Annual Reliability Performance Report

Year ending 30 June 2023
August 2023

SA Power Networks

Empowering South Australia

Contents

1. Executive Summary

With respect to reliability and customer service performance, SA Power Networks:

- Met all of its customer service targets established by the Essential Services Commission of South Australia (ESCoSA); and
- Met "best endeavours" requirements for reliability in all aspects of how it is measured (outage numbers, duration, feeder type, historical comparison).

Historical trend analysis since 2005-2006 shows South Australians today enjoy significantly improved system reliability performance, highlighted by reduced average outage duration impact for the metropolitan area, major regional centres, and regional areas such as the Eyre Peninsula.

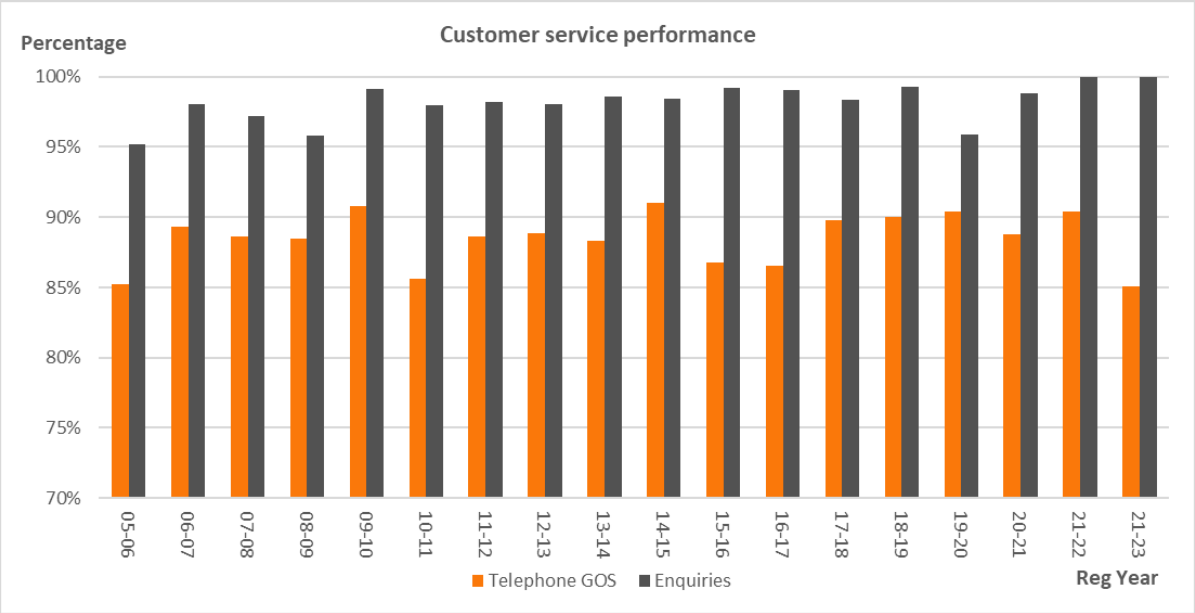
SA Power Networks achieved all customer service standards

SA Power Networks:

- Answered 85%[1] of telephone calls within 30 seconds compared to a target of 85%; and
- Responded to 100% of enquiries within 5 business days compared to a target of 95%.

The graph below highlights SA Power Networks' customer service performance on these two measures since 1 July 2005. SA Power Networks focus on resolving customer enquiries at first call, declined our overall telephone response performance compared to prior years.

Figure 1 – Customer service performance



SA Power Networks achieved 10 reliability service standard targets

In 2022-23, SA Power Networks achieved 10 of the 16 normalised reliability targets, for the four feeder categories, specified in the South Australian Electricity Distribution Code (**EDC**). The targets exclude the reliability contribution from interruptions starting on Major Event Days (**MEDs**)[2]. The following measures are

[1] SA Power Networks answered 91.8% of Faults and Emergency calls in 30 seconds.

[2] A MED is any day where the USAIDI contribution from interruptions starting on the day exceed a predetermined USAIDI threshold which is recalculated annually, historically it has been around 6 minutes. On average there have been 3.1 MEDs pa over the 15-year period 1 July 2005 to 30 June 2020, contributing 56.5 minutes to USAIDI.

now used to monitor reliability performance:

- Unplanned System Average Interruption Duration Index (**USAIDI**), which is the average time in minutes that customers are without their electricity supply due to unplanned interruptions per annum;
- Unplanned System Average Interruption Frequency Index (**USAIFI**), which is the average number of unplanned interruptions that customers experience per annum; and
- Customer restoration of supply (**CRoS**), which is a measure of the percentage of customers who experience an interruption for the year ending 30 June where the duration exceeds a specified number of hours.

The EDC specifies normalised measures and targets (ie excluding interruptions on MEDs), which are designated with a "n" (ie USAIDI**n** and USAIFI**n**). Table 1 and Table 2 below details for each of the four-feeder categories and overall, the targets and actual normalised performance for 2022-23.

Table 1 - Feeder Category Normalised Reliability Performance

EDC Feeder Category	USAIDIn		USAIFIn	
	TARGET	2022-23	TARGET	2022-23
Central Business District (CBD)	15	13	0.15	0.18
Urban	110	102	1.15	0.87
Rural Short (RS)	200	180	1.65	1.23
Rural Long (RL)	290	299	1.75	1.43
Overall Distribution System[3]	***150***	***143***	***1.30***	***1.00***

Table 2 - Restoration of supply performance (CRoSn)

EDC Feeder Category	Duration of Interruption (Hrs)	Target (%)	Actual (%)
CBD	≥ 1	11	9.8
	> 2	4	1.8
Urban	> 2	27	25.4
	> 3	11	12.9
RS	> 3	27	26.2
	> 5	8	10.9
RL	> 4	30	31.5
	> 7	10	11.3

[3] The ESCoSA reliability service standards do not include an overall distribution system target. These figures are the implied equivalent targets using the individual feeder category targets and the number of customers supplied from each feeder category.

The EDC now incorporates a reporting threshold[4] which acknowledges the normal variation in annual performance[5] of the reliability measures. Of the six targets not achieved in 2022-23, five were better than the reporting threshold (light green shading) and one worse than the reporting threshold (yellow shading).

There were six MEDs

For the 2022-23 regulatory year there were six MEDs as summarised in Table 3 below.

Table 3 - Major Event days 2022-23

Date(s)	USAIDI	Customers Affected	MED Category[6]	Comment
4 October 2022	8.1	26,897	Cat 1	Severe storms
12 November 2022	193.8	115,748	Cat 4	Severe storm
13 November 2022	14.7	10,828	Cat 4	Severe storm
19 November 2021	10.7	12,804	Cat 2	Severe storm
20 March 2023	26.8	49,566	Cat 3	Severe storm
7 June 2023	9.1	26,969	Cat 2	Severe storm
Total	**263.2**	**242,812**		

Section 6.2 includes further details of these MEDs.

SA Power Networks is maintaining the distribution system to deliver electricity to customers reliably

SA Power Networks monitors three key metrics (among others) to determine if the distribution system is being maintained cost effectively to reliably transport electricity to customers under normal weather conditions and on MEDs. The three metrics are:

- The contribution to USAIDIn of equipment failure related interruptions. This monitors our performance in maintaining the distribution system under normal operating conditions;
- The contribution to USAIDIn of weather[7] related interruptions; and
- The percentage of USAIDI resulting from equipment failure related interruptions on MEDs. This monitors the ability of the distribution system to cope with Severe Weather Event (SWE).

Figure 2 (next page) indicates that SA Power Networks has been appropriately maintaining the distribution system as there is no increasing trend in the USAIDIn from interruptions caused by equipment failure or weather under normal conditions (ie non-MED days). The percentage contribution to USAIDI from equipment failure related interruptions on MEDs is volatile and was below average (ie 9.4%) for 2022-23, and there is no long-term increasing trend (ie no decline in distribution system's resilience) in the percentage contribution to USAIDI due to equipment failure on MEDs.

