

Distribution Reliability Measures Guideline

Draft Version 2 for consultation

August 2022

© Commonwealth of Australia 2022

This work is copyright. In addition to any use permitted under the *Copyright Act 1968* all material contained within this work is provided under a Creative Commons Attributions 3.0 Australia licence with the exception of:

- the Commonwealth Coat of Arms
- the ACCC and AER logos
- any illustration diagram, photograph or graphic over which the Australian Competition and Consumer Commission does not hold copyright but which may be part of or contained within this publication.

The details of the relevant licence conditions are available on the Creative Commons website as is the full legal code for the CC BY 3.0 AU licence.

Inquiries about this publication should be addressed to:

Australian Energy Regulator
GPO Box 3131
Canberra ACT 2601
Tel: 1300 585 165

AER reference: #13,760,188

Amendment record

Version	Date	Pages
01	14 November 2018	10
<u>02</u>	<u>1 August 2022, Stand Alone Power System added</u>	<u>11</u>

Contents

1	Nature and Authority	1
1.1	Introduction	1
1.2	Authority	1
1.3	Definitions and interpretation	1
1.4	Process for revision	1
1.5	Version history and effective date	1
2	Appication of this guideline.....	2
3	Reliability measures and supporting definitions	3
3.1	Measurements - CAIDI, SAIDI, SAIFI, MAIFI, MAIFle.....	3
3.2	Definitions	4
3.3	Exclusions	7
3.4	Illustration of how to measure supply interruptions	9
4	Glossary.....	10

1 Nature and Authority

1.1 Introduction

This *guideline* 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.

Currently the Australian Energy Regulator (AER) and States regulators define how reliability should be measured, which means it is difficult to compare the reliability performance across Australia. Consequently, the Australian Energy Market Commission (AEMC) implemented a rule change that required us to develop common definitions for distribution reliability measures for application in the National Electricity Market (NEM).

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 Guideline (the *guideline*).

1.3 Definitions and interpretation

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

- in section 3.2
- 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 *guideline* at least every 5 years.¹

1.5 Version history and effective date

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

¹ NER clause 6.28(c)

2 Application of this guideline

We will apply the definitions of reliability measures specified in this *guideline* when we issue a Regulatory Information Notice (RIN) under section 28D or Regulatory information Order (RIO) under section 28C of the *National Electricity Law* (NEL).

We may also make references to this *guideline* where we consider it appropriate to do so. Other regulatory bodies may make references to this *guideline*.

3 Reliability measures and supporting definitions

The reliability measures contained in this *guideline* are:

- SAIDI or System Average Interruption Duration Index
- SAIFI or System Average Interruption Frequency Index
- CAIDI or Customer Average Interruption Duration Index
- MAIFI or Momentary Average Interruption Frequency Index
- MAIFLe or Momentary Average Interruption Frequency Index event
- Supply reliability levels experienced by the lowest-reliability customers.

When calculating SAIDI, SAIFI, MAIFI and MAIFLe:

- Exclusions – One or more of the circumstances numbered 1 to 7 below in section 3.3
Exclusions may be excluded from the calculation of these 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 tables below provides the definitions of these measures to enable an assessment and comparison of reliability performance of DNSPs.

3.1 Measurements - CAIDI, SAIDI, SAIFI, MAIFI, MAIFLe

CAIDI or Customer Average Interruption Duration Index 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.

SAIDI or System Average Interruption Duration Index, means the sum of the durations of all the *Sustained Interruptions* (in minutes), divided by the *Customer Base*. Momentary Interruptions (of three minutes or less) are excluded from the calculation of unplanned SAIDI.

SAIFI or System Average Interruption Frequency Index, means the total number of *Sustained Interruptions*, divided by the *Customer Base*. Momentary Interruptions (of three minutes or less) are excluded from the calculation of unplanned SAIFI.

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

Notes: When calculating SAIFI, SAIFI, MAIFI and MAIFle:

- Exclusions – One or more of the circumstances numbered 1 to 7 in Section 3.3 of this section may be excluded from such calculations.
- Interruptions – The Interruptions used to calculate such measurements may be limited to Planned Interruptions or Unplanned Interruptions.
- Feeders – The calculations may be limited to CBD feeders, urban feeders, short rural feeders, long rural feeders or a combination of such feeders.

3.2 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.

