

Supplementary file

Probability calculation

A system's total survival hours for an outage starting in the [index+1] th hour is represented by each value in an array of length 8760 for hourly analysis, denoted by r , where each value in the array stands for the system's total survival hours. After calculating the surviving outage durations (or r) series, the following equation is used to calculate the probabilities of survival for outages of various durations.

$$P(hrs_i) = \frac{1}{ts} \sum_{h \in r} \begin{pmatrix} 1, & \text{if } h > hrs_i \\ 0, & \text{otherwise} \end{pmatrix} \quad \text{for } i \in [1, r_{max}]$$

Where, P represents the system's probability of surviving i number of hours; ts signifies the whole time steps (8760 for hourly analysis); The system's survival hours during an outage that starts in the i th hour are expressed as h (from the r series); hrs_i is the total number of survival hours for which the probability is being determined; r_{max} describes the highest maintained hours of the system (for an outage starting from a distinct hour of the year emanated from the index of r_{max} in the series). The above equation specifies the system's likelihood of maintaining an outage size in the range from 1 to r_{max} . These possibilities are averaged over the hour of the day (for all 24 hours) and the month of the year (for all 12 months) to consider the impact of the outage beginning hour and month on the outage survival span.