



Draft Distribution Reliability Measures Guidelines

Electricity distribution network service providers

June 2017

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1 Nature and Authority

1.1 Introduction

This document sets out how distribution system reliability should be measured. It establishes a set of common definitions of reliability measures that can be used to assess and compare the reliability performance of Distribution Network Service Providers (DNSPs) for all jurisdictions in Australia.

1.2 Authority

Clause 6.28 of the National Electricity Rules (*NER*) requires the AER to make and publish, in accordance with the *distribution consultation procedures*, this Distribution Reliability Measures Guidelines (the *guideline*).

1.3 Definitions and interpretation

In this *guideline* the words and phrases have the meaning given to them in:

- the glossary, or
- if not defined in the glossary, the *NER* or the *National Energy Retail Rules* (*NERR*).

1.4 Process for revision

We may amend or replace this *guideline* from time to time in accordance with the *distribution consultation procedures*.

The AER must review this Distribution Reliability Measures Guidelines at least every 5 years.

1.5 Version history and effective date

A version number and an effective date of issue will identify every version of this *guideline*.

2 Application of this guideline

The AER may apply the definitions of reliability measures specified in this guideline when we issue a Regulatory Information Notice (RIN) under section 28D of the National Electricity Law (NEL), or Regulatory information Order (RIO) under section 28C of the NEL, as appropriate.

The AER may also make references to this guideline where we consider it appropriate to do so.

Other bodies may make references to this guideline.

3 Reliability measures and supporting definitions

The reliability measures are:

- SAIDI or System Average Interruption Duration Index
- SAIFI or System Average Interruption Frequency Index
- Customer Average Interruption Duration Index (CAIDI)
- MAIFLe or Momentary Average Interruption Frequency Index event
- Supply reliability levels experienced by the Worst-served customer

When calculating SAIDI, SAIFI, MAIFI and MAIFLe:

- Exclusions – One or more of the circumstances numbered 1 to 7 below in section 3.2 Exclusions may be excluded from the calculation of the reliability measures.

The MAIFI measure may be used where the current recording facilities do not have the capacity to record *momentary interruption events* under the MAIFLe method.

Reliability measures should be reported as planned and unplanned supply outages and total outages and on the following basis:

- by feeder type
- overall performance of the entire network.

The table below provides the definition of these measures and associated definitions to enable an assessment and comparison of reliability performance of DNSPs .

3.1 Definitions

CBD feeder means a *feeder* in the CBD area of State or Territory capital that has been determined by the relevant *participating jurisdiction* as supplying electricity to predominantly commercial, high-rise buildings, supplied by a predominantly underground *distribution network* containing significant interconnection and redundancy when compared to urban areas.

Customer means an end user of electricity who purchases electricity supplied through a *distribution system* to a connection point.

Customer Base in respect of a relevant period, means:

- the number of *Distribution Customers* as at the start of the relevant period; plus
- the number of *Distribution Customers* as at the end of the relevant period, divided by two.

Customer Average Interruption Duration Index (CAIDI) in respect of a relevant period, means the total duration of all the *Sustained Interruptions* (in minutes) divided by the total number of *Sustained Interruptions* that have occurred during the relevant period, which is equivalent to dividing the *SAIDI* by the *SAIFI* measures.

This measure represents the average time to restore supply to *customers* after a supply *interruption* event.

This performance measure should be reported on both by *feeder* type and by distribution network overall basis.

Distribution Customer means a connection point between a *distribution network* and *Customer* that has been assigned a NMI, including energised and de-energised *connection points* but excluding *unmetered connection points*.

Feeder means a power line, including underground cables, that is part of a *distribution network*.

IEEE Guide means the 'IEEE Guide for Electric Power Distribution Reliability Indices, IEEE Std 1366-2012' published by the Institute of Electrical and Electronic Engineers on 31 May 2012.

Interruption means any loss of electricity supply to *Distribution Customers* associated with an *outage* of any part of the *network*, including *outages* affecting a single *Customer's* premises but excluding *disconnections* caused by a *retailer* or a fault in electrical equipment owned by a *Customer*, provided that:

- the start of an *Interruption* is taken to be when the *Interruption* is initially automatically recorded by equipment such as SCADA or, where such equipment does not exist, at the time of the first *Customer* reports that there has been an *outage* in the *network*; and
- the end of an *Interruption* is taken to be when the *Interruption* is automatically recorded as ending by equipment such as SCADA or, where such equipment does not exist, the time when electricity supply is restored to the affected *Distribution Customers*.¹

Long rural feeder means a *feeder* with a total feeder route length greater than 200 km, which is not a *CBD feeder* or *urban feeder*.

Major Event Day has a meaning consistent with that given in the *IEEE Guide*, provided that for the purposes of applying a common distribution reliability measure, the regulator applies a log standard deviation of 2.5, that is, a '2.5 beta'.