Distribution Customer means a connection point between a *distribution network* and *Customer* that has been assigned a *National Metering Identifier*, including energised and de-energised *connection points* but excluding *unmetered connection points without a National Metering Identifier*.

Feeder means a power line, including underground cables, that is part of a *distribution network* or a Regulated Stand-alone Power System (SAPS).

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

Interruption² 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*.³

Long rural feeder means a *feeder* that is not a *CBD feeder*, *urban feeder* or *short rural 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’.

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:

² The definition of interruption under this guideline is modified from that specified in the *National Electricity Retail Rules* because supply outages due to some upstream events are included in the reliability measures in addition to those interruptions initiated from the distribution networks.

³ The number of affected Customers during an Interruption may need to be estimated.

- Single premises outage is a network interruption irrespective of whether the outage is caused by the customer's installation. However, if power is still available at the point of supply, there is no supply interruption.
- 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.

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

Regulated Stand-alone Power System (SAPS) has the same meaning as defined in the NER.

SAPS feeder means a *feeder*, or a group of *feeders*, that serves a *Regulated Stand-alone Power System (SAPS)*. To avoid doubt, there will be only one *SAPS feeder* for each *regulated SAPS*.

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 3 year average feeder route length greater than 0.3 MVA/km.

Inadequate level of service customer means a *customer* experiencing greater than 4 times the Network average for unplanned SAIDI on a three-year rolling average basis compared with a network average customer.

Note DNSPs must report to the AER:

- the average unplanned SAIDI of the ***inadequate level of service customer***
- the average unplanned SAIFI of the ***inadequate level of service customer***
- the top five feeders or feeder sections with the most ***inadequate level of service customer***
- the number of ***inadequate level of service customer*** of each of the top five feeders or feeder sections.

Where data are unavailable at feeder or feeder-section level, the DNSP may report on zone substation level.

3.3 Exclusions

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

1. Except for a SAPS feeder, Load shedding due to a generation shortfall.
 2. Except for a SAPS feeder, Automatic load shedding due to the operation of under-frequency relays following the occurrence of a power system under-frequency condition.
 3. Except for a SAPS feeder, 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) 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 or 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.
 8. 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.

3.4 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 1.1 Sustained interruption, unsuccessful auto-reclose

