2010 LOLE Study – Methodology and Results

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Board of Directors
November 16, 2010

Background

- **The scope of this study is to evaluate the impact of system volatility on the relationship between generation reserve levels and system reliability.**
- **This study is updated about every two years. The last study was completed in 2007. The current study was performed according to the description contained in the GATF Report Recommendations approved by the Board in April 2010**
- **The following components of system volatility are being considered:**
  - The forced outage and derating of generating facilities.
  - Load forecast uncertainty related to weather.
  - The intermittent nature of wind power.
- **The main indicator of reliability is the Loss-of-Load Events (LOLEV).**
  - LOLEV is the number of times in a year that available generation was incapable of meeting demand
  - Traditional one-day-in-10-years criteria is equivalent to 0.1 LOLEV
- **Study year was 2012**

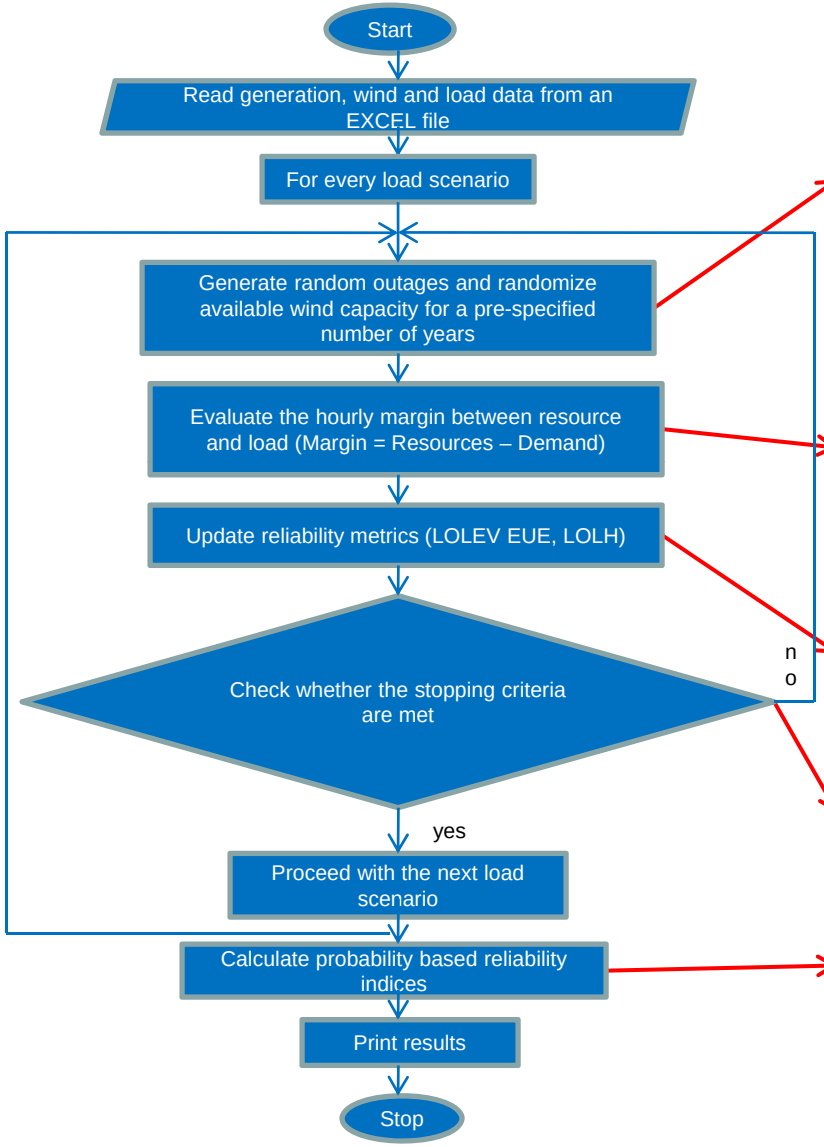
Input Data

- **Generation (non-wind)**
  - Existing and signed IA generation
    - Seasonal capacity ratings from RARF
    - Forced outage rates from NERC GADS
    - Outages are modeled sequentially, using random draws from two exponential distributions which represent the mean time to failure and mean time to repair.
    - The outage modeling results in unit unavailability due to forced outage equal to EFORd.
- **Load**
  - Five load scenarios
    - Extreme summer (10% probability of occurrence)
    - Warmer than average (23%)
    - Average (34%)
    - Cooler than average (23%)
    - Much cooler than average (10%)
  - Specific historic year's hourly chronological load used for each scenario, chosen to be statistically representative

Input Data, continued

- **Wind Generation**
  - Based on the annual wind generation patterns prepared for ERCOT by AWS Truewind for the CREZ analysis.
    - Contain representative geographic diversity and hourly volatility
  - When evaluating a particular day in one of the load scenarios, the hourly wind profile for that day was chosen from these patterns for dates ±7 days from date under study
  - Forced outages of individual wind turbines are not being modeled.

