Energy Systems Integration Group (ESIG) Spring Technical Workshop

Resource Adequacy in ERCOT

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Reliability Standard Criteria

The Reliability Standard for the ERCOT region serves as a performance benchmark for the region's ability to meet consumer demand now and three years in the future.

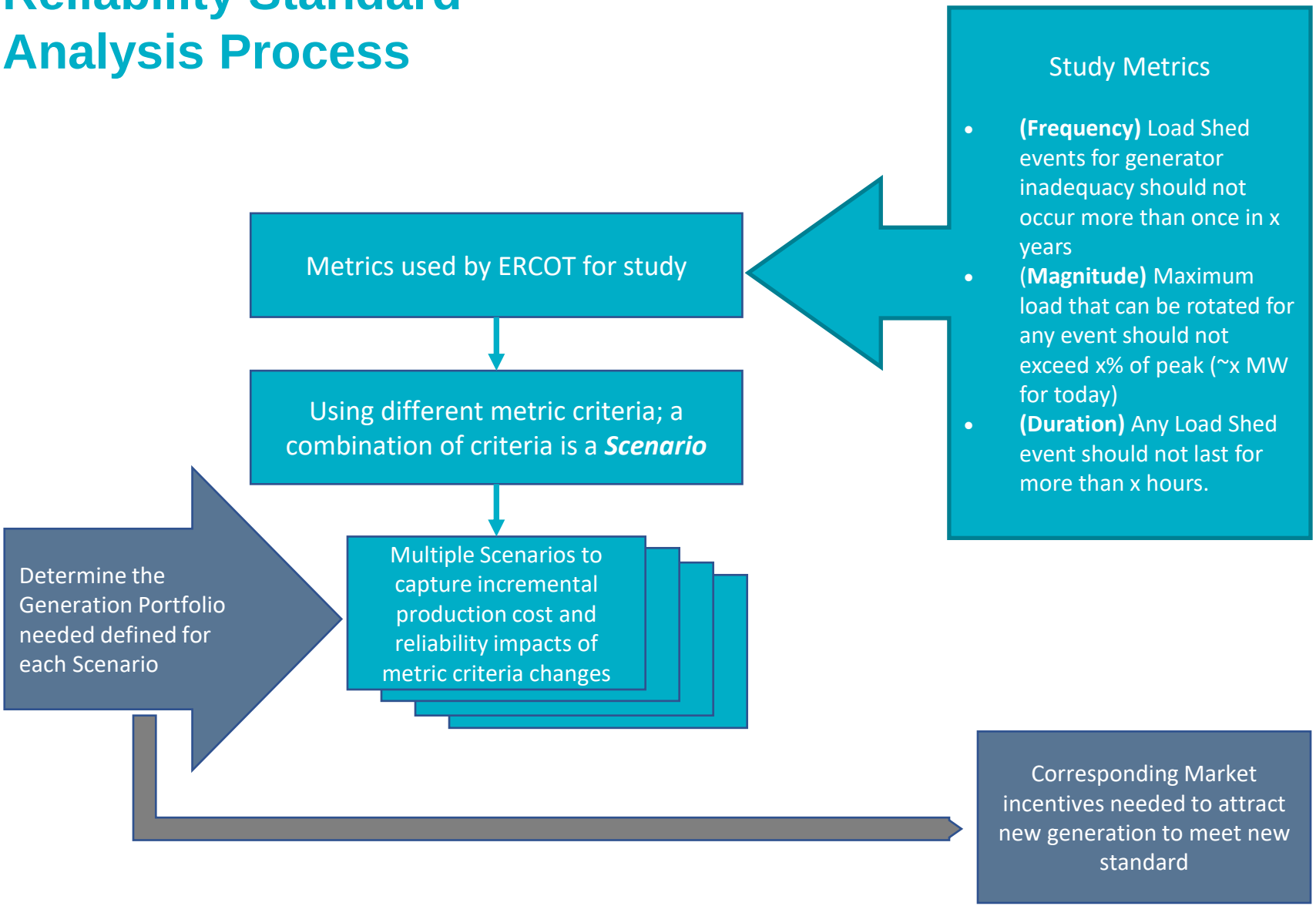
To remain compliant with the Reliability Standard, the ERCOT region must meet the following three criteria:

- **Frequency:** The frequency at which supply (electric generation) is inadequate to meet demand (electric load) on the ERCOT grid. On average, demand is not expected to exceed supply more than once every 10 years.

- **Magnitude:** The maximum amount of unserved energy (loss of load (LOL)) during any single hour of a potential outage. This LOL is expected to be less than the amount of load shedding that can be rotated among consumers during an outage with 1% exceedance probability.

