TWO WAYS OF VIEWING PRM (SWEDE 2026 SUMMER)

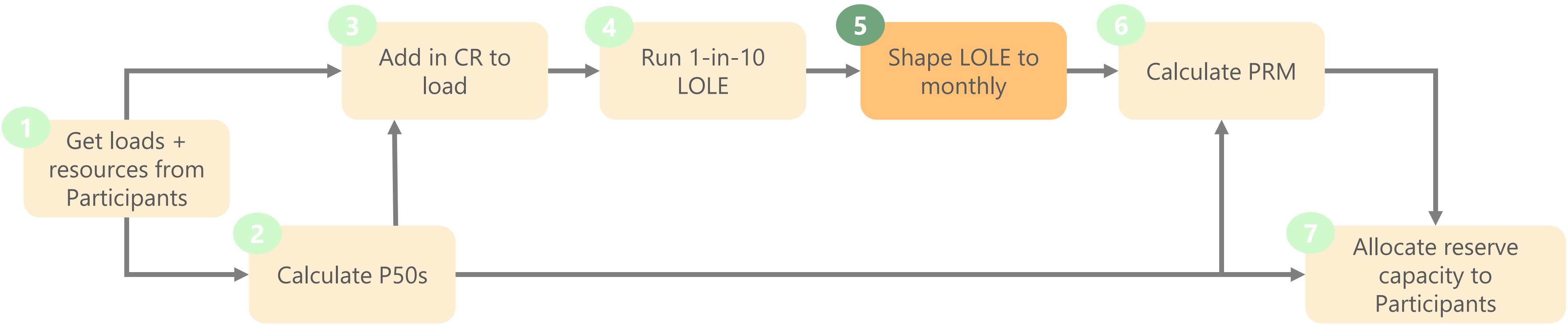
1. **Optimize Capacity Seasonally – Capacity may be further optimized assuming the natural LOLE, and using the seasonal P50 Peak (peak across all months) and determine a seasonal P50 PRM**

(Values are conceptual and have not been comprehensively calculated)

MIDC	SEASON
LOLE	0.10
2027 Peak Demand (NCP)	37,908
Capacity requirement	41,324
UCAP NCP PRM	**9.0%**

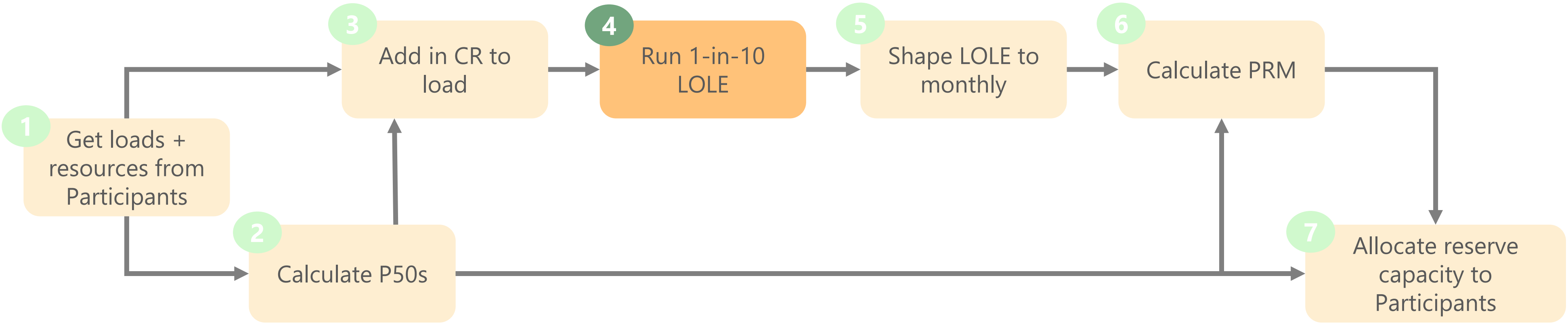
PRM VARIABILITY

- What causes PRM variability from month to month?
  - PRM variability from month to month is indicative of the observed variance in the risk (differences in measured LOLE) in the months due to loads and VER performance.
  - LOLE can shift between months of the season from year to year
  - While WRAP has a requirement for seasonal LOLE (0.1 seasonal LOLE), WRAP does not have a requirement for monthly LOLE, other than it must be a 'minimum of at least 0.01 seasonal LOLE per month.
    - This further facilitates shifts in LOLE in each month from year to year.
  - Outlier weather events (extreme event observed in the most recent 'look-back' period, particularly in a shoulder month) can trigger LOLE in the months of interest. Shoulder months with typically lower P50 peak forecasts can see increased PRMs due to the observed risk of lost load.