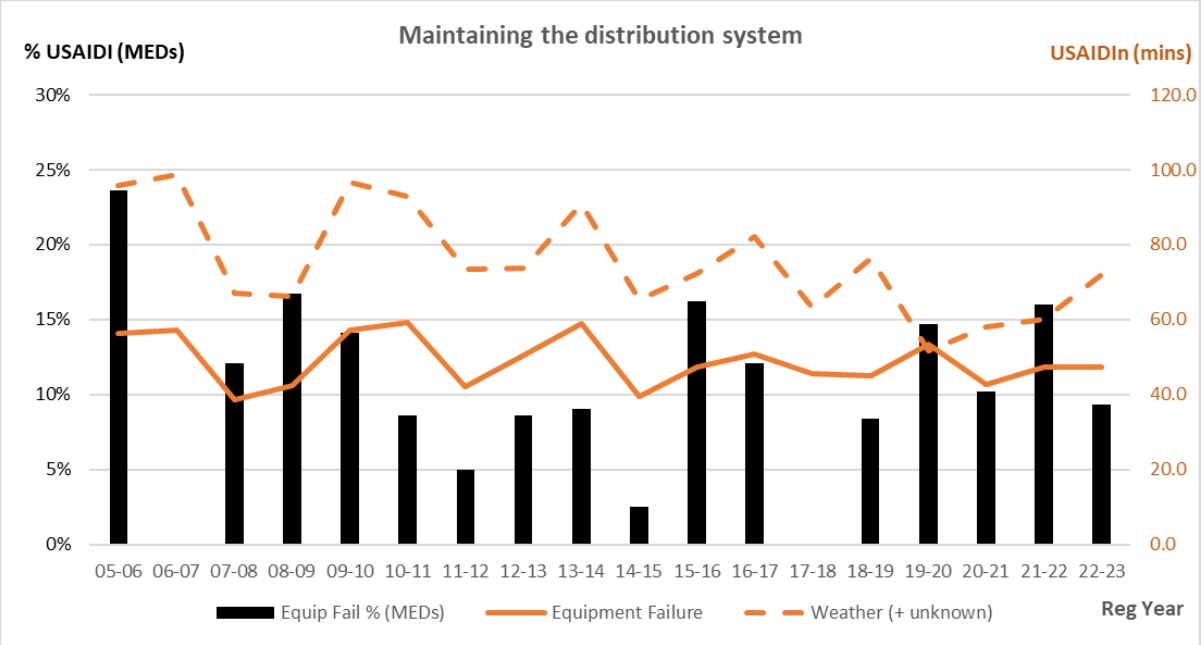
4 The threshold is set so that on average once every four years the performance will be worse than the reporting threshold and therefore will require detailed explanation.

5 Noting that the EDC reliability targets are based on average performance over the 10-year period ending 30 June 2019, and there must be no expectation that the targets will be achieved every year. Noting, that no funding was provided to achieve the targets each year.

6 SA Power Networks categorises the severity of MEDs based on the USAIDI contribution from interruptions that commence on that day, with the severity graded from the least Cat1 to the most Cat4.

7 Weather related includes unknown and vegetation, as the contribution from these causes is higher during SWE.

Figure 2 – Maintaining the network performance



One of the 16 reliability measures exceeded the reporting threshold.

In 2022-23, the Rural Short CRoSn > 5hours is the only reliability measure that exceeded the RT, compared with an average of three over the 10-year Target Setting Period (**TSP**).

The following table details the single reliability measure that exceeded the reporting threshold in 2022-23 and the reasons for that exceedance.

Table 4 - Reliability performance that exceeded the reporting threshold.

Feeder Category and measure	Comment
Rural short CRoSn	The contribution to the poor RS CRoSn > 5hours was caused by several severe weather events (ie 2.0%) which didn't result in MEDs and an increase in the contribution from car hit poles (1.0%). The average CRoSn for the first three years of the 2020-25 RCP is 8.1%, which is same average for the 10-year TSP. Consequently, SA Power Networks consider this a normal annual variation and does not indicate a declining trend, and therefore not of concern.

There were no systemic asset related issues with poor CRoSn performance, and SA Power Networks continues to cost-effectively maintain the distribution network (see Figure 2 above).

There are no declining trends in regional reliability performance

SA Power Networks is required to report the reliability of ten regions: nine distinct regions and another segmentation of feeders in a Major Regional Centres[8] (**MRC**) as defined in ESCoSA's Guideline No.1.

The annual regional reliability performance varies from year to year, both positive (better) and negative (poorer) than the long-term historical average (ie 15-year period ending 30 June 2020). There has been no

[8] MRC agreed high voltage feeders in Urban centres and Localities with a population of 10,000 or more at the 2016 census, except Adelaide and Gawler.

declining trend in the reliability performance of any region's normalised reliability performance (ie excluding MEDs) over the long-term, despite service standards being established on feeder categories since 1 July 2015. SA Power Networks monitors the regional reliability using the measures USAIDIn and USAIFIn, to determine if historic performance of any region has declined.

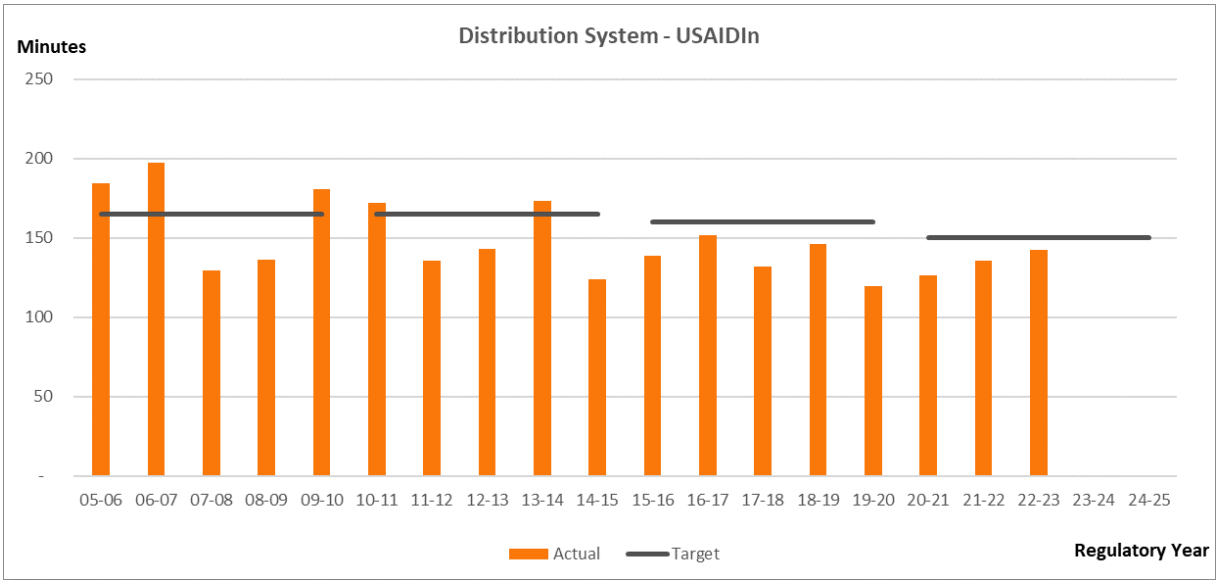
In 2022-23, 16 of the 20 reliability measures (two per region) were better than the 15-year historic average. The USAIDIn and USAIFIn for the Riverland and Murrayland (**RM**) Region exceeded the equivalent RT. The poor reliability of the RM Region in 2022-23 resulted from the significant increase in weather related interruptions, which contributed more than 50 minutes to USAIDIn and more than 0.5 interruptions to USAIFIn, when compared to both 2020-21 and 2021-22. The RM Region exceeded the USAIDIn RT threshold in 2021-22 because of asset failure cause interruptions on two 33kV Sub-transmission lines. As the poor reliability in 2021-22 resulted from asset failure related interruptions and the poor reliability in 2022-23 resulted from weather related interruptions, no declining trend is evident in the reliability of the RM Region.

SA Power Networks used 'best endeavours' to meet all reliability targets in 2022-23

The EDC now contains a reporting threshold, we are required to demonstrate the use of best endeavours where the reporting threshold for a reliability measure is exceeded. The best endeavours benchmark means that SA Power Networks can still comply with these obligations despite not achieving some feeder category reliability targets. SA Power Networks has used best endeavours to meet all 16 targets.

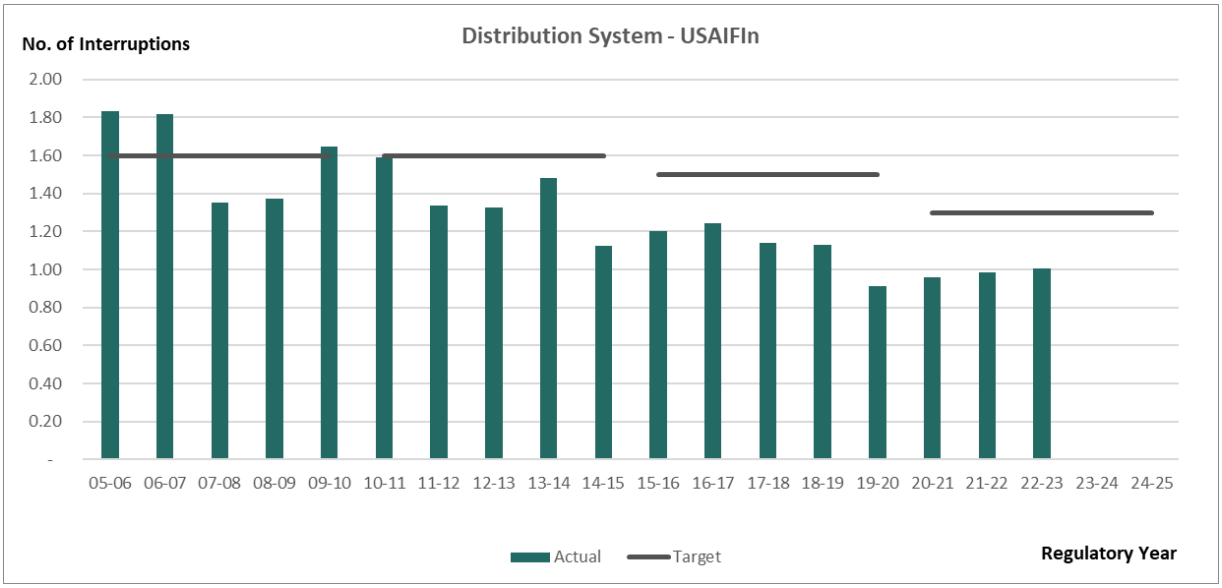
As outlined above, SA Power Networks achieved 10 of the 16 EDC feeder category reliability targets in 2022-23, compared with an average of nine over the 10-year TSP. Of the six targets not achieved, there is no declining trend in normalised reliability performance for any feeder category[9], just typical annual variations in performance (see Section 7 for more details).