- **Duration:** The maximum duration of a LOL during a potential outage is expected to last less than 12 hours with 1% exceedance probability.

Reliability Standard Analysis Process



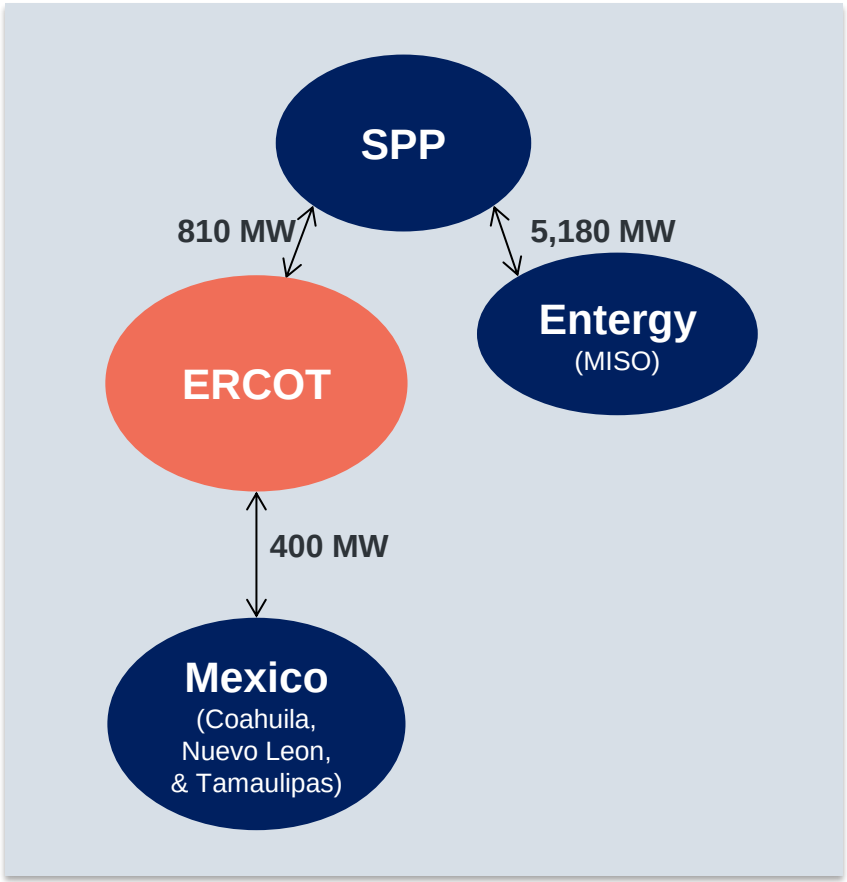
Modeling Details

- Base Case
  - Resources and load forecast based on December 2022 Capacity, Demand and Reserve (CDR) report
  - Forty-two weather years
  - Five economic load forecast errors (LFEs) following a normal distribution, e.g., 0%, 2% and 4% above and below the forecast
  - 85% weatherization effectiveness
  - Multiple generation portfolios evaluated for each frequency (LOLE): (1) 900 MW and 3,300 MW retirements; (2) incremental solar and storage resources based on May 2023 CDR
  - Multiple frequencies evaluated including 1 in 5, 1 in 8, 1 in 10, 1 in 15 and 1 in 20
- Four sensitivities
  - Fifteen weather year sensitivity
  - Increased Inverter Based Resource (IBR) portfolio sensitivity
  - 70% weatherization effectiveness
  - 90% weatherization effectiveness
- Updated Base case with resources and load forecast based on December 2023 CDR report