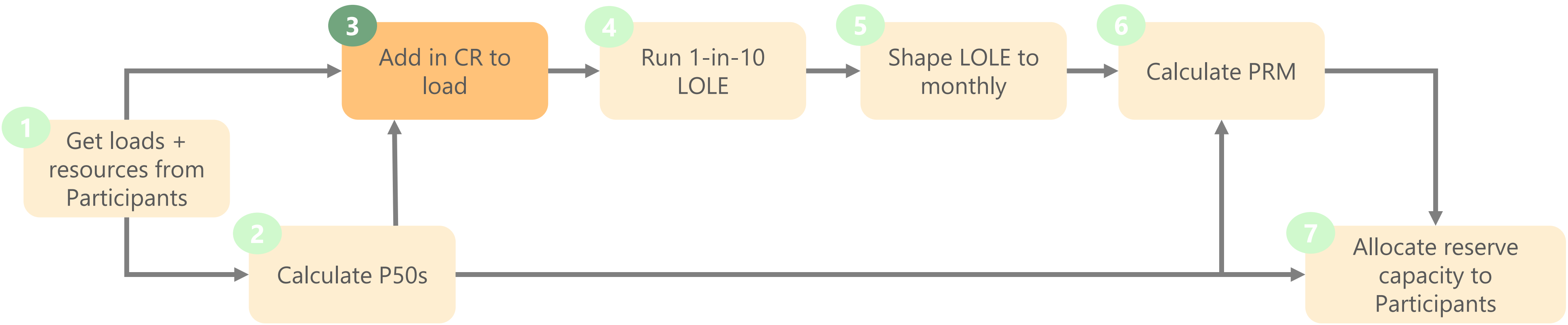
PRM VARIABILITY

- What causes PRM variability from year to year?
  - PRM variability from year to year can be observed either by
    - Outlier weather events (extreme events observed in the most recent weather 'look-back' time frame) that may occur in either shoulder or peak months
      - Outlier weather events can result in both 1) high loadings and 2) volatility in VER output
    - LOLE can shift between months of the season from year to year. This can cause higher PRM in a particular month one year than in the next year.
    - Changes in resource mix – e.g. large increases in solar penetration when compared against an extreme weather event that had low solar output can exacerbate net load amounts, result in increased loss of load expectation, and can drive higher PRMs.