MAIFI or Momentary Average Interruption Frequency Index in respect of a relevant period, means the total number of *Momentary Interruptions* that have occurred during the relevant period, divided by the *Customer Base*, provided that *Momentary Interruptions* that occur within the first three minutes of a *Sustained Interruption* are excluded from the calculation.

MAIFle or Momentary Average Interruption Frequency Index event in respect of a relevant period, means the total number of *Momentary Interruption Events* that have occurred during the relevant period divided by the *Customer Base* for the relevant period, provided that *Momentary Interruptions* that occur within the first minutes of a *Sustained Interruption* are excluded from the calculation.

Momentary Interruption means an *Interruption* to a *Distribution Customer's* electricity supply with a duration of 3 minutes or less, provided that the end of each *Momentary Interruption* is taken to be when electricity supply is restored for any duration. (see Figure 1.2)

Momentary Interruption Event means one or more *Momentary Interruptions* that occur within a continued duration of 3 minute or less, provided that the successful restoration of electricity supply after any number of *Momentary Interruptions* is taken to be the end of the *Momentary Interruption Event*. (see Figure 1.2)

National electricity legislation has the meaning given in the *National Electricity Law*.

Outage means the loss of ability of a component to deliver electrical power.

Note: for reporting purposes:

- Single premises outage is a network interruption unless customer fault is actively identified.
- HV single phase outage – unless accurate means to determine the exact number of customers affected, report of 67% of all downstream customers for a single-phase HV outage on a three phase network. Report of 100% of customers for all other HV outages, for example; when there is a single HV phase outage on a two phase or single phase HV system.
- LV single phase outage – unless accurate means to determine the exact number of customers affected, report of 33% of all downstream customers for a single phase outage.

Planned Interruption means an *Interruption* resulting from a *Distribution Network Service Provider's* intentional interruption of electricity supply to a *Customer's* premises where the *Customer* has been provided with prior notification of the *Interruption* in accordance with all applicable laws, rules and regulations.

¹ The number of affected Customers during an Interruption may need to be estimated.

Point of Supply has the same meaning as defined in the relevant jurisdiction's Service and Installation Rules.

SAIDI or System Average Interruption Duration Index in respect of a relevant period, means the sum of the durations of all the *Sustained Interruptions* (in minutes) that have occurred during the relevant period, divided by the *Customer Base*.

SAIFI or System Average Interruption Frequency Index in respect of a relevant period, means the total number of *Sustained Interruptions* that have occurred during the relevant period, divided by the *Customer Base*.

SCADA or Supervisory Control and Data Acquisition means a system employed to gather and analyse real-time data in respect of *network* related infrastructure.

Short rural feeder means a feeder with a total feeder route length less than 200 km, which is not a *CBD feeder* or *urban feeder*.

Sustained Interruption means an *Interruption* to a *Distribution Customer's* electricity supply at the *point of supply* that has a duration longer than 3 minutes, provided that the successful restoration of supply to the *Distribution Customer* is taken to be the end of the *Sustained Interruption*.

Unplanned Interruption means an *Interruption* that is not a *Planned Interruption*.

Urban feeder is a *feeder* which is not a *CBD feeder* and has a 3-year average maximum demand over the feeder route length greater than 0.3 MVA/km.

Worst served customer means a *customer* suffer from a disproportionate number of faults, compared with the network average customer, because the *customer* experienced greater than 4 times the Network average for unplanned SAIDI on a three-year rolling average basis.

Note DNSPs must report to the AER annually:

- the average unplanned SAIDI of the worst-served customers
- the average unplanned SAIFI of the worst-served customers
- the top five feeders with the most worst-served customers
- the number of worst-served customers of the above five feeders.

3.2 Exclusions

Interruptions that result from the following circumstances may be excluded from the calculation of *SAIDI*, *SAIFI*, *MAIFI* and *MAIFLe* :

1. *Load shedding* due to a *generation* shortfall.
2. Automatic *load shedding* due to the operation of under-frequency relays following the occurrence of a *power system* under-frequency condition.
3. *Load shedding* at the direction of *AEMO* or a *System Operator*.
4. *Load interruptions* caused by a failure of the shared *transmission network*.
5. *Load interruptions* caused by a failure of *transmission connection assets* except where the interruptions were due to (a) the direction actions, or inactions, of the *Distribution Network Service Provider* that are inconsistent with good industry practice; or (b) inadequate planning of *transmission network* connections points and the *Distribution Network Service Provider* is responsible for the planning of *transmission network connection points*.

For example, when a DNSP omits to suppress back-up earth fault (BUEF) protection when undertaking network switching operation that resulted in momentary paralleling of supplies from two different terminal stations, which is inconsistent with the standard practice.