Flowchart



- For every unit, build sequences of generator availability and unavailability periods using MTTF and MTTR respectively.
- For every day, create random daily wind profiles. To randomly choose a day's wind profile, a span of +/- 7 days is used.
- Generate hourly resource profiles by summing up the hourly capacity available (wind and non-wind).

- Once hourly resource profiles are available, the margin is calculated.
- A negative margin indicates a loss of load hour and it's value the amount of load that could not be served. A sequence of loss of load hours is treated as one loss of load event.

- The reliability metrics (LOLEV, EUE and LOLH) are updated based on the hourly margin obtained.

- Once a (maximum) number of iterations has been run or the stopping criteria have been met, proceed to the next load scenario. See next slide for the stopping criteria.

- Based on the probability associated with each of the load scenarios, calculate the study-wide reliability indices.

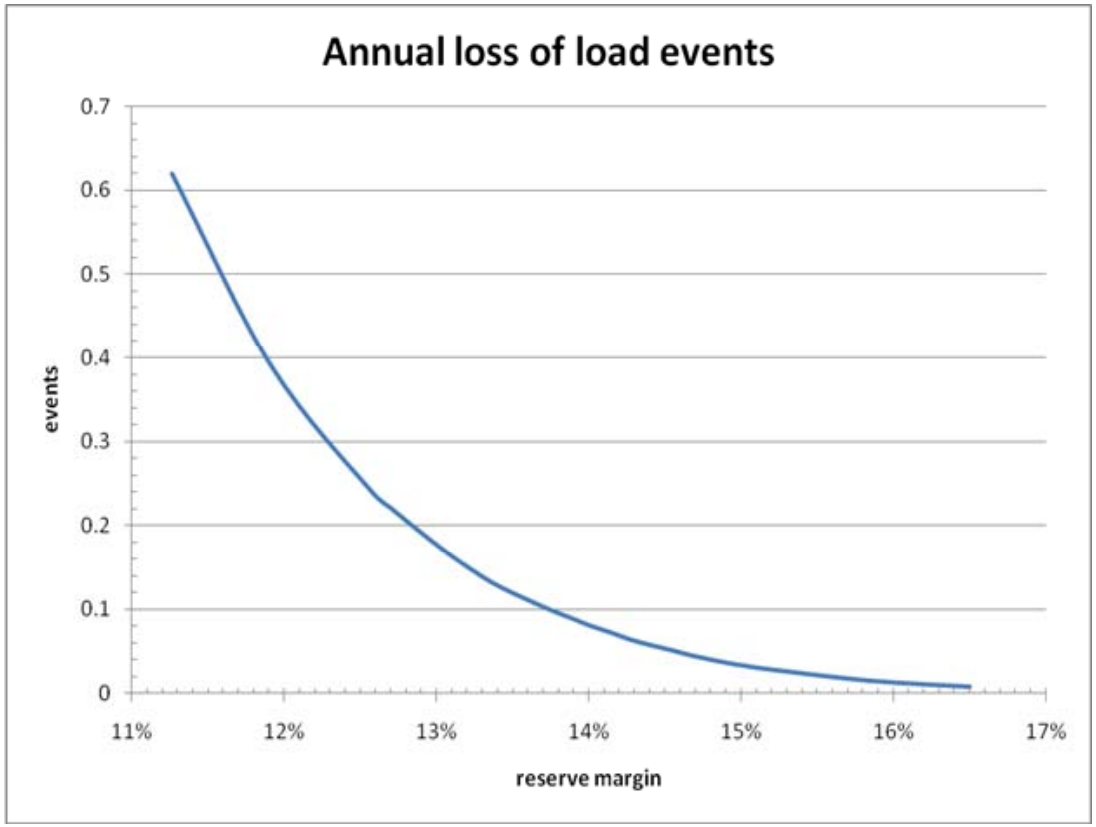
ELCC calculation

- **Methodology for the ELCC calculation:**
  - LOLEV is calculated, using process on previous slide, for the base case system with all generation, including wind
  - Wind units are removed and LOLEV is calculated
  - The capacity of each non-wind generator in the fleet is proportionally increased and the LOLEV is recalculated
    - This process is repeated until the resulting LOLEV is equivalent to that in the base case
  - The ELCC value is equal to the ratio of additional non-wind capacity (capacity multiplier-1 times the installed non-wind capacity) divided by the total installed capacity of wind, in percent

- **This ELCC calculation effectively "equalizes" the contribution to LOLEV from wind to that of the non-wind generation, on an annual basis**

Study Results

- The ELCC for wind using the LOLEV metric is 12.2%
- The Target Reserve Margin using the LOLEV metric of 0.1 is 13.75%



Questions?