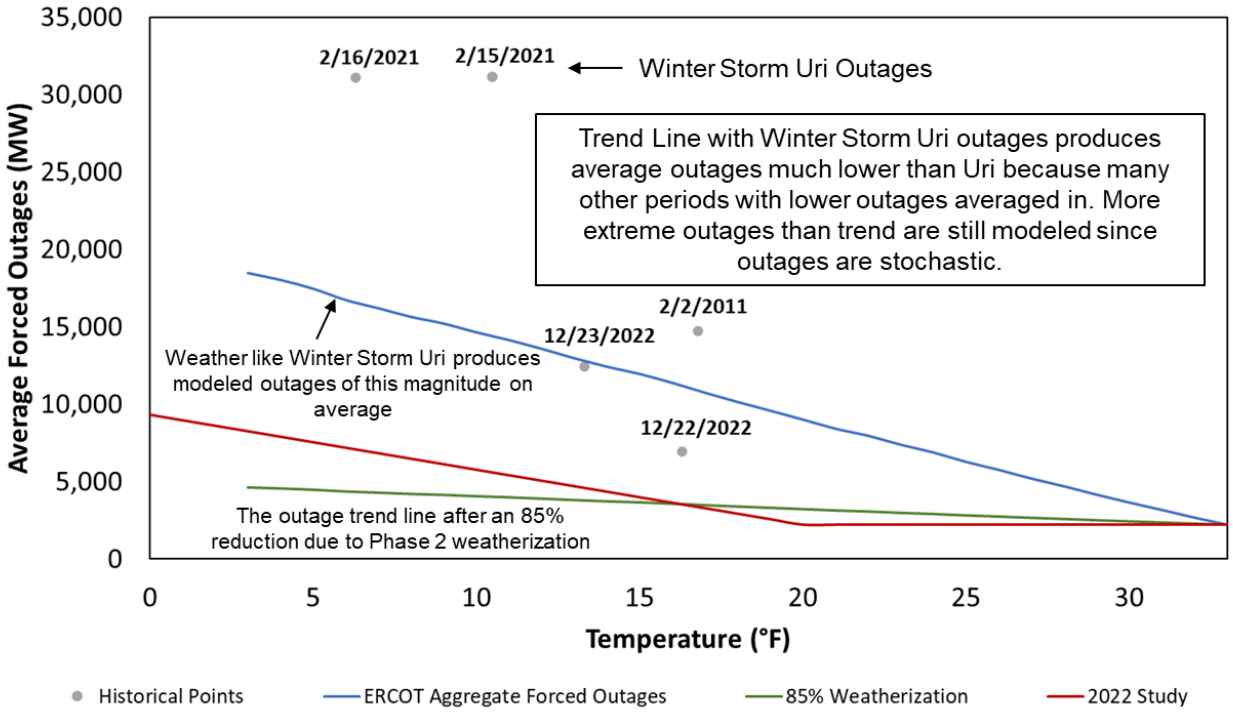
Modeling Details (Continue)

- Number of trials for each scenario: number of weather years x number of LFEs x number of generation outage samples.
  - For example: 42 weather years x 5 LFEs x 25 outage samples = 5,250 trials

Modeled Interconnection Topology



Cold Weather Forced Outage Modeling



- Both partial and full forced outages were simulated
- Additionally, forced outages due to cold weather were modeled

Overview of Exceedance Probability Approach

Exceedance Probability is defined as the likelihood that Magnitude and Duration will be higher than a given risk tolerance threshold

For example, a 1% Exceedance Probability means that the expected frequency of Magnitude and Duration exceeding certain levels should occur no more than 1 day in 100 years, or 0.01 day in a year

Calculation Steps:

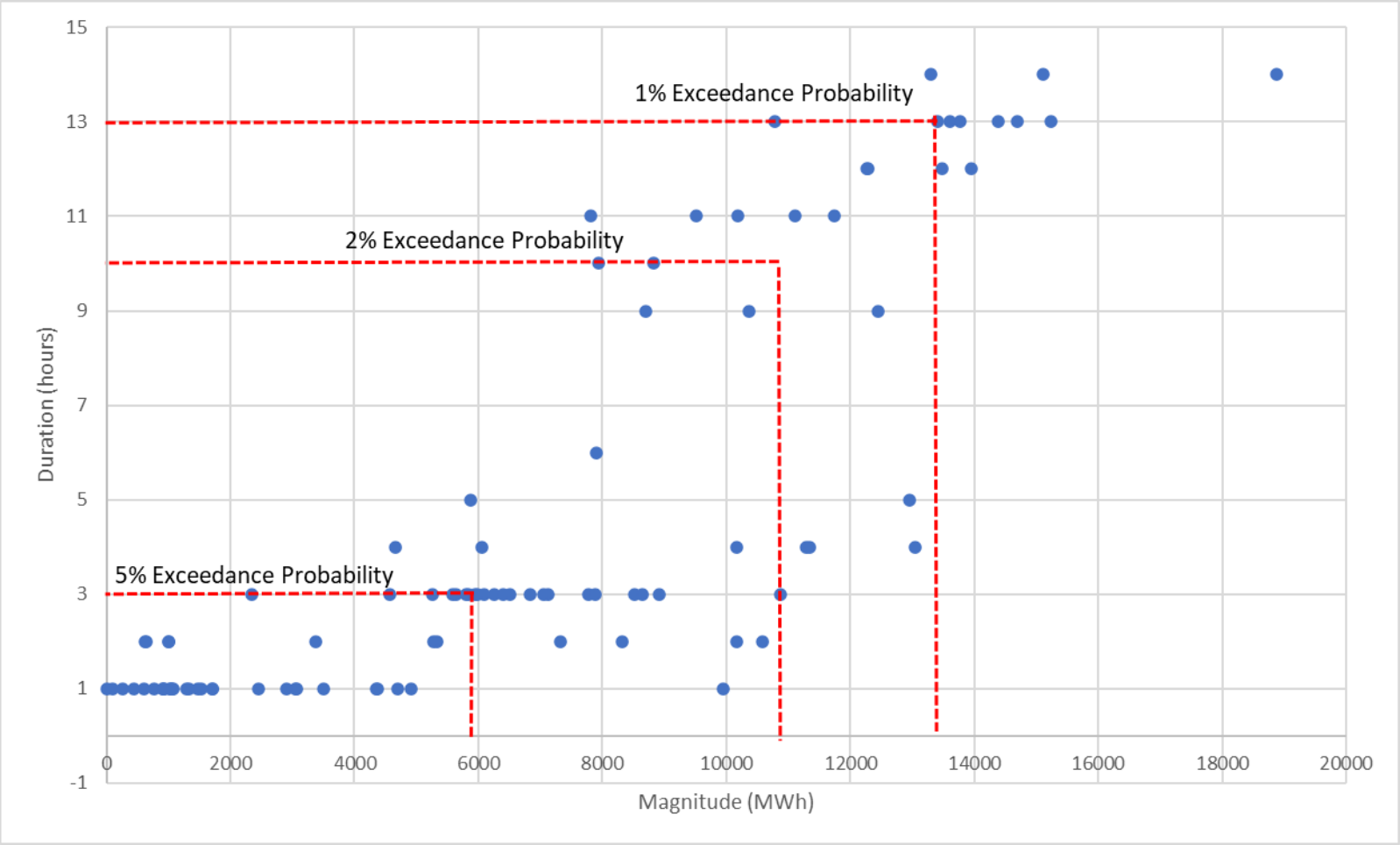
1. For each LOLE level, rank all the Events independently by Magnitude from highest to lowest, and Duration from longest to shortest

2. Select an exceedance probability; for example, 1%, or a 1-in-100 chance

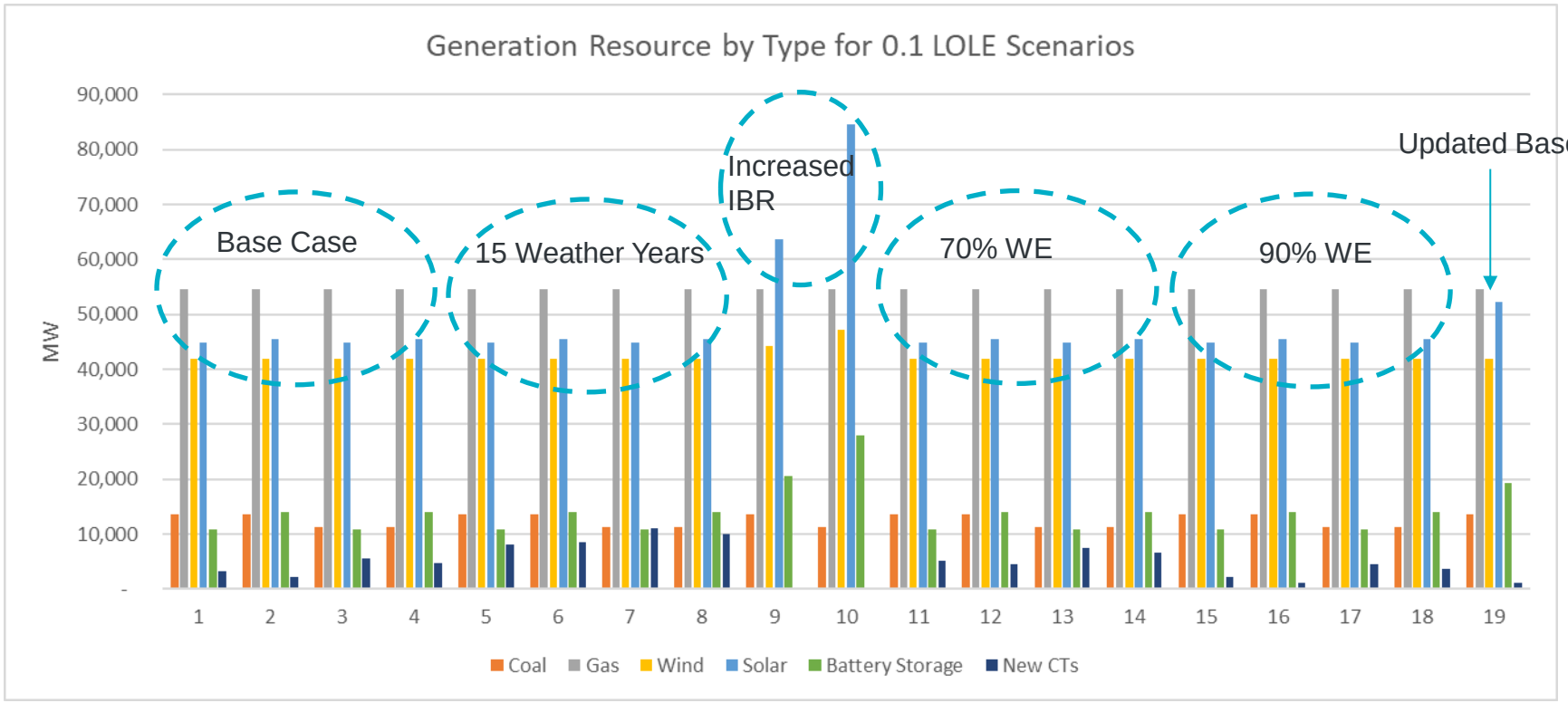
3. Determine the ranking that corresponds to the exceedance probability; the Magnitude and Duration values associated with that ranking are the risk tolerance thresholds