Figure 3 – Distribution system USAIDIn and implied target



[9] Noting that for CBD feeders there is an emerging issue with the condition of some older high voltage and low voltage cables in the CBD. This emerging issue was not present in the 2020-21 and 2021-22 reliability performance of the CBD.

Figure 4 - Distribution system USAIFIn and implied target



Our analysis shows that reliability performance at the aggregate level of the distribution system has been maintained in 2022-23 and reflects that SA Power Networks has used best endeavours to meet the EDC reliability targets (see Figure 3 and Figure 4). This assessment is based on the following observations:

- Trends of normalised USAIDI and USAIFI performance show that reliability performance has been maintained in 2022-23 and over recent years. As shown in Figure 3 and Figure 4 above, normalised reliability is improving (ie historic declining trend).
- Analysis of distribution system maintenance practices and outcomes indicates that:
    - The contribution to normalised USAIDI performance due to 'equipment failure' is stable and has no worsening trend; and
    - The percentage contribution to USAIDI performance during MEDs due to 'equipment failure' is also stable.
- The reliability measures which exceeded the reporting threshold were either due to weather related interruptions or emerging systemic issues that are being addressed, where cost effective.

Emerging Issues

There are two emerging issues that we are closely monitoring that have the potential to cause a detrimental impact on reliability performance:

Increasing number of power outages caused by Grey Headed Flying Foxes (fruit bats) causing short circuits when the land on our overhead infrastructure in Urban areas of Adelaide – see Sections 4.3.d and 7.3.b.

The decline in the Rural long feeder category restoration of supply performance which was highlighted in SA Power Networks Monitoring and Compliance Strategy (MECS).

2. Definitions

Definitions of terms used in this report:

Term	Definition
2.5β method	The IEEE Std 1366^{TM}-2012 2.5 Beta statistical method used to calculate T_{MED}.
ABA	Adelaide Business Area – geographic area/region as defined in ESCoSA's Guideline No.1 (same as the CBD).
AER	Australian Energy Regulator
BMY	Barossa, Mid-North & Yorke Peninsula– geographic area/region as defined in ESCoSA's Guideline No.1.
CBD feeder	a feeder supplying predominantly commercial, high-rise buildings, supplied by a predominantly underground distribution network containing significant interconnection and redundancy when compared to urban areas.
CRoS	Customer restoration of supply – percentage of total customers who have an interruption exceeding a specific number of hours.
CRoSn	Normalised CRoS (excluding interruptions that commence on MEDs)
EDC	South Australian Electricity Distribution Code version v13.1 unless otherwise stated.
EH	Eastern Hills – geographic area/region as defined in ESCoSA's Guideline No.1.
EP	Eyre Peninsula – geographic area/region as defined in ESCoSA's Guideline No.1.
ESCoSA	Essential Services Commission of South Australia
FP	Fleurieu Peninsula – geographic area/region as defined in ESCoSA's Guideline No.1.
Feeder	means a high voltage electric powerline and associated equipment which the distributor uses to distribute electricity
GAMA	Greater Adelaide Metropolitan Area – geographic area/region as defined in ESCoSA's Guideline No.1.
IEEE	US Institute of Electrical and Electronic Engineers Inc
SWE	Significant Weather Event – a significant weather event where the contribution to USAIDIn from weather related caused interruptions has a material contribution to USAIDI of the distribution system, feeder category or a region.
Long Rural feeder	a feeder which is not a CBD or urban feeder with a total feeder route length greater than 200 km, or otherwise as agreed by SA Power Networks and ESCoSA.
MED	Major Event Day – any day where the daily USAIDI accrued on that day, exceeds a predetermined USAIDI threshold. The threshold is determined in accordance with the IEEE Std 1366^{TM}-2012 2.5 Beta statistical method.
MRC	Major Regional Centres – geographic area/region as defined in ESCoSA's Guideline No.1 (agreed high voltage feeders in Urban centres and Localities with a population of 10,000 or more at the 2016 census, except Adelaide and Gawler)
RCP	Regulatory Control Period means the period covered by a regulatory distribution determination by the AER.
RM	Riverland & Murrayland – geographic area/region as defined in ESCoSA's Guideline No.1
RT	Reporting threshold as defined in the EDC Section 2.2.1
SE	Southeast – geographic area/region as defined in ESCoSA's Guideline No.1.

Short Rural feeder	a feeder which is not a CBD or urban feeder with a total feeder route length less than 200 km, or otherwise as agreed by SA Power Networks and ESCoSA.
STPIS	The AER's Service Target Performance Incentive Scheme with provides incentive for distributors to maintain or improve reliability performance.
T_{MED}	The daily USAIDI threshold used to determine if a day will be classified as a MED.
TSP	Target Setting Period is the ten-year period ending 30 June 2019 used to establish the feeder category reliability service standard targets.
UCAIDI	Unplanned Customer Average Interruption Duration Index (ie average time taken to restore supply to customers as a result of an unplanned interruption)
UN	Upper North – geographic area/region as defined in ESCoSA's Guideline No.1.
Urban feeder	a feeder, which is not a CBD feeder, with actual maximum demand over the reporting period per total feeder route length greater than 0.3 MVA/km, or otherwise as agreed by SA Power Networks and ESCoSA.
USAIDI	Unplanned System Average Interruption Duration Index – total number of minutes, on average, that a customer is without electricity because of unplanned interruptions[10] in a year.
USAIFI	Unplanned System Average Interruption Frequency Index – average number of times a customer's supply is interrupted per year from unplanned interruptions
USAIDIn	Normalised USAIDI (USAIDI excluding interruptions that commence on MEDs)
USAIFIn	Normalised USAIFI (USAIFI excluding interruptions that commence on MEDs)

[10] Excludes interruptions where the duration is three minutes or less.

3. Reliability service standards for the 2020-25 regulatory control period

3.1 Measuring distribution system performance

As electricity distribution systems are extremely reliable, their overall reliability is typically measured in how many minutes on average they are not able to supply customers with electricity. If a distribution system was unable to supply electricity for 180 minutes in a year, then it was able to supply energy for 525,420 minutes of that year (ie its availability to supply electricity was 99.97%).

The reliability measures used by the Essential Services Commission of South Australia (**ESCoSA**) and the Australian Energy Regulator (**AER**) to monitor a distributor's performance are:

- USAIDIn (unplanned system average interruption duration index) — a measure of how long on average each customer is without supply in minutes for the period (typically a year) and is normalised by excluding interruptions that start on Major Event Days[11] (**MEDs**));
- USAIFIn (unplanned system average interruption frequency index) — a measure of how many times on average each customer is interrupted for the period (typically a year) and is normalised by excluding interruptions that start on MEDs; and
- In addition, ESCoSA uses two customer restoration of supply (**CRoS**) targets for each feeder category. These measure the percentage of the customers supplied by that feeder category who have an unplanned interruption exceeding a specified number of hours.

The measures are normalised because the variation in annual performance is significant with the inclusion of MEDs and masks underlying performance trends. For example, the USAIDI result for the distribution system in 2016-17 was 481 minutes with 9 MEDs, compared with 148 minutes in 2015-16 with one MED and 132 minutes in 2017-18 with nil MEDs. Most MEDs result from significant weather events that are beyond the distributor's control and are the major cause of the annual variation in reliability.

So that regulators can assess whether a distributor is maintaining the network to cope with normal weather events amongst other outage causes (eg animals), MEDs are excluded from the reliability measures they monitor. However, it is important to monitor the performance on MEDs to ascertain if distributors are still maintaining their ability to effectively respond to the effects of MEDs on their distribution system. Distributors need to have processes and practices in place to respond to MEDs so that customers impacted on those days have their supply restored in a reasonable time. As MEDs can have different characteristics and severity, it is not possible to establish standards for performance on MEDs. For example, the USAIDI contribution of a single MED, can vary from about 6 USAIDI minutes to about 160 USAIDI minutes. Section 4.4 provides further details on MED categorisation and assessment of performance.