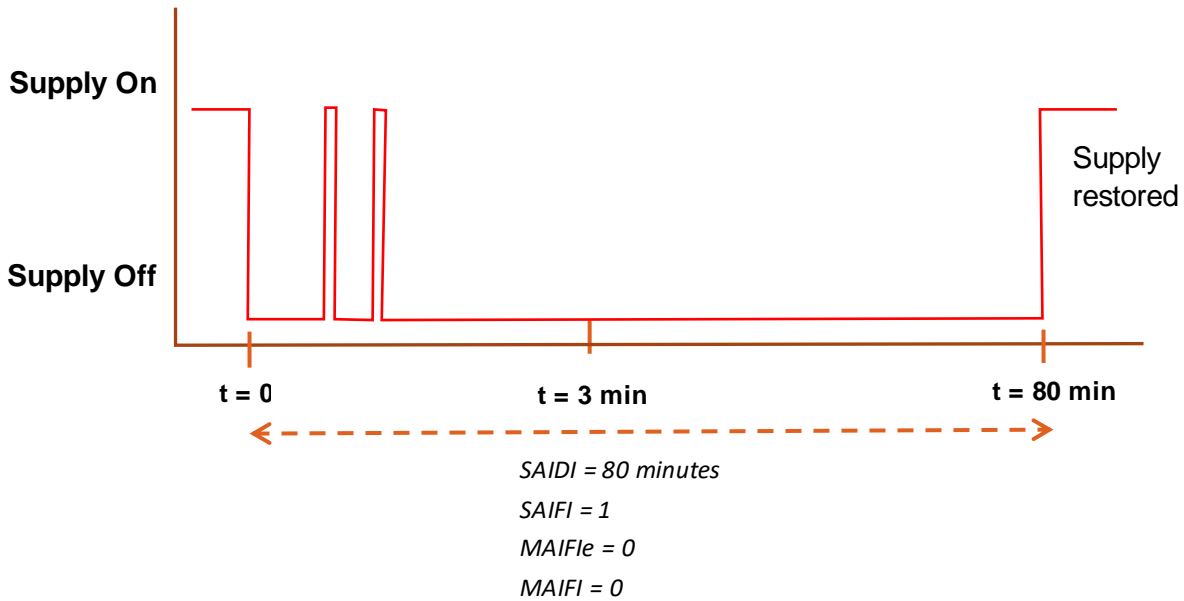
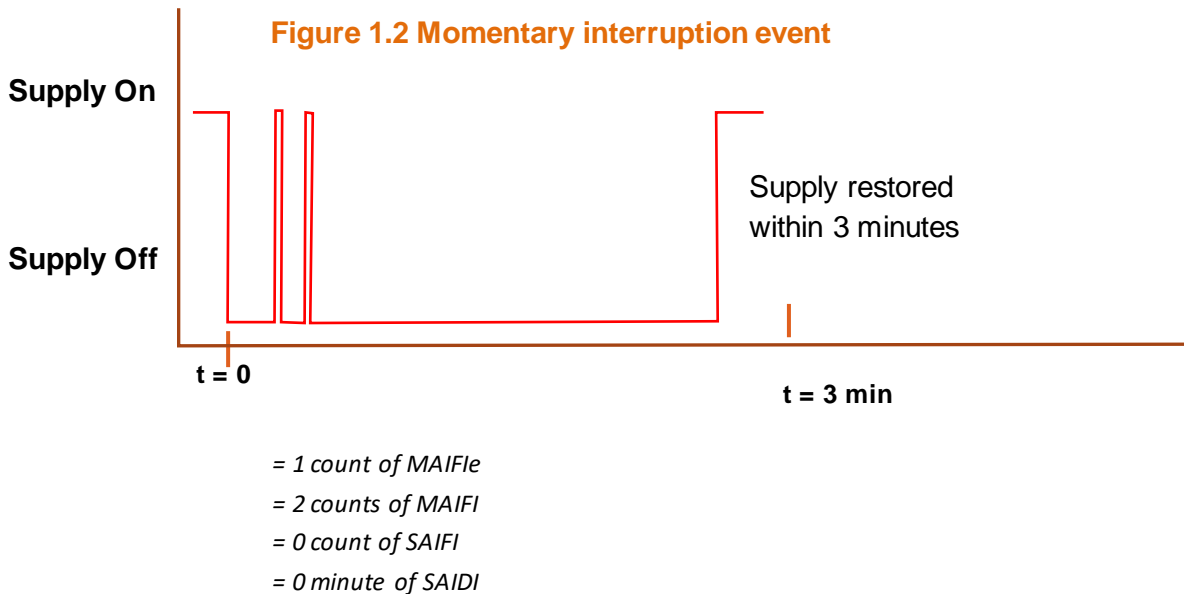


Figure 1.2 demonstrates the difference between MAIFI and MAIFle. It shows an example of a momentary interruption event, where the affected customers experience two momentary interruptions before the supply is successfully restored. In this case, the duration of the interruption is less than the momentary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

Figure 1.2 Momentary interruption event



4 Glossary

This guideline uses following definitions and acronyms.

Shortened form	Extended form
CAIDI (Customer Average Interruption Duration Index)	has the meaning set out in section 3.
distribution consultation procedures	has the meaning set out in the <i>National Electricity Rules</i> .
DNSP (distribution network service provider)	has the meaning set out in the <i>National Electricity Rules</i> .
interruption	has the meaning set out in section 3.
jurisdictional electricity legislation	has the meaning set out in the <i>National Electricity Law</i> .
load shedding	has the meaning set out in the <i>National Electricity Rules</i> .
MAIFI	has the meaning set out in section 3.
major event day	has the meaning set out in section 3.
NEL	the <i>National Electricity Law</i> .
national electricity legislation	has the meaning set out in the <i>National Electricity Law</i> .
national electricity market	has the meaning set out in the <i>National Electricity Law</i> .
National Metering Identifier	The NMI (National Metering Identifier) is a unique ten character (plus a one digit checksum) identifier for a metering point.
NER	the <i>National Electricity Rules</i> .
NERR	the <i>National Energy Retail Rules</i> .

Shortened form	Extended form
network type	the type of network supplying customers being either CBD, urban, short rural or long rural feeders as defined in section 3.
<u>SAPS</u>	<u>Stand-a-Alone Power System.</u>
system operator	has the meaning set out in the <i>National Electricity Rules</i> .
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.
unplanned SAIDI	has the meaning set out in section 3.
unplanned SAIFI	has the meaning set out in section 3.