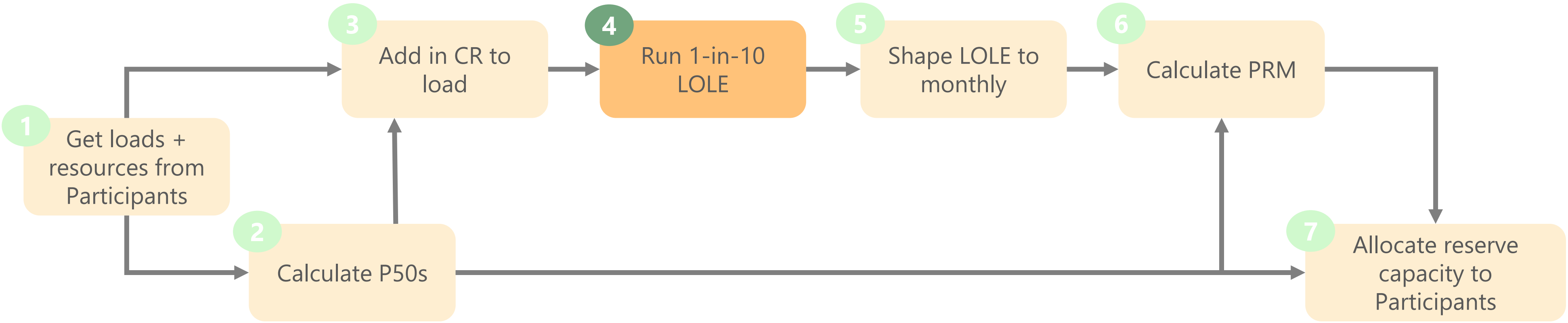
OTHER PRM CONCEPTS/QUESTIONS

- How does the requirement to include Contingency Reserves (CR) in the PRM impact the PRM value?
  - The requirement to include CR, requires WRAP to determine the PRM by tabulating loss of load expectation while holding back approximately 6% of load (roughly equivalent to the WECC requirement of holding back 3% of generation and 3% of load).
  - The requirement results in a PRM that, prior to determination of the non-coincident peak load, is approximately 6% higher than the PRM would be without holding back CR. The difference in PRM is typically less than 6% due to the non-coincident peak (NCP) methodology of allocating the PRM.



OTHER PRM CONCEPTS/QUESTIONS

- How does the inclusion of specific months in the summer/winter season impact the PRM
  - Inclusion of the months of the season (June through September 15th) and (November through March 15th) determine the months that loss of load expectation is being tracked during the LOLE/PRM simulations.
  - Removal of one or more months from the season will result in less LOLE being tracked in the simulations.



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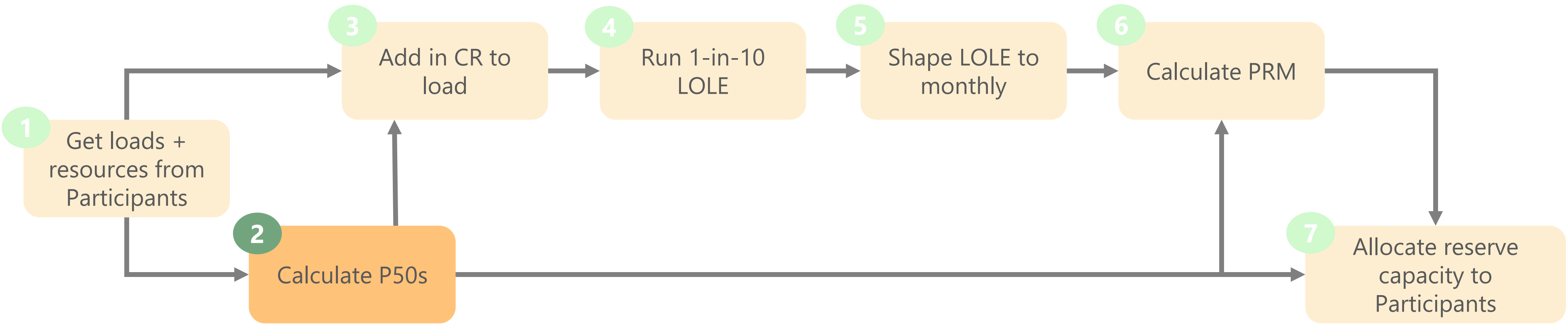
OTHER PRM CONCEPTS/QUESTIONS

- NCP VS CP LOAD
  - Using Coincident Peak (CP) instead of the non-coincident Peak (NCP) load would result in higher Monthly PRMs
  - This is due to the CP load being lower than the NCP load, but the capacity requirement is the same.
  - The P50 Demand applied to the CP PRM would be based on the Participant's demand at the time of the subregion coincident peak.
    - Need for diversity factor calculation methodology