3.2 Jurisdictional reliability service standards

SA Power Networks is required by the South Australian Electricity Distribution Code (**EDC**) clause 2.2.1 to use ''best endeavours[12]'' to achieve the following reliability targets (see Table 5 and Table 6 below) for each year ending 30 June during the 2020-25 Regulatory Control Period (**2020-25 RCP**) ie 1 July 2020 to 30 June 2025:

SA Power Networks is required to report on how it has applied its best endeavours if its performance is worse than the reporting thresholds (**RT**) set out in Table 5 and Table 7.

[11] A MED is a day where the total USAIDI contribution from interruptions that commence on that day exceed a predetermined total distribution system USAIDI value (Tmed). The value of Tmed is determined using a statistical process for each year based on the prior 5 years daily distribution system USAIDI data. Since 1 July 2005 there are on average about 3 MEDs pa.

[12] In the EDC, best endeavours, means "to act in good faith and use all reasonable efforts, skill and resources".

Table 5 - Feeder category reliability service standards

Measure		CBD Feeders	Urban Feeders	Rural Short Feeders	Rural Long Feeders
USAIDIn (average minutes off supply per customer per annum)	Target	15	110	200	290
	Reporting threshold	20	125	220	330
USAIFIn (average number of supply interruptions per customer per annum)	Target	0.15	1.15	1.65	1.75
	Reporting threshold	0.20	1.35	1.85	2.10

Table 6 - Feeder category customer restoration of supply standards

Target (%)	Single interruption duration	CBD Feeders	Urban Feeders	Rural Short Feeders	Rural Long Feeders
Percentage of total customers in each feeder category per annum	Interruption equal to or greater than 1 hour	11			
	Interruption longer than 2 hours	4	27		
	Interruption longer than 3 hours		11	27	
	Interruption longer than 4 hours				30
	Interruption longer than 5 hours			8	
	Interruption longer than 7 hours				10

Table 7 - Feeder category customer restoration of supply reporting thresholds

Reporting Threshold	Interruption duration	CBD Feeders	Urban Feeders	Rural Short Feeders	Rural Long Feeders
Percentage of total customers in each feeder category per annum	Interruption equal to or greater than 1 hour	13.5			
	Interruption longer than 2 hours	6.5	29.5		
	Interruption longer than 3 hours		13.5	29.5	
	Interruption longer than 4 hours				32.5
	Interruption longer than 5 hours			10.5	
	Interruption longer than 7 hours				12.5

Note: These standards reflect unplanned supply interruptions on the low voltage and high voltage distribution network but exclude:

a) Any planned supply interruptions and unplanned supply interruptions with a duration no more than three minutes; and

b) Any unplanned supply interruption that starts on a day which qualifies as a MED.

The EDC feeder category reliability targets were established using the average performance over the ten-year period ending 30 June 2019 (referred to as the target setting period (**TSP**)**.** The averages were then rounded to the nearest five minutes for USAIDI and the nearest 0.05 interruptions for USAIFI (ie some targets were rounded down and others up). As the targets are based on averages, there must not be an expectation[13] that all targets will be achieved each year. The number of targets detailed in Table 5 and Table 6 that were achieved annually during the TSP varied between 4 and 16 with an average of 9.

ESCoSA expressed concerned that establishing service standards using feeder categories may result in some regional areas of the state experiencing a decline in reliability. Consequently, it requires SA Power Networks

[13] SA Power Networks receives funding to maintain average historic reliability performance not to achieve all EDC reliability targets every year.

to report on the reliability of ten regions, to enable it to monitor if there was any longer-term decline in regional performance. See Section 8 for each region's performance.

3.3 The Australian Energy Regulator's Service Target Performance Incentive Scheme

The AER is required by the National Electricity Rules (**NER**) to develop a scheme that provides incentives for distributors, like SA Power Networks, to maintain or improve customer service including supply reliability. The AER scheme is known as the Service Target Performance Incentive Scheme (**STPIS**) which is detailed in the AER STPIS Guideline[14].

Under the reliability component of the STPIS, the AER establishes feeder category USAIDIn and USAIFIn targets for a RCP, with those targets detailed in its final distribution determination every five years. Under the STPIS regime the distributor is then annually rewarded or penalised based on the variation from those targets for each year. A positive variation is rewarded, and a negative variation penalised.

The STPIS targets are different to EDC feeder category targets as the targets are based on a 5-year average (ie 1 July 2014 to 30 June 2019) and have been adjusted because the incentive reward outcome was capped twice in this 5-year period and we received funding for improving some low reliability feeders. Table 8 below details the adjusted STPIS feeder category reliability targets that apply to each year of the 2020-25 RCP.

Table 8 – STPIS Reliability targets (year ending 30 June) for the 2020-25 RCP

Feeder Category	USAIDIn	USAIFIn
CBD Feeders	22.5	0.185
Urban Feeders	105.1	1.057
Short Rural Feeders	181.9	1.427
Long Rural Feeders	277.9	1.526

[14] The AER's STPIS Guideline is at https://www.aer.gov.au/system/files/AER%20-%20Service%20Target%20Performance%20Incentive%20Scheme%20v%202.0%20-%2014%20November%202018%20%28updated%2013%20December%202018%29.pdf

4. Assessment of Reliability Performance

4.1 Introduction

As outlined in Section 3, SA Power Networks is required to use best endeavours to achieve the EDC feeder category normalised reliability targets for each year ending 30 June. We can still comply with our reliability obligation when the reliability is worse than the target, provided we can demonstrate the use of best endeavours.

The EDC defines best endeavours as:

> *'**best endeavours**' means to act in good faith and use all reasonable efforts, skill and resources*

SA Power Networks is not funded to achieve the absolute performance targets each and every year, but we are funded to maintain the average long-term historic performance. ESCoSA must determine whether we have used best endeavours to meet those targets.

SA Power Networks' reliability obligation in its simplest form can be expressed as "to maintain historic average reliability levels". While positive and negative variations occur, there should be no long-term worsening trend in reliability in any of the feeder categories. A worsening trend is when the performance of a reliability measure exceeds the RT in two consecutive years.

The exclusion of MEDs from the reliability service standard targets reduces the extreme variation in annual reliability. The variation in reliability comprises three components: variations in normalised performance (ie non-MEDs), and variations due to the number of MEDs (which has varied from nil to nine) and the severity of individual MEDs (which has varied between 6.0 and 161.3 USAIDI minutes).

This section explores the major influencers of the annual variation in normalised reliability and the variations in annual MED performance experienced by customers.

4.2 Reliability of the distribution network

The normalised reliability performance of the distribution network is dependent on:

- The proportion of the network that is overhead, as underground cables are not affected by weather;
- How the system is designed and constructed (eg meshed or radial network);
- How the system is being maintained (eg performance would decline in the long term if the network was not being appropriately maintained);
- Trees[15], vegetation debris or other objects impacting powerlines from outside the regulated 'clearance zones';
- The interruptions/failures of the network that result from local SWEs. These events have a material[16] USAIDIn impact (ie excluding MEDs) and are the result of many weather (eg lightning) caused interruptions on a single day.; and
- How well a distributor responds to interruptions during MEDs, especially in terms of the time taken to restore customers' electricity supply.

SA Power Networks has varying degrees of control over these individual factors. Any assessment of the use of best endeavours should only consider those factors that SA Power Networks can reasonably control/affect.

[15] SA Power Networks is limited by the Electricity Act on the extent that it can clear vegetation from around powerlines. SA Power Networks must clear vegetation from around a powerline so it must not grow or bend into the clearance zone.

[16] Material impact in this context means the USAIDI attributed to the day exceeds 3% of the average annual historic performance (ie about 10 times an average day's contribution)

4.3 Major causes of annual variations in reliability

4.3.a Introduction

SA Power Networks is obligated to use best endeavours to meet average historic levels of normalised (ie excludes MEDs) reliability. The determination of best endeavours from analysing the reliability measures is difficult, considering the significant variations in reliability from one year to the next, despite the exclusion of MEDs.

The main causes of significant annual variations in unplanned reliability levels, in order of greatest to least, are:

- Weather (includes unknown[17]);
- Equipment failure; and
- Other (includes operational, third party (eg vandalism, car hit pole, grey-headed flying foxes) and other causes).

4.3.b Weather-caused interruptions

Weather-caused interruptions during the TSP have varied in their contribution to USAIDIn (ie normalised reliability which excludes MEDs) from a low of 63 minutes in 2017-18 to a high of 95 minutes in 2009-10, and an average of 79 minutes. The contribution to USAIDIn in 2022-23 from weather caused interruptions was 72 minutes. Figure 5 shows a declining (improving) contribution to USAIDIn from weather caused interruption. This improvement has resulted from SA Power Networks reliability improvement initiatives (eg installing lightning resistant insulators in areas of repeat lightning strikes).