6. *Load interruptions* caused by the exercise of any obligation, right or discretion imposed upon or provided for under *jurisdictional electricity legislation* and *national electricity legislation* applying to a *Distribution Network Service Provider*.
-

7. *Load interruptions* caused or extended by a direction from state or federal emergency services, provided that a fault in, or the operation of, the *network* did not cause, in whole or part, the event giving rise to the direction.

Interruptions may also be excluded that occur on days where the daily *unplanned SAIDI* for the DNSP's distribution network exceeds the *major event day* boundary, when the event has not been excluded under the seven *exclusion* clauses described above.

3.3 Illustration of how to measure supply interruptions

Figure 1.1 shows an example of a sustained interruption, where two unsuccessful attempts are made. In this case, the duration of the interruption is greater than the momentary interruption threshold of 3 minutes.

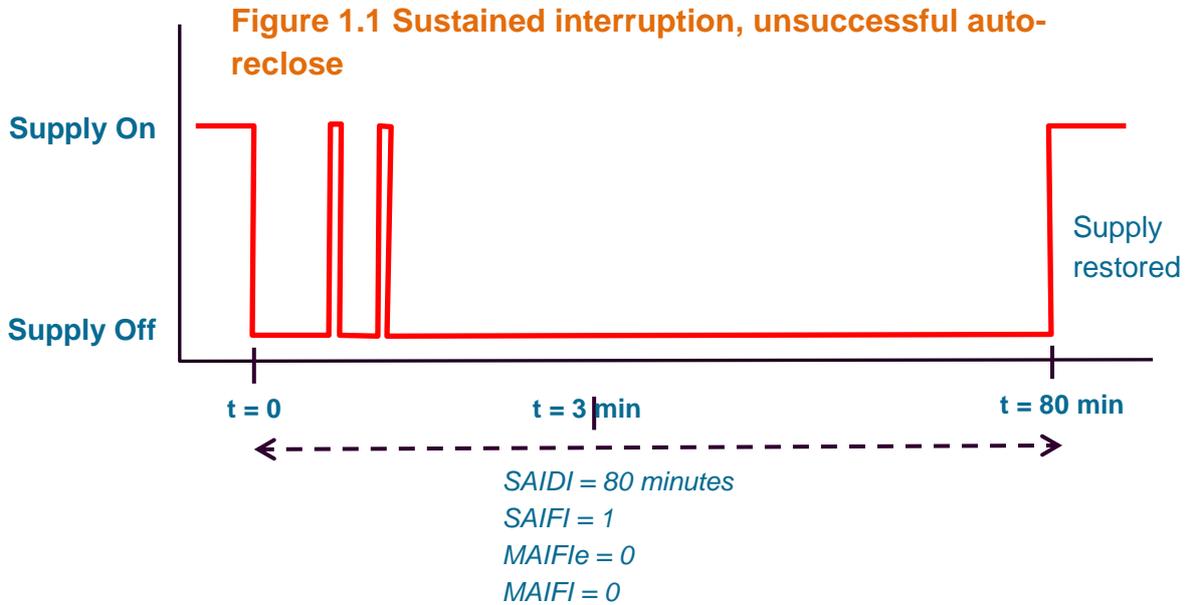
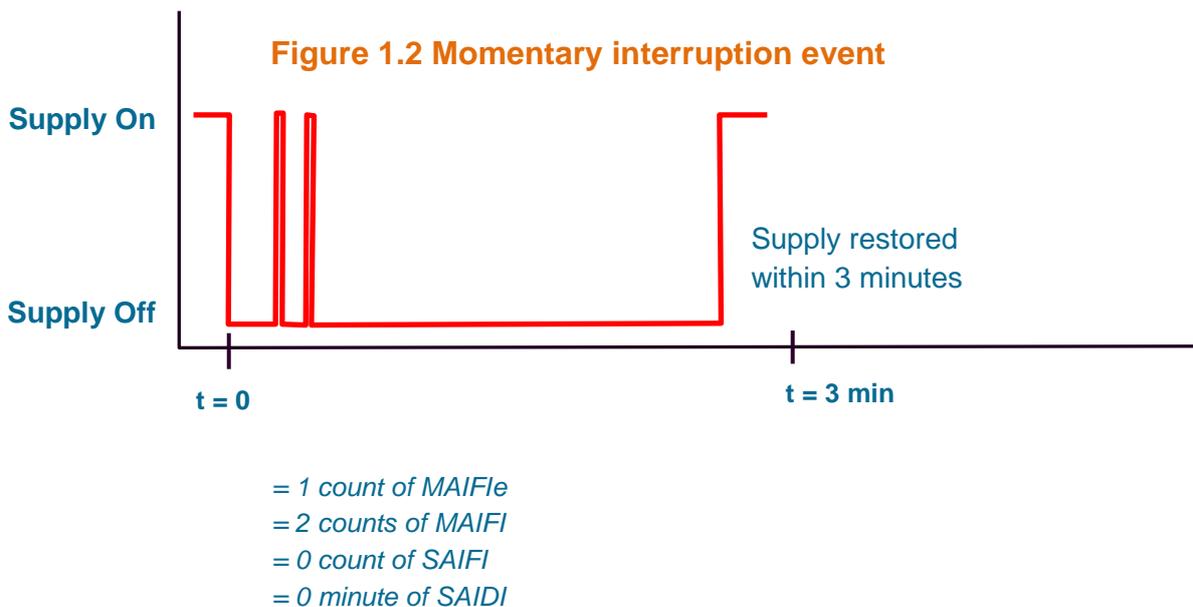