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HOW DOES WEATHER VARIABILITY IMPACT LOLE/PRM SIMULATIONS

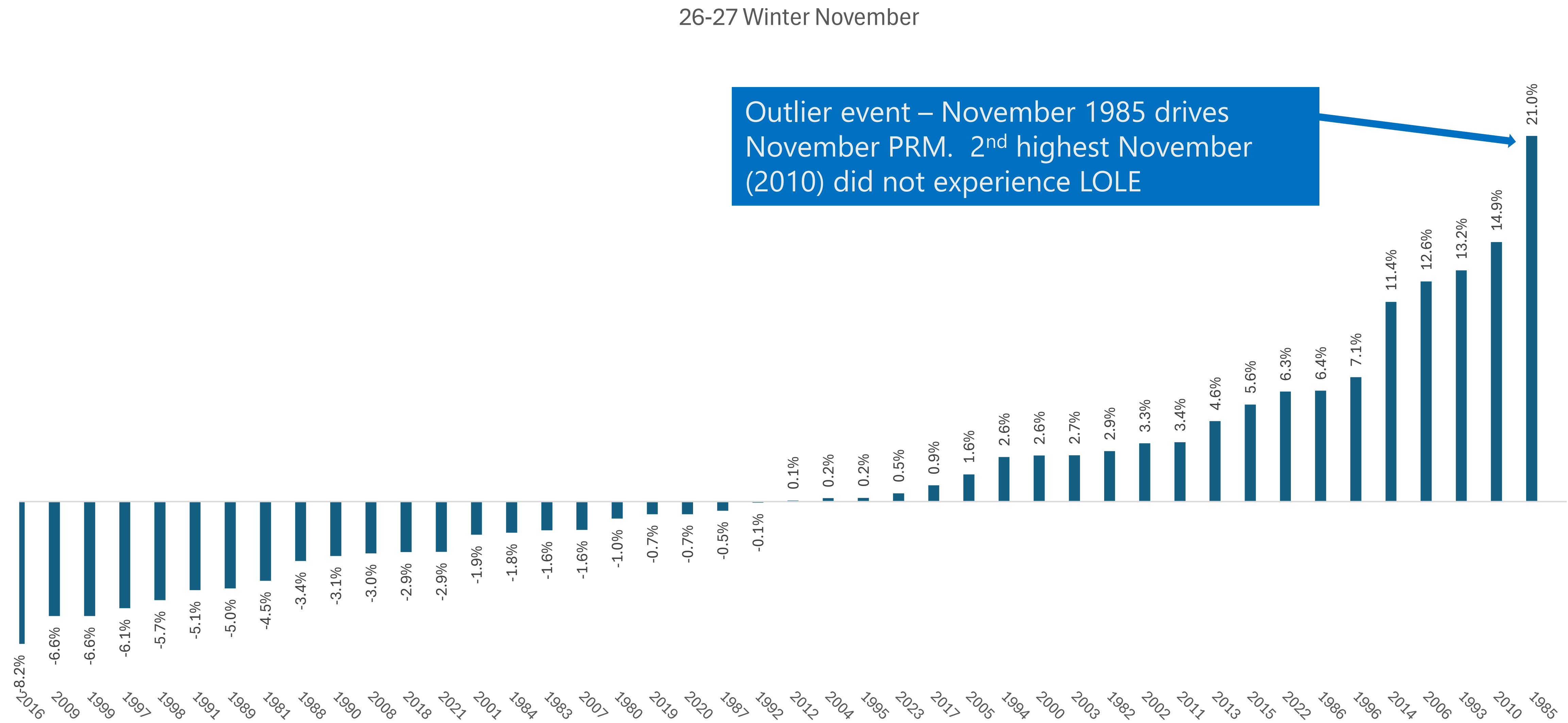
- For the LOLE Study, load conditions are forecast from past historical weather conditions using recent loadings.
- For the Winter 2026-2027 Advanced Assessment, Participant data was provided in March 2024, for load and VER data through the 2023 weather year
  - Load, Wind, Solar and ROR outputs were re-forecast for **1980-2023** using weather data from 1980-2023 and Participant Load, Wind, outputs for ***2021-2023.***
  - The previous Advanced Assessment had used Participant and weather data from 2016-2020 for forecasting purposes.
- Significant events occurred during the newly included weather years (2021-2023)
  - Winter Storm Uri
  - Winter Storm Elliott
- Temperatures observed during these 2021-2022 events mirrored temperatures in November and December 1985. No recent events prior to 2021 (2016-2020) had closely resembled the 1985 events.
  - Near-record colds for late November in Seattle and Portland
  - Below-average temperatures for late December in Seattle, Portland, Vancouver and Columbia River Gorge
  - Below-average temperatures for late December for the Desert Southwest