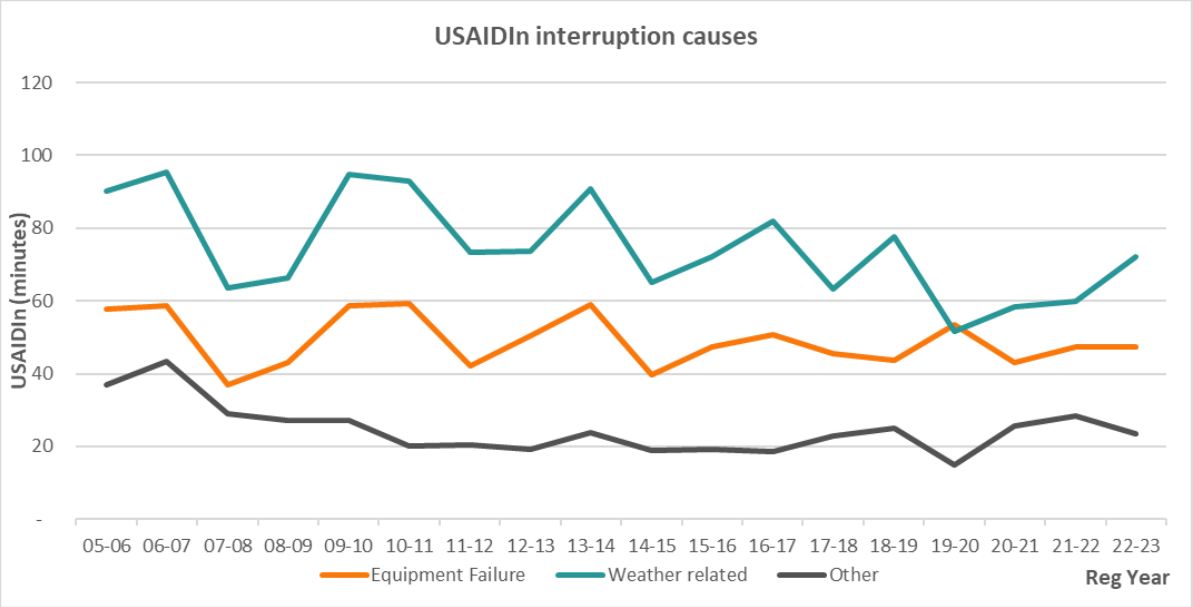
4.3.c Equipment failure caused interruptions

The contribution of equipment failure-caused interruptions to USAIDIn during the TSP has varied from a low of 45 minutes in 2017-18 and 2018-19, to a high of 59 minutes in 2010-11, with an average of 50 minutes. The contribution to USAIDIn in 2022-23 from equipment failure caused interruptions was 47 minutes. Figure 5 shows a stable contribution to USAIDIn from equipment failure caused interruptions. This stability demonstrates that SA Power Networks has been appropriately maintaining the distribution system.

Figure 5 shows some correlation in the variations in the contribution to normalised USAIDI from weather caused and equipment caused interruptions.

[17] There is a reasonably strong correlation between weather and unknown causes, so these are grouped together to simplify the analysis.

Figure 5 - Annual USAIDIn contribution from interruptions caused by weather, equipment failure and other.



4.3.d Other-caused interruptions

Other-caused interruptions contribution to USAIDIn during the 10-year target setting period varied from a minimum of 19 minutes in 2015-16 to a high of 27 minutes in 2009-10, and an average of 22 minutes. Figure 5 above highlights that the contribution to USAIDIn from interruptions caused by 'other' causes (eg due to third parties) has been relatively stable at around 20 minutes since 2010-11. There was an increase in 2020-21, 2021-22 and a slight decrease in 2022-23 USAIDIn due to an increase in the number of interruptions caused by the increase in the grey-headed flying fox (fruit bats) population, which mainly affects Urban Feeders. We are currently trialing different methods to mitigate the number of interruptions caused by fruit bats[18] on Urban feeders.

4.3.e Conclusion

There is no worsening trend in the Asset failure and Weather-related causes and while the impact of fruit bats has contributed to a worsening trend in the Other category in recent years, this has not contributed to a failure to meet targets. SA Power Networks is therefore appropriately maintaining and operating the distribution system for the benefit of customers.

4.4 Categorisation of MEDs

4.4.a Introduction

The overall annual contribution to USAIDI, at the distribution system aggregate level, from interruptions on MEDs has varied from nil to 329 minutes over the 15-year period to 30 June 2020. The significant variation is due to the:

- annual number of MEDs varying from nil to nine; and
- severity (using USAIDI as a proxy) of a single MED varying from 6.0 to 192.8 USAIDI minutes.

As highlighted previously, although excluded from the EDC reliability service standards it is important that our performance on MEDs is still monitored. This section details how MEDs are classified and how SA Power Networks categorises them to enable comparison of our performance on similar severity MEDs.

[18] Fruit bats are not native to South Australian and only migrated and established a colony (near the Adelaide Botanic Gardens) in South Australia in 2012.

4.4.b MED classification

A MED is determined using the US Institute of Electrical and Electronic Engineers Inc (**IEEE**) Std 1366™-2012 2.5 Beta Method (**2.5β Method**). The 2.5β Method pre-determines a MED USAIDI threshold ($\mathbf{T_{MED}}$) that applies for a reporting period (ie a year). Any day where USAIDI exceeds the threshold is classified as a MED. (See Appendix A for further details). In determining the daily USAIDI, any interruptions that commence between midnight and midnight on that day are accrued to that day.

4.4.c Factors affecting restoration of customers' electricity supply on MEDs

The other component of ESCoSA's 2020-25 RCP reliability framework is the monitoring of MED performance. The main measure of SA Power Networks' performance on MEDs is the average time taken to restore customers' electricity supply. Restoration of electricity supply times on MEDs is affected by:

- number of interruptions;
- numbers of customers affected;
- location of interruptions/damage (eg metro vs rural and difference in the corresponding distance travelled to patrol, repair);
- extent of damage to infrastructure (eg broken insulator can be fixed by a crew and an EPV[19], but in comparison a failed Stobie pole needs a new pole, a crew, EPV, crane, and consequently takes significantly longer to repair and restore supply);
- crew availability;
- duration of SWE (crews cannot work beyond 16 hours in any 24-hour period and this can adversely affect MED resourcing if the event commences prior to the MED); and
- accuracy of weather forecast (ie if severe weather event isn't forecast we haven't had the ability to adequately prepare for the event.ihc)

4.4.d Categorisation of MEDs

These factors make the determination of whether SA Power Networks' response during MEDs has declined or not, complex. SA Power Networks considers it essential to compare each MED with similar historic MEDs to determine if the restoration of supply times have declined or not. This categorisation is important in assessing the MED performance because since 1 July 2010 the distribution system has experienced more intense MEDs[20]. SA Power Networks has ranked the intensity of the MEDs, albeit with limited data for some MED categories, into the following four categories which are:

- Category 1 (Cat1) MED where the maximum daily USAIDI is less than nine minutes (note: more than half the MEDs fall into this category)[21];
- Category 2 (Cat2) MED where the maximum daily USAIDI is more than nine minutes and no more than 23 minutes[22];
- Category 3 (Cat3) MED where the maximum daily USAIDI is more than 23 minutes and no more than 55 minutes; and
- Category 4 (Cat4) MED where the maximum daily USAIDI exceeds 55[23] minutes.

SA Power Networks may assign MEDs to a higher or lower category based on other factors like:

- Extent of the damage to infrastructure (eg many pole failures versus just insulator failures);

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19 EPV – Elevated Platform Vehicle

20 The BoM has advised SA Power Networks that it is likely that the number and intensity of SWEs will increase due to the effects of climate change.

21 Note some MEDs that would classify as a Cat1 due to its USAIDI value (<9 minutes), are classified as Cat2 as they mainly affected rural areas, and as such the response times are longer.

22 The 23-minute threshold was based of the IEEE Std 1366 2.5β methodology for determining MED but used a 3.5 multiplier for Beta.

23 The 55 minute threshold uses the IEEE's 1366 2.5β methodology but with a 4.15 multiplier for Beta which is referred to in the IEEE's standard as a Catastrophic Event Day (**CED**). There has been one Cat4 MED, on 4 Feb 2014.

- Locations of the interruptions to electricity supply (eg rural versus urban areas);
- Significant weather event lasts more than 24 hours;
- Access to our infrastructure (eg preventing from accessing our infrastructure due to a bushfire, ground too wet for vehicle access).

5. Reliability assessment framework and use of Best Endeavours

As outlined in Section 4, SA Power Networks is required to employ best endeavours to achieve the EDC's feeder category reliability targets for each year ending 30 June. Despite the exclusion of interruptions commencing on MEDs, ESCoSA must assess whether SA Power Networks has complied with its reliability service standards, in that it has used best endeavours where the performance is worse than the target.

The exclusion of interruptions commencing on MEDs removes the extreme variations in annual reliability performance but there can still be significant variations (eg up to 50% of the reliability target) in feeder category reliability measures. These variations are normally related to local or state-wide SWEs that do not breach the MED USAIDI threshold.

5.1 Introduction

Each year during the 2020-25 RCP ESCoSA will determine whether SA Power Networks has:

- used best endeavours to meet the normalised reliability targets;
- maintained its responsiveness to restore customers' electricity supply as soon as practical, for those customers that experience an outage on MEDs; and
- maintained the historic reliability levels for those customers in the 10 regions.

