Energy Systems Integration Group (ESIG) Fall Technical Workshop

Triple Metrics for Resource Adequacy

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Reliability Standard Framework

Loss of Load Event

Defined as a period of time when firm load exceeds available generation capacity **+ 1,500 MW** of operating reserves, and ERCOT must use rotating outages as a balancing tool to maintain system stability.

Frequency
How often (#/yr) an event is expected to occur

Magnitude
Maximum size (MW) for an event

Duration
How long (hrs) event lasts

Exceedance Tolerances

Framework Components

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) and demand (electric load) on the ERCOT grid are not balanced. On average, demand is not expected to exceed supply more than once every 10 years.

- **Magnitude:** The maximum amount of electricity lost (loss of load (LOL)) during any single hour of a potential outage. This LOL is expected to be less than the amount of electricity that can be rotated among consumers during the outage.

- **Duration:** The maximum duration of a LOL during a potential grid outage is expected to last less than 12 hours.

Process Requirements

- Criteria deficiencies to be determined by reliability assessments at least once every three years; deficiencies require ERCOT to develop market design options to address the expected deficiencies with Independent Market Monitor (IMM) review.

- First reliability assessment will start in 2026 with simulations for years 2026 and 2029.

- Modeling assumptions must be developed and approved by the Public Utility Commission of Texas (PUCT) with a public review process prior to conducting the assessment.

Rationale for the Chosen Framework

Why use multiple probabilistic measures?

- The most common probabilistic reliability measure, Loss of Load Expectation (LOLE), focuses on the average frequency of loss-of-load (LOL) events across all the Monte Carlo simulation outcomes.

- LOLE does not address tail risk characteristics: severe LOL events exemplified by large magnitudes, long durations, or both.

- While LOLE is useful, additional measures are needed to ensure that the entire reliability risk profile (averages and tail events) is addressed.

Why include maximum magnitude and maximum duration along with frequency?

- Maximum magnitude addresses a key physical reliability constraint: How many MWs at one time can be effectively managed for rotating load shed purposes?

- Maximum duration addresses a key reliability policy constraint: What is the maximum acceptable length of an outage event for customers?

Role of Expected Unserved Energy (EUE)

What about using Expected Unserved Energy as one of the measures?
- EUE is an average measure, like LOLE, and does not distinguish the characteristics of extreme events (magnitude and duration).
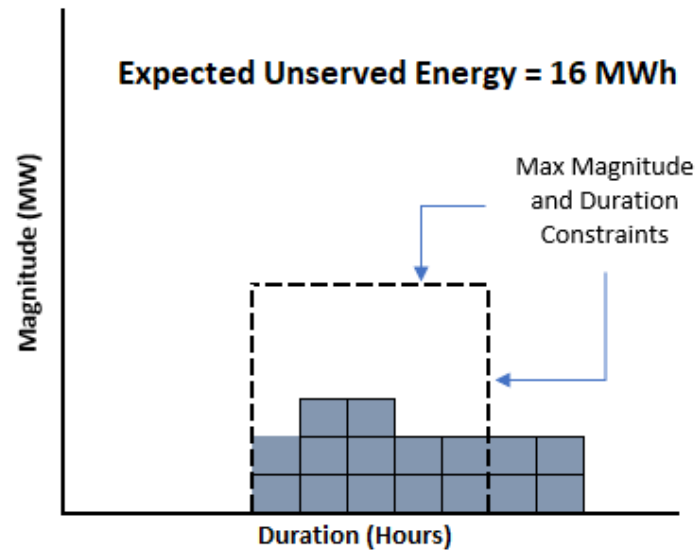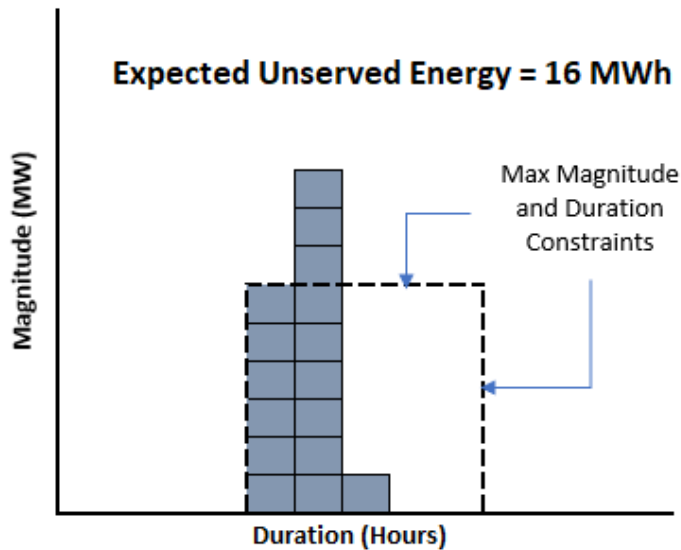

- EUE is a useful measure for characterizing cost impacts:
  - The expected cost of not meeting customer firm load requirements
  - The expected incremental cost of modifying Reliability Standard elements

Exceedance Probability and Tolerance

- **Exceedance Probability:** The likelihood that maximum magnitude and maximum 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.