Exceedance Probability Example

- Resource portfolio with a 0.1/year LOLE (18.46% Reserve Margin)

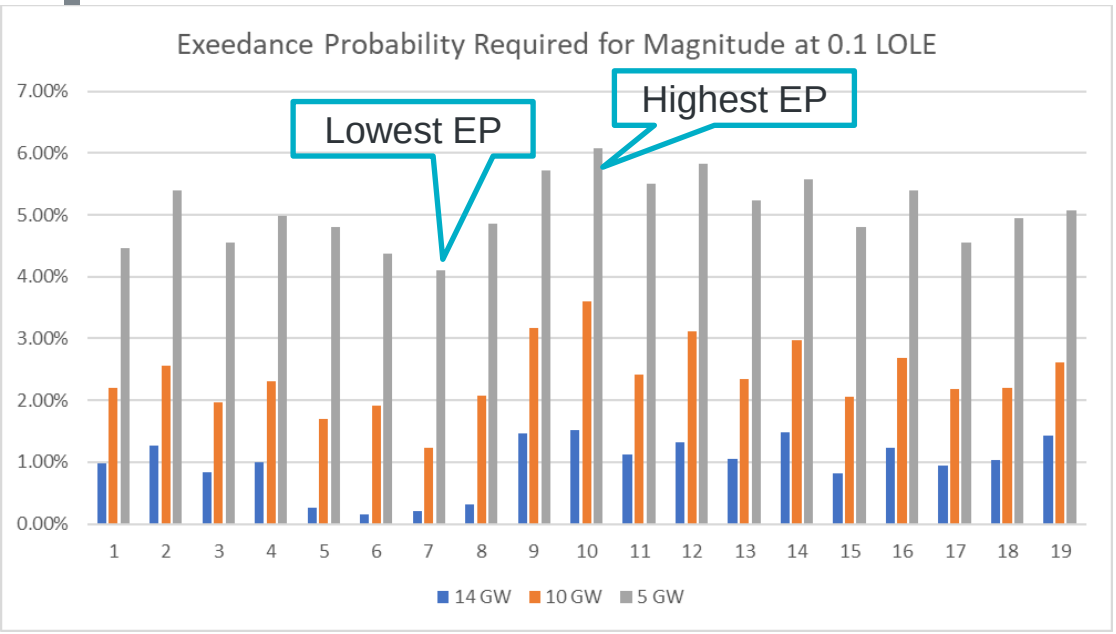


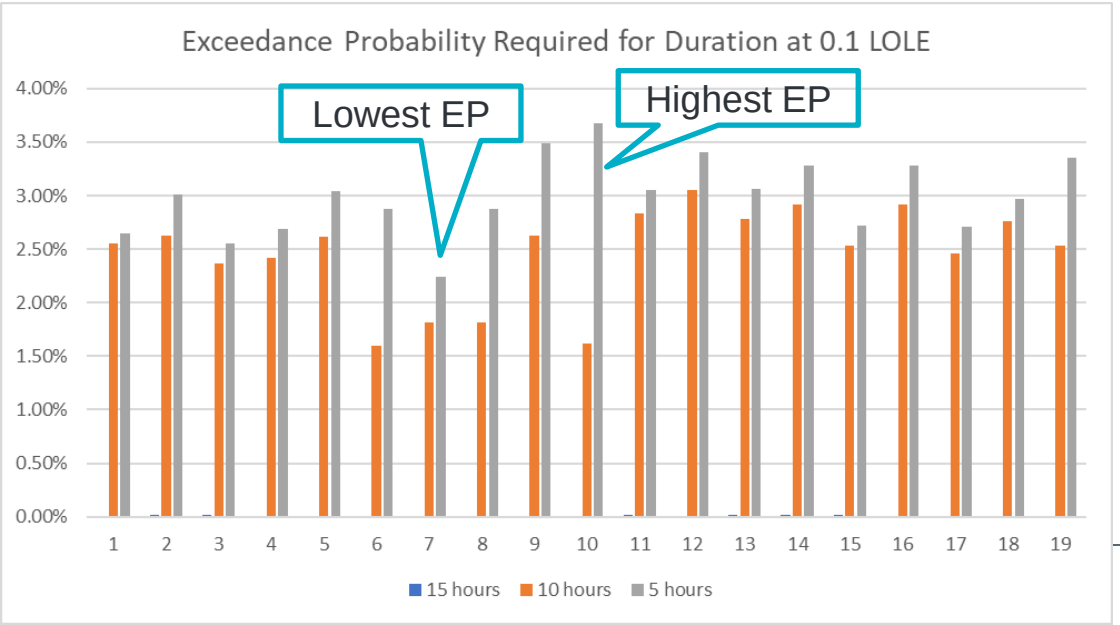
Generation Resource by Type for 0.1 LOLE Scenarios



- LOLE is 0.1 across these 19 scenarios
- LOLE below and above 0.1 scenarios were evaluated as well