How each of these components should be determined and assessed is detailed below.

5.2 Normalised reliability

5.2.a Introduction

In determining whether best endeavours have been used to achieve the EDC reliability targets it is first necessary to consider normalised reliability (ie excluding MEDs) and determine if:

- Reliability levels are stable for the aggregate distribution system and an individual feeder category basis (ie there has been no worsening trend in performance over several years);
- the distribution system is being appropriately maintained if there has been no declining trend in the following measures:
  - USAIDIn resulting from 'equipment failure' caused interruptions; and
  - USAIDIn resulting from weather caused interruptions; and
- any remaining significant deviations in performance are the result of local or state-wide SWEs that do not result in a MED and/or 'one-off' type events or causes.

5.2.b Normalised reliability analysis

The first step in analysing normalised reliability is to examine the performance trend over several years, as large annual variations generally result from either local SWEs or one-off events. Longer term trend performance is analysed as it may take many years before any degradation of the network can be identified from its reliability performance.

Individual feeder categories or the 10 regions can have significant variations in normalised reliability as the normalisation process is less effective at sub-system levels of the distribution system as previously explained.

A stable non-declining trend in USAIDIn, provides a good indication that SA Power Networks has used best endeavours to meet EDC reliability targets and to maintain historic regional reliability, provided any material excursions are due to weather events or one-off non-systemic events.

5.2.c Design, construction and maintenance of the network

The next step in analysing whether best endeavours have been used is to analyse the trend performance in the overall average daily USAIDIn contribution from weather caused interruptions. This measure provides an indication that:

- The distribution system is being maintained to cope with 'normal' SWEs (ie non-MED SWEs); and
- new additions to the network are appropriately designed and constructed to withstand normal weather variations.

Another indicator of whether SA Power Networks is adequately maintaining all parts of the network is to analyse the trend performance in USAIDIn that is attributed to equipment failure. A stable non-declining trend in USAIDIn from equipment failure caused interruptions indicates that SA Power Networks is appropriately maintaining the network to achieve the EDC reliability targets.

5.2.d Normalised reliability conclusion

SA Power Networks considers that the use of best endeavours is demonstrated by a stable non-declining trend performance in:

- USAIDIn and USAIFIn at the aggregate distribution system and feeder category level;
- Annual contribution USAIDIn from weather caused interruptions is not increasing; and
- USAIDIn contribution from equipment failure-caused interruptions is also not increasing.

5.3 MED Performance

5.3.a Introduction

Section 4.4 above detailed the factors that impact MED reliability performance. The common denominator that results in longer than average Unplanned Customer Average Interruption Duration Index[24] (**UCAIDI**) during a MED is the degree of the damage to infrastructure or delays in safe access to make repairs. For example, the MED on 3 January 2020, should have been categorised as a Cat 1 but was categorised as a Cat 4, as SA Power Networks was prevented from accessing infrastructure to restore supply due to raging bushfires on Kangaroo Island. Delays in restoring supply under bushfire conditions result from factors like, extended times to patrol, gain access to the fire grounds and make repairs and to ensure premises can be safely reconnected or to disconnect unsafe premises prior to restoring supply.

5.3.b Measures

SA Power Networks assesses the use of best endeavours during MEDs by analysing:

- MEDs by their category[25] (ie Cat1, Cat2, Cat3 or Cat4 as defined in Section 4.4 above);
- the equipment-failure contribution to the MED USAIDI (this should indicate if the distribution system is being appropriately maintained to cope with MEDs or Major SWEs); and
- individual MED UCAIDI by MED Category. This is a measure of SA Power Networks' processes and practices in responding to major SWEs, with MED performance the proxy. UCAIDI will normally be longer as the category increases from Cat2 to Cat4, especially when there is extensive infrastructure damage associated with the MED or there are access issues (eg flooding preventing access).

5.3.c MED reliability conclusion

SA Power Networks considers that the use of best endeavours during MEDs can be demonstrated by:

- Achieving reasonable average restoration of supply times for:
  - Cat1 UCAIDI — typically 180 minutes with expected range between 150 and 210 minutes;
  - Cat2 UCAIDI[26] — typically 330 minutes with expected range between 230 and 500 minutes:
  - Cat3 UCAIDI — typically 290 minutes with expected range between 210 and 430 minutes; and

[24] UCAIDI is a measure of the average time, in minutes, that customers who experience an interruption are without supply.

[25] A Cat1 MED would normally occur every year, Cat2 every few years and Cat3 or Cat 4 once every 5 years or more.

[26] Cat2 MEDs now exclude the two MEDs which were associated with Major SWEs which lasted over two days and resulted in two consecutive MEDs, one of which was a Cat3 and the other a Cat2.

    - Cat4 UCAIDI — typically 600 minutes but expected to be greater than 500 minutes and is associated with extensive infrastructure damage; and
- Demonstrating no decline in trend performance in the proportion of USAIDI attributed to equipment failure.

Cat1 MED restoration of supply (UCAIDI) provides the best indicator of whether SA Power Networks has maintained its ability to appropriately respond to MEDs. This is because Cat1 MEDs make up at least half the MEDs, have the smallest variation in USAIDI and consequently are associated with similar intensity SWE.

6. Distribution system reliability performance during 2022-23

6.1 Overall Normalised Performance 2022-23

6.1.a Test for use of best endeavours

As detailed in Section 5.2 the test for determining if SA Power Networks has employed best endeavours in maintaining normalised reliability performance is no declining trend performance in:

- USAIDIn and USAIFIn at the aggregate distribution system and each feeder category level;
- Annual contribution to USAIDIn from weather caused interruptions is not increasing; and
- Annual contribution to USAIDIn from equipment failure caused interruptions is also not increasing.

6.1.b Aggregate distribution system reliability performance

Table 9 below shows that aggregate distribution system normalised reliability is better than the implied distribution network target.

Table 9 - SA Distribution System's Unplanned Normalised Reliability Performance

	USAIDIn		USAIFIn	
	Target	Actual	Target	Actual
2022-23	150	143	1.30	1.00

Figure 6 - Distribution system normalised reliability (excludes MEDs)

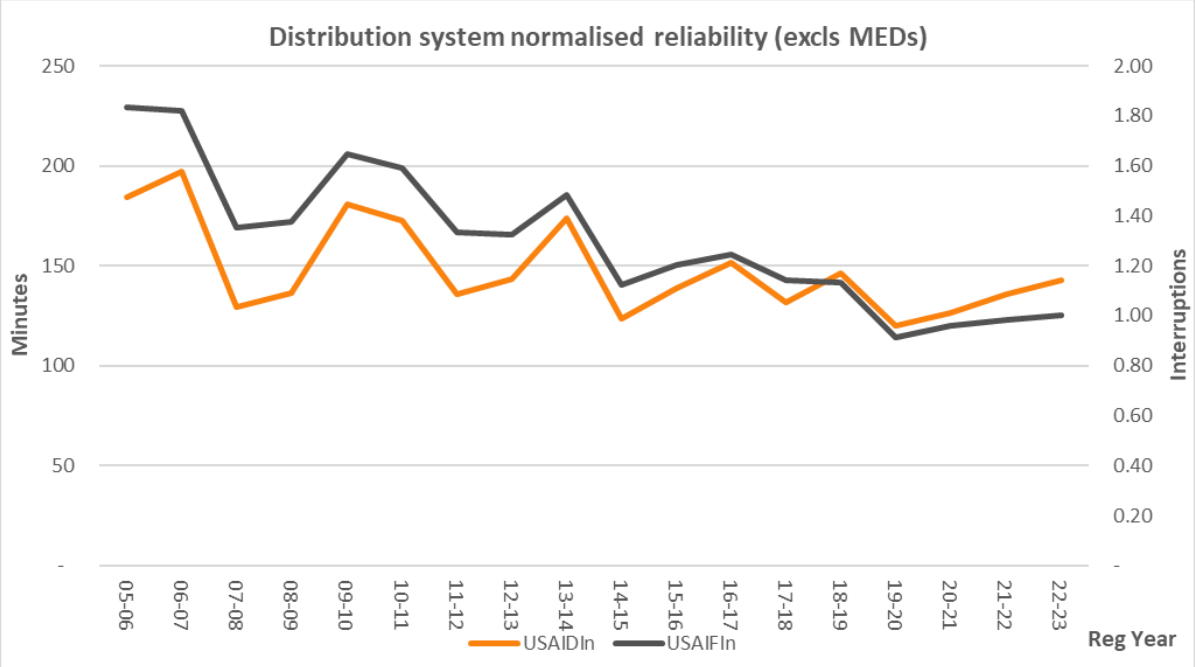


Figure 6 above highlights that there is a positive trend (ie customers on average are experiencing less minutes without supply and less interruption each year) in the distribution network's normalised reliability performance, as measured using USAIDIn and USAIFIn, over the past 17 years.

