Load Model (LM) Selection Procedure for RRS

Introduction

The RRS uses PRISM to calculate the IRM/FPR. Load uncertainty in PRISM is modeled via 52 normal distributions, one for each week. The normal distributions (mean and standard deviation) can be estimated by using historical load data. The length of the time period used to estimate the normal distributions has to be 7 years or longer to ensure statistically significant estimates of the mean and the standard deviation. PJM has load data for its entire footprint and for its neighbors' from 1998 up until 3 years prior to the RRS year. Using this data, there are multiple time-periods (7 years or longer) that can be considered to estimate the mean and standard deviation. The comparative assessment of these time-period candidates (from here on in referred to as Load Model candidates) is based on two premises: 1) consistency with the RTO's CP1 distribution for 4 years in the future from the most recent PJM Load Forecast and 2) reasonable representation of historical PJM-World load diversity.

Definitions

To understand the premises of the comparative assessment at the core of the Load Model Selection Procedure, the following concepts are defined.

- CP1 Distribution (or Coincident Peak 1 Distribution): PJM develops a peak load forecast for each of the next 15 years at the RTO and zonal levels. The forecast accounts for weather uncertainty by considering historical weather scenarios. Each of these weather scenarios has the same probability of occurrence and produces a different peak load forecast. This collection of equally likely peak load forecast values corresponds to the CP1 Distribution. The value published in the PJM Load Forecast Report is the median (or 50/50 value) of the CP1 distribution.
- PJM-World Load Diversity: difference in the timing of annual peaks between PJM and the World. It is usually expressed as the World's load (in per-unitized terms) at the time of the PJM peak and vice-versa.

Procedure

- Assess the consistency of each of the Load Model (LM) Candidates with the RTO's CP1 distribution for 4 years in the future from the most recent PJM Load Forecast. This is accomplished by using two approaches:
    - Approach 1
        - For each LM Candidate,
            - Make the necessary adjustments to the 52 means and standard deviations so that the monthly peak relationship from the most recent PJM Load Forecast is captured by the LM.
            - Perform 5 random draws (one for each weekday daily peak) from the normal distribution that contains the expected annual peak

- Calculate the highest of the 5 numbers previously drawn (this number represents the sampled annual peak)
- Repeat the two step above N times, with N being the number of weather scenarios in the most recent PJM Load Forecast
- Develop a Cumulative Distribution Function (CDF) by sorting the N sampled annual peaks (each of the N peaks is equally likely and therefore all have the same probability 1/N)
- Calculate the point-to-point absolute MW error between the sampled CDF and the CDF produced with the CP1 distribution.
- Add up the N absolute MW errors; this is the total MW error for a LM Candidate.

▪ Select 3-5 LM Candidates with the smallest total MW error in the 70th percentile and above (where LOLE risk is concentrated).

o Approach 2

▪ For each LM Candidate,

- Make the necessary adjustments to the 52 means and standard deviations so that the monthly peak relationship from the most recent PJM Load Forecast is captured by the LM.
- Using the mean and standard deviation of the week that contains the expected annual peak, calculate the probability of the annual peak being less than or equal to each of the N peaks in the CP1 distribution (this results in N probability values)
- Calculate the point-to-point absolute probability error between the above N probability values and the probability values of the CDF produced with the CP1 distribution.
- Add up the N absolute probability errors; this is the total probability error for a LM Candidate.

▪ Select 3-5 LM Candidates with the smallest total probability error in the 70th percentile and above (where LOLE risk is concentrated).

- Develop World Load Models using the time-periods of the PJM Load Models shortlisted in Approaches 1 and 2 (it is likely that both approaches produce the same set of PJM Load Models)
- Make the necessary adjustments to the 52 means and standard deviations of each World Load Model so that the relationship between the World's forecasted monthly peaks is captured by the LM.
- Compare the annual peaks of PJM and the World for each of the LM candidates and corresponding World LMs to ensure consistency with historical load diversity patterns. Also, consider the Capacity Benefit of Ties resulting from multi-year GE-MARS simulations.

Additional Notes

In the case of ties between LMs, take into consideration the following:

- A more recent LM is preferred
- A LM built with more data (longer time-period) is preferred
- Results from Approach 2 are favored over Approach 1 since Approach 2 does not rely on random sampling.