Magnitude and Duration Exceedance Probabilities

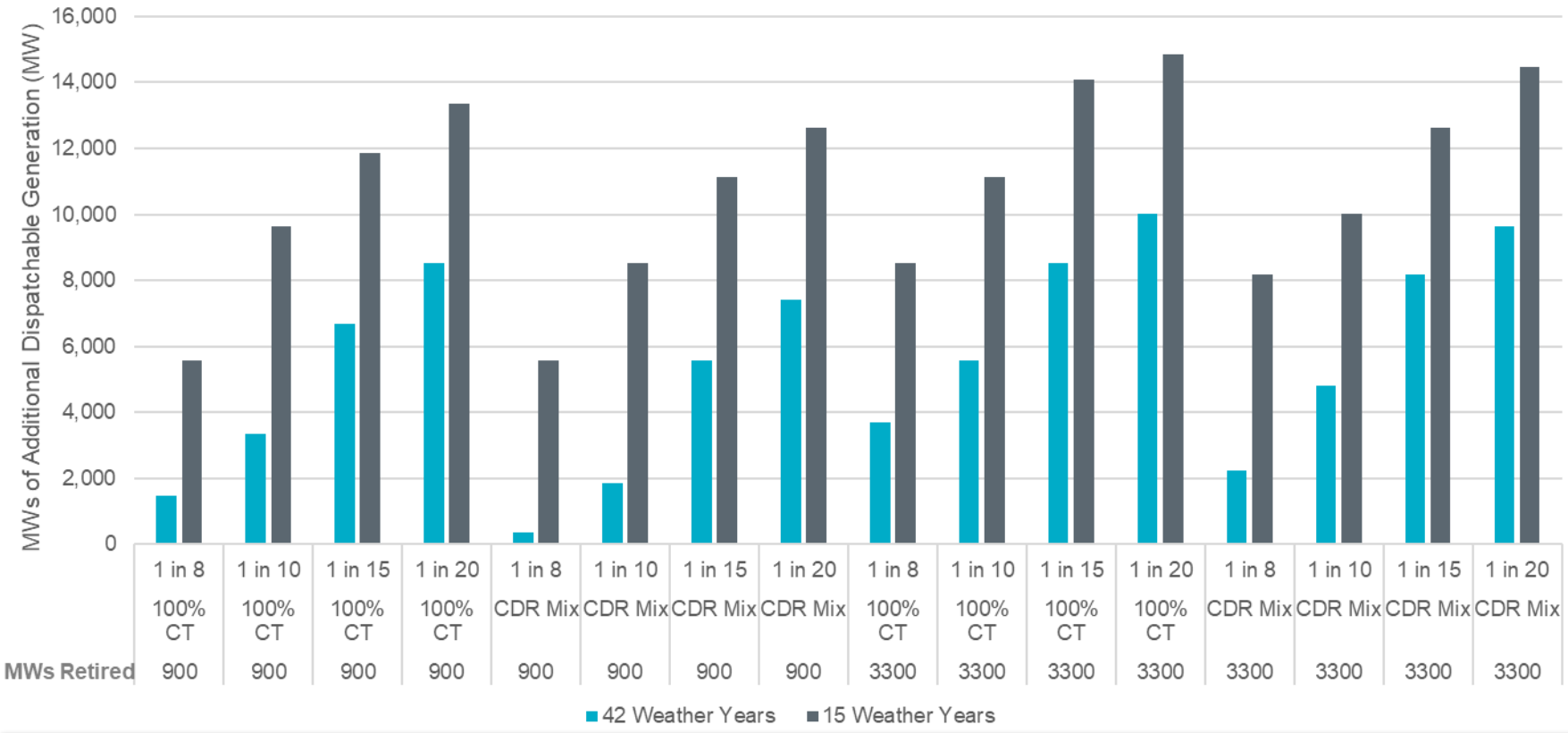




Key Takeaway:

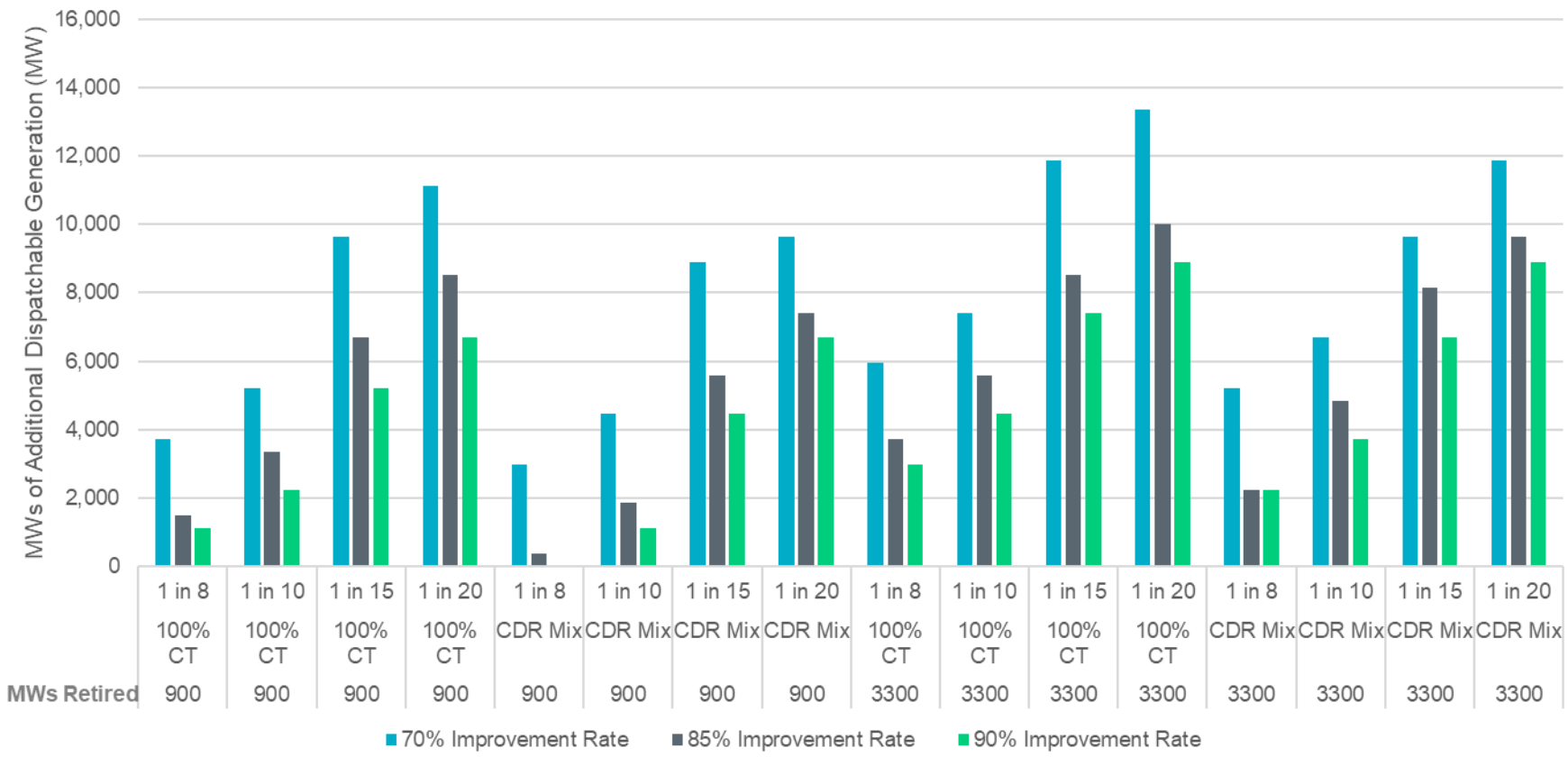
- For the same magnitude and duration thresholds at the same loss of load expectation, exceedance probabilities are affected by differences in generation portfolio and the selection of weather years.
- The most binding of the three dimensions depends on the threshold values, the number of weather years considered and the resource mix.