Figure 7 - Customer restoration of supply

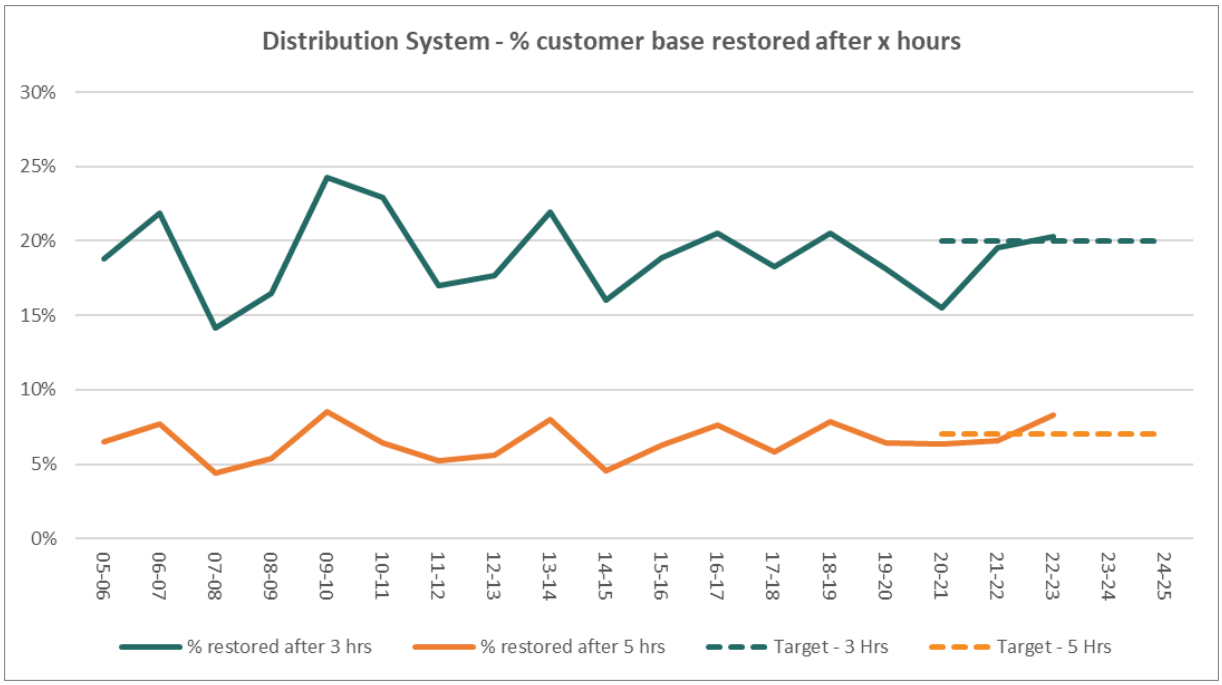


Figure 7 highlights that there was an increase in the percentage of customers who experience an unplanned interruption that is longer than five hours in 2022-23. The performance in 2022-23 resulted from several severe weather events which did not result in a MED or were before or after a MED.

6.1.c USAIDIn Cause Contribution to Normalised Performance

Figure 8 below demonstrates that there are no trends in the cause categories of weather[27], equipment-failure or 'other', over the 17-year period. The figure shows that the 2022-23 normalised reliability performance contribution to USAIDIn from these categories is within normal variation and indicates that there is no negative trend. This indicates that the distribution system is being appropriately maintained to cope with normal weather events, and to cost effectively manage the interruptions that result from equipment failure. The increase in 'other' in 2020-21 and 2021-22 is mainly due to the impact of juvenile grey headed flying foxes (GHFF), and the significant increase in the colony size near the Adelaide Botanic Gardens. The impact of GHFF was lower in 2022-23 than the previous two years due to the on average wetter and cooler nights. We are currently investigating options to mitigate the impact of these flying foxes.

The increased asset inspections undertaken during the 2010-15 and the 2015-20 RCPs identified a significant increase in the volume of work required to replace poor condition assets. Management has placed priority on addressing the highest risk defects which has enabled the impacts of the condition of the network infrastructure to be managed.

[27] Weather includes weather and unknown causes, as the majority of interruptions categorised as cause 'unknown' occur during weather related events (ie SWE, storms etc).

Figure 8 - Normalised USAIDI contribution due to weather and equipment failure

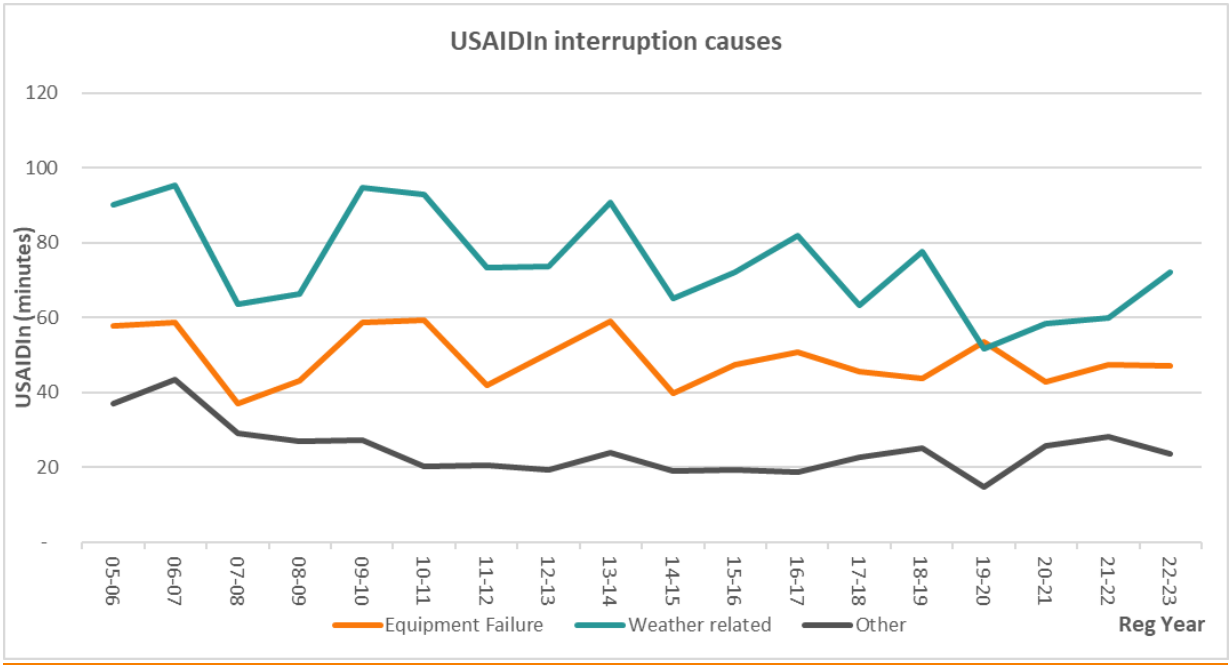


Table 10 - Distribution system USAIDIn cause contributions

USAIDIn	Weather	Asset failure	Other
2022-23	72	47	23
TSP	79	50	22

Table 10 above highlights that all causes except Other had a lower contribution to USAIDIn in 2022-23 than during the TSP. The USAIDIn from cause Other was only marginally above average for the TSP.

6.1.d Conclusion – normalised reliability performance 2022-23

The overall normalised reliability performance during 2022-23 has shown:

- no decline in normalised performance;
- the normalised reliability performance achieved the implied targets;
- no decline in performance due to any specific cause including 'equipment failure'; and
- no decline in the network's resilience to cope with non-MED SWEs.

Consequently, we consider that we have employed best endeavours to maintain normalised reliability performance in 2022-23, to achieve the EDC reliability targets.

6.2 MED Performance 2022-23

6.2.a Test to determine if performance during MEDs has been maintained

Section 5.3 outlined the test for determining if SA Power Networks has maintained its responsiveness to restoring supply to customers interrupted during MEDs.

6.2.b MED Performance during 2022-23

In 2022-23 there were a total of six MEDs contributing 262.2 minutes to USAIDI, comprising one Cat1 and four Cat2 MEDs.

Table 10 below details the date of these MEDs and their USAIDI and USAIFI contributions and the UCAIDI on the day.

Table 11 - Details of MED exclusions during 2022-23

Event #	MED Category	Dates	USAIDI	USAIFI	UCAIDI	Comment
1	Cat 1	4 Oct 22	8.1	0.029	280	Severe weather event
2	Cat 4	12 Nov 22	192.8	0.125	1,545	Severe weather event
3	Cat 4	13 Nov 22	14.7	0.012	1,257	Severe weather event
4	Cat 2	19 Nov 22	10.7	0.018	592	Severe weather event
5	Cat 3	20 Mar 23	26.8	0.053	501	Severe weather event on 20th and 21st
6	Cat 2	7 Jun 23	9.1	0.029	314	Severe weather event
Total		5 days	262.2	0.266		

6.2.b.1 *Cat1 MED on 4 October 2022*

There was a severe weather event on the 4 October 2022. There were 175 interruptions unplanned interruptions, with weather related interruptions contributing 84% of the USAIDI. The event mainly affected Urban Feeders in the Adelaide Metropolitan Area, with the total USAIDI contribution to Urban feeders of 11 minutes. The average restoration of supply time (ie 280 minutes) was greater than normal due to the significant number of interruptions that occurred on the day.

