

## Common T&D Reliability Indices

This paper gives formulas used to calculate common reliability indices based on outage history.

### Definitions

$N_i$  = number of customers interrupted by outage  $i$

$N_T$  = total number of customers in the system

CN = total number of customers in the system experiencing 1 or more sustained outages

$CN_{(k>n)}$  = total number of customers in the system experiencing more than  $n$  sustained outages

$CNT_{(k>n)}$  = total number of customers in the system experiencing more than  $n$  outages

$L_i$  = connected kVA of customers interrupted by outage  $i$

$L_{ave\ i}$  = average load of customers interrupted by outage  $i$

$L_T$  = total connected kVA of the system

$r_i$  = duration of interruption to customers interrupted by outage  $i$

$T$  = period, usually one year, (8760 hours or 525600 minutes)

$ID_i$  = interrupting device operations

$ID_E$  = interruption device events

### Sustained Customer Interruption Indices

System Average Interruption Frequency Index

$$SAIFI = (\sum N_i)/N_T$$

System Average Interruption Duration Index

$$SAIDI = (\sum r_i * N_i)/N_T$$

Customer Average Interruption Duration Index

$$CAIDI = SAIDI/SAIFI$$

Customer Total Average Interruption Duration Index

$$CTAIDI = (\sum r_i * N_i)/CN$$

Customer Average Interruption Frequency Index

$$CAIFI = (\sum N_i)/CN$$

Average Service Availability Index

$$ASAI = (N_T * T - \sum r_i * N_i)/(N_T * T)$$

Customers Experiencing Multiple Interruptions

$$CEMI_n = CN_{(k>n)}/N_T$$

### Momentary Customer Interruption Indices

Momentary Average Interruption Frequency Index

$$MAIFI = (\sum ID_i * N_i)/N_T$$

Momentary Average Interruption Frequency Event Index

$$MAIFI_E = (\sum ID_E * N_i)/N_T$$

Customers Experiencing Multiple Sustained and Momentary Interruptions

$$CEMSMI_n = CNT_{(k>n)}/N_T$$

### Load and Energy Based Indices

Average System Interruption Frequency Index

$$ASIFI = (\sum L_i)/L_T$$

Average System Interruption Duration Index

$$ASIDI = (\sum r_i * L_i)/L_T$$

Expected Energy Not Supplied

$$EENS = \sum L_{ave\ i} * r_i$$

Average Energy Not Supplied

$$AENS = (\sum L_{ave\ i} * r_i)/N_T$$

Average Customer Curtailment Index

$$ACCI = (\sum L_{ave\ i} * r_i)/CN$$

**Economic Indices** (see power point on cost of customer interruption for more details)

Sector Customer Damage Function

$$SCDF$$

Composite Customer Damage Function

$$CCDF = \sum L_{ave\ i} * SCDF$$

Expected Customer Outage Cost

$$ECOST = \sum CCDF(r)$$

Interrupted Energy Assessment Rate

$$IEAR = ECOST/EENS$$

### Miscellaneous Terms

Customer Minutes

$$CMIN$$

Customers Experiencing Sustained Outages

$$CESO$$

Customer Experiencing Momentary Outages

$$CEMO$$

### Generation Adequacy Indices

Loss of Load Probability

$$LOLP$$

Loss of Load Expectation

$$LOLE$$

Loss of Energy Expectation

$$LOEE$$