Additional Dispatchable Generation Comparison: 15 Weather Years vs. 42 Weather Years



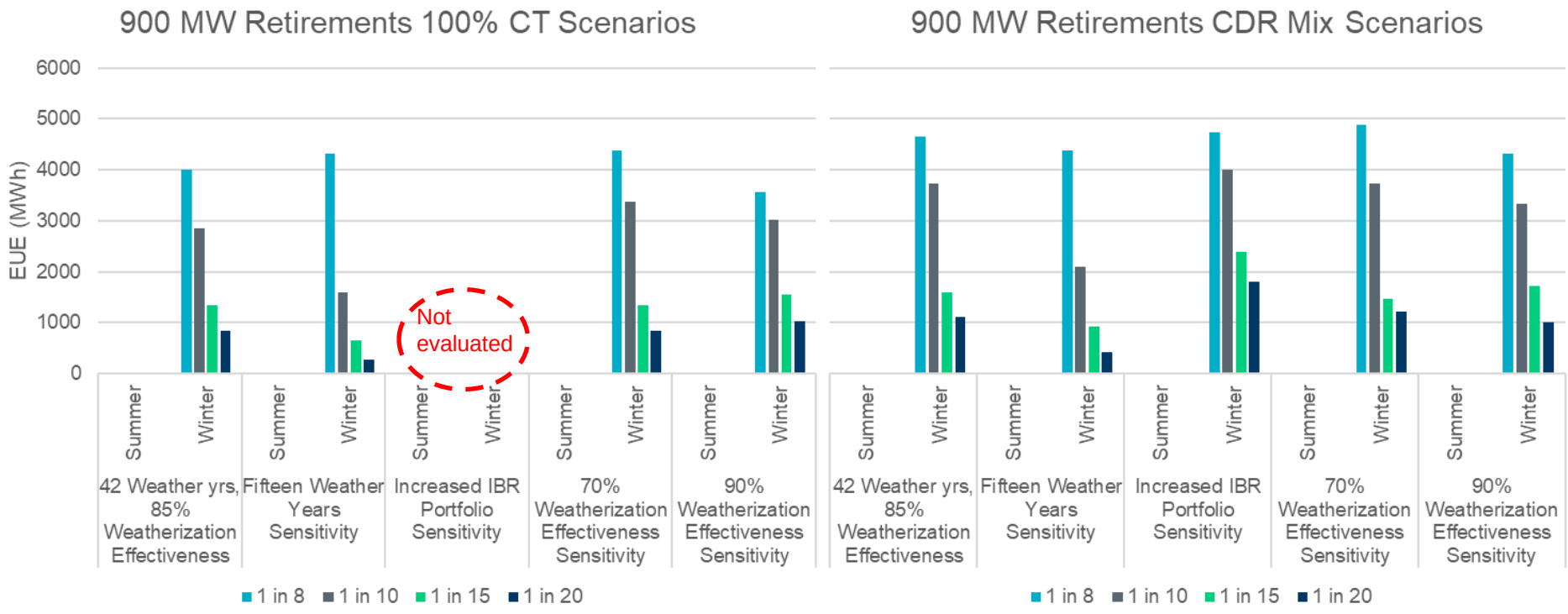
Key Takeaway: Around 5 GW more generation capacity is needed to reach the same frequency if future weather resembles the most recent 15 simulated years. This supplementary generation capacity significantly reduces max duration, max magnitude and EUE.

Impacts of Weatherization Effectiveness



Key Takeaway: A higher weatherization success rate reduces the additional CT capacity required to reach the same expected frequency. An improvement of 1% in weatherization success rate translates to a saving of approximately 175 MW of CT capacity.

Summer and Winter Expected Unserved Energy: 900 MW Retirement Scenarios



Key Takeaway: Most of the loss of load events take place in the winter season due to additional cold weather-related outages, low reliability contribution from solar and elevated winter peak load. Less than 2% of expected unserved energy occurs during the summer and other seasons across all scenarios.

Reference

- https://interchange.puc.texas.gov/Documents/54584_53_1358763.PDF