HOW DOES WEATHER VARIABILITY IMPACT LOLE/PRM SIMULATIONS

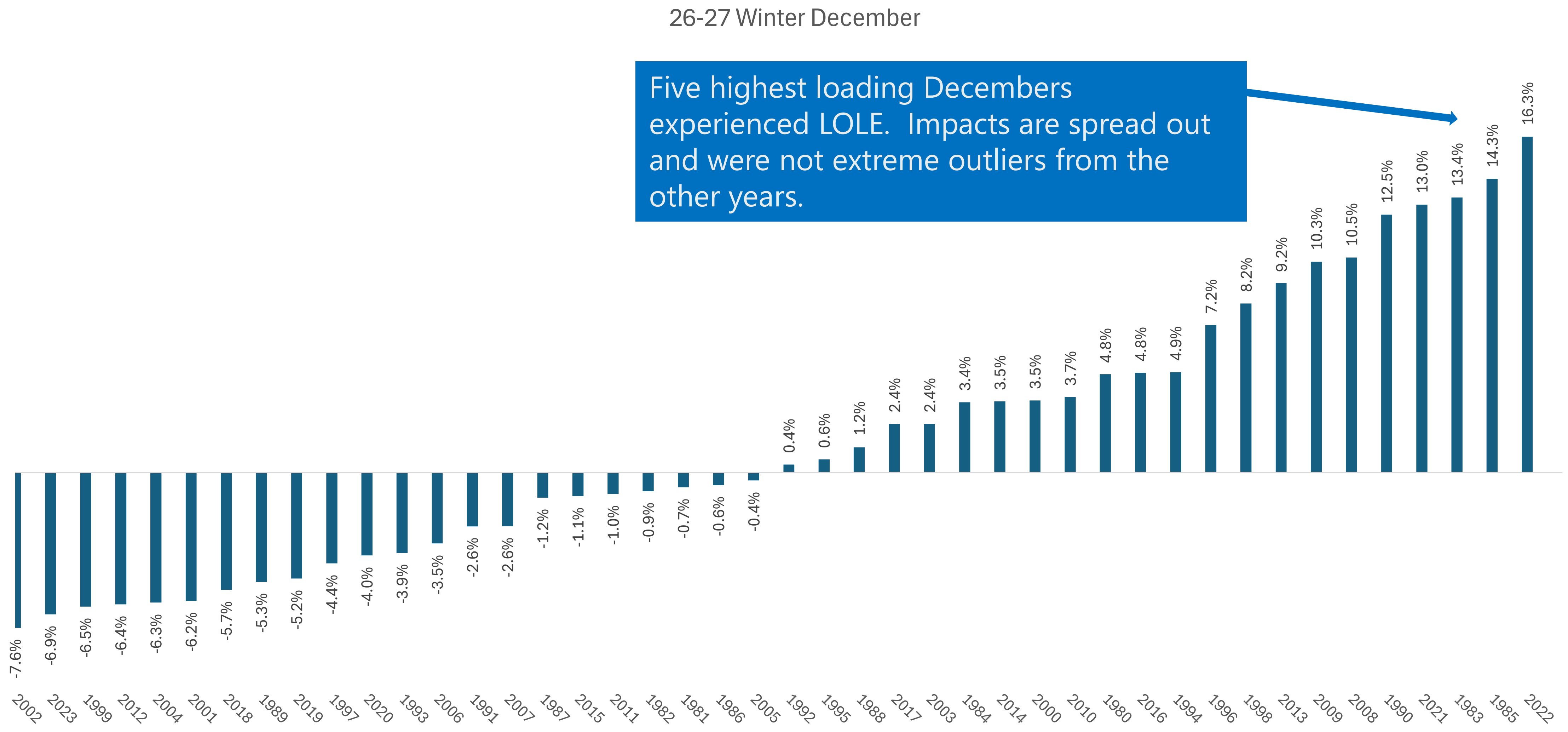
- These weather events resulted in 1985, 2021, 2022 and 2023 weather years having peak loads greater than previous years and driving LOLE. You see that 16% of LOLE is occurring in November – whereas prior to W.S. Elliot, minimal LOLE occurred in November.
- From a PRM perspective, because December typically has larger P50 Peak values, the PRM impact is normal (not elevated), but due to November having typically low peaks, the P50 peak is out of proportion to the risk and the PRM for November is elevated.

WEATHER YEAR	November	December	January	February	March
1983	0%	16%	0%	0%	0%
1985	16%	18%	0%	0%	0%
1990	0%	8%	0%	0%	0%
2021	0%	5%	0%	0%	0%
2022	0%	16%	0%	0%	0%

MIDC MONTHLY LOAD VARIANCE BY LOLE YEARS



MIDC MONTHLY LOAD VARIANCE BY LOLE YEARS



MIDC WINTER 26-27 LOAD VARIANCE BY WEATHER YEAR