- **Exceedance Tolerance**: The maximum acceptable percentage of simulations in which the modeled ERCOT System experiences a loss-of-load event that exceeds the threshold for a given criterion of the reliability standard.

Exceedance Probability Example

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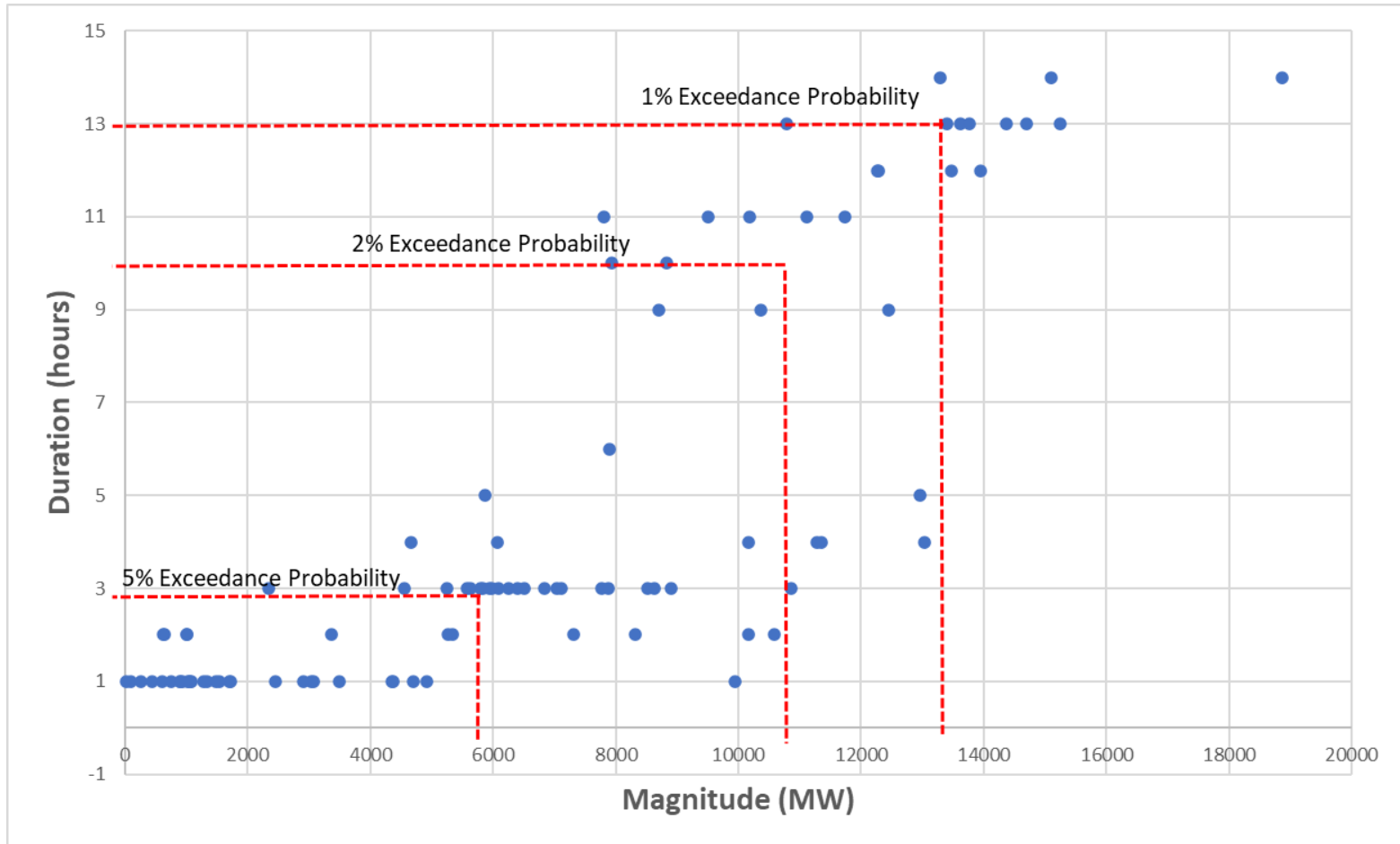
Modeling Challenges

- Increasing complexity of load forecasting
  - Large loads, electric vehicles/electrification, rooftop solar and other distributed resources, energy storage charging
- Extreme weather event modeling
- Modeling price-responsive demand
- Supply deliverability impacts
- Resource capacity expansion
- Market design representation
- Energy storage impacts