Figure 1.2 demonstrates the difference between MAIFI and MAIFle. It shows an example of a momentary interruption event, where the affected customers experience two momentary interruptions before the supply is successfully restored. In this case, the duration of the interruption is less than the momentary interruption threshold of 3 minutes.



4 Glossary

This guideline uses following definitions and acronyms.

| Shortened form | Extended form |
|--|--|
| annual revenue requirement | has the meaning set out in the National Electricity Rules. |
| business day | has the meaning set out in the National Electricity Rules. |
| CAIDI (Customer Average Interruption Duration Index) | the sum of the duration of each sustained customer interruption (in minutes), divided by the total number of sustained customer interruptions (SAIDI divided by SAIFI). CAIDI excludes momentary interruptions (one minute or less duration). |
| CPI (consumer price index) | has the meaning set out in the National Electricity Rules. The CPI used to escalate the value of customer reliability to the start of the relevant regulatory control period should be the same that was used to roll forward the DNSP's regulatory asset base (using the roll forward model) in the relevant distribution determination. |
| distribution consultation procedures | has the meaning set out in the National Electricity Rules. |
| DNSP (distribution network service provider) | has the meaning set out in the National Electricity Rules. |
| inactive account | a connection to the DNSP's network that is inactive, that is, does not have an active account with a retailer or is otherwise ineligible to take a supply of electricity. |
| incentive rate | the rate at which a revenue increment or decrement accrues due to a change in service performance. |
| interruption | <p>an interruption is any loss of electricity supply to a customer associated with an outage of any part of the electricity supply network, including generation facilities and transmission networks, of more than 0.5 seconds, including outages affecting a single premises. The customer interruption starts when recorded by equipment such as SCADA or, where such equipment does not exist, at the time of the first customer call relating to the network outage. An interruption may be planned or unplanned, momentary or sustained.</p> <p>Does not include subsequent interruptions caused by network switching during fault finding. An interruption ends when supply is again generally available to the customer.</p> |
| jurisdictional electricity legislation | has the meaning set out in the National Electricity Law. |
| load shedding | has the meaning set out in the National Electricity Rules. |
| MAIFI | has the meaning set out in section 2. |
| major event day | has the meaning set out in section 2. |
| NEL | the National Electricity Law |
| national electricity legislation | has the meaning set out in the National Electricity Law. |

| Shortened form | Extended form |
|---|--|
| national electricity market | has the meaning set out in the National Electricity Law. |
| NER | National Electricity Rules |
| NERR | National Energy Retail Rules |
| network type | the type of network supplying customers being either CBD, urban, short rural or long rural feeders as defined in section 2. |
| parameters | the performance measures defined in appendix section 2. |
| performance target | the level of performance that results in a DNSP neither receiving a financial penalty nor financial reward in the regulatory year. |
| regulatory obligation or requirement | has the meaning assigned in the National Electricity Law. |
| regulatory control period | has the meaning set out in the National Electricity Rules. |
| regulatory information instrument | has the meaning set out in the National Electricity Law. |
| regulatory proposal | has the meaning set out in the National Electricity Rules. |
| regulatory year | has the meaning set out in the National Electricity Rules. |
| revenue at risk | as defined in clauses 2.5 and 5.2, the amount by which a DNSP's revenue may increase or decrease as a result of the application of the scheme. |
| unplanned SAIDI | has the meaning set out in section 2. |
| unplanned SAIFI | has the meaning set out in section 2. |
| s-factor or service standards factor | the percentage revenue increment or decrement that applies in each regulatory year. |
| scheme | service target performance incentive scheme. |
| service target performance incentive scheme | the service target performance incentive scheme defined in the National Electricity Rules. |
| standard control service | has the meaning set out in the National Electricity Rules. |
| system operator | has the meaning set out in the National Electricity Rules. |
| unplanned event | an event that causes an interruption where the customer has not been given the required notice of the interruption or where the customer has not requested the outage. |
| unplanned interruption | an interruption due to an unplanned event. |