6.2.b.2 *Cat4 MEDs on 12 & 13 Nov 2022*

These two MEDs were the result of a severe weather event, with the MED on 12th being the most significant MED on record, with extensive damage to powerlines, mainly due to vegetation (eg trees falling over). SA Power Networks couldn't prepare for the event as the weather forecast didn't predict it. These MEDs were part of several serve weather events that occurred between 9 November and 20 November 2022. Normally 60-80kmh winds don't cause anything like the infrastructure damage that occurred during the event, but in this case the winds were from the east instead of the more prevailing west. That, combined with wet soils, brought many trees and tree limbs down, with most of the impact felt in the metropolitan area.

There were total of 551 unplanned interruptions with 403 of the 12th and 148 on the 13th. The total USAIDI contribution of the event was 207 minutes with 192.8 minutes on the 12th and 14.7 minutes on the 13th, with weather related interruptions contribution 84% of the USAIDI. The event affected all feeder categories except CBD feeders. The average restoration of supply was 1,520 minutes which reflected the extensive damage to infrastructure and the requirement to rebuild many kilometres in total of overhead powerlines to restore electricity supply.

SA Power Networks Monitoring and Compliance Strategy section 4.6 details the preparation and activities implemented during the event for a category ERL3 event. Due to the severity of the event we used all available resources including contractors, and brought in crews from Essential Energy in New South Wales.

The photo below is typical of the damage that occurred during the event and shows a tree being uprooted by the combined effects of strong winds and wet soils.

These two MEDs were the main contributor to the significant increase in reliability duration GSL payments for 2022-23 of more 91,000 payments exceeding $14.6m.

6.2.b.3 *Cat2 MED on 19 November 2022.*

This MED was part of a series of severe weather events that occurred between 9 and 20 November 2022. There were 101 unplanned interruptions with weather related interruptions contributing 93% of the USAIDI. It mainly affected Rural Short feeders. The average customer restoration of supply time was 592 minutes, which is above the average of 330 minutes but is due to the number of severe weather events between 9 and 20 November and constraints on resources.

6.2.b.4 *Cat3 MED on 20 March 2023*

This MED was mainly the result of weather-related interruptions (86% of USAIDI) and there was a total of 181 unplanned interruptions. It severely impacted the Greater Adelaide Metropolitan Area and Urban feeder category feeders with significant damage to infrastructure.

The average customer restoration of supply time was 501 minutes, which is above the average of 330 minutes and at the high end expected range (up to 500 minutes), but understandable due to the infrastructure damage.

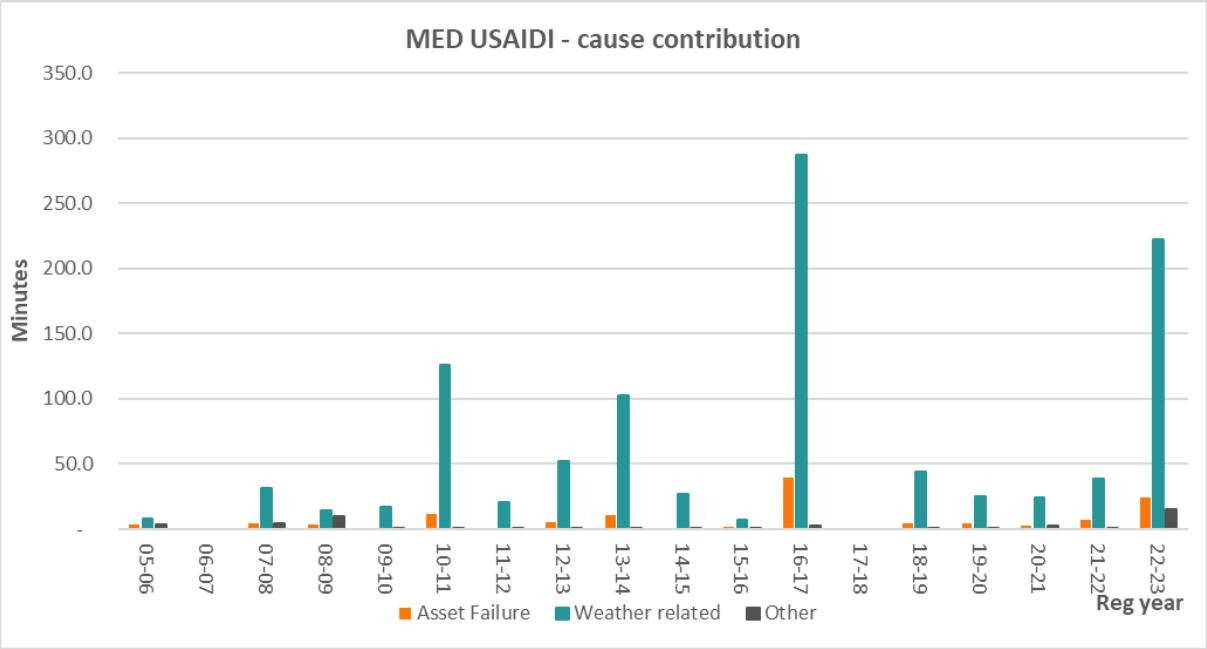
6.2.b.5 *Cat 2 MED on 7 June 2023*

This MED was mainly the result of weather-related interruptions (contributing 93% of USAIDI) and there was a total of 221 unplanned interruptions. It has widespread impact with significant impact on the Greater Adelaide Metropolitan Area, Barossa York Peninsula & Mid North, Riverland & Murraylands, Southeast and Upper North Regions. The average customer restoration of supply time was 221 minutes, which is better than the average of 330 minutes for a Cat2 MED.

6.2.c Equipment failure component of MEDs

Another indicator of whether SA Power Networks is appropriately maintaining the distribution system is the proportional contribution to USAIDI on MEDs that result from equipment failure outages, being cognisant that as the MED USAIDI increases so does the absolute value of USAIDI due to equipment failure (ie as intensity of the MED increases there are more interruptions due to electricity infrastructure damage and consequently longer times to restore each interruption). Figure 9 below highlights the contribution to MED USAIDI from weather (and unknown), equipment failure and other.

Figure 9 - MEDs USAIDI contribution from causes weather and equipment failure



The contribution from 'equipment failure' on MEDs in 2022-23 of 9% was proportionally lower than the 10-year target setting period historic average of 10%. This is a reduction from 2021-22 result of 16%. In addition, the USAIDIn contribution from equipment failure was 47 minutes which is lower than during the TSP where the average was 50 minutes (See Figure 2). Further Figure 2 shows no declining trend in this metric. Consequently, we conclude that the proportion of USAIDI contribution during MEDs from 'equipment failure' is relatively stable. The stability reflects the priority given to addressing the highest risk defects identified from our increased asset inspections. Those inspections have identified a significant increase in the volume of work required to address the condition of aging assets.

6.2.d MED performance conclusion

SA Power Networks considers that average restoration of supply times have not declined in 2022-23, but were poor in 2022-23 due to three MEDs being associated with a number of severe weather events between 9 and 20 November 2022, which stretched resources. The average restoration of time for the MEDs excluding those in November were either better or poorer than the average which demonstrates that average restoration of supply times has not decline in 2022-23.

In addition, the proportional contribution to MED USAIDI from equipment failure-caused interruptions is within the normal range in 2022-23. This provides evidence that the distribution system is being appropriately maintained to achieve the EDC reliability targets. Consequently, SA Power Networks concludes that our responsiveness to restore customers who experience interruptions during MEDs in 2022-23 has been maintained.

6.3 Conclusion – overall reliability outcome for 2022-23

The distribution system's reliability was maintained during 2022-23 and SA Power Networks' response during MEDs has been maintained. In particular,

- The normalised reliability of the distribution system has been maintained;
- The USAIDIn contribution due to equipment failure-related interruptions is stable;
- The USAIDIn contribution from weather related interruptions is not increasing;
- The average restoration of supply times MEDs have been maintained; and
- The equipment failure percentage contribution to USAIDI during MEDs has been stable.

SA Power Networks has therefore complied with its reliability obligations at a distribution system level in 2022-23.

7. EDC Feeder Category reliability performance

7.1 Introduction

In the sections to follow, SA Power Networks assesses each of the feeder categories' reliability performance in three steps:

- Determining if the normalised performance achieves the reliability targets.
- Determining if over the last few years there has been any declining trend in performance.
- Where the normalised performance is worse than the EDC normalised targets, explaining that performance by removing the effects of local SWEs, other one-off type events and analysing the annual USAIDIn cause contributions.

Note:

- Where a feeder category's normalised performance meets the service standard target, no further comment will be made except to determine if the performance was consistent with historic performance.
- The normalisation process, as explained earlier, does not work equally well for all feeder categories' performance.

7.2 CBD feeder category normalised performance

7.2.a Introduction

The CBD feeder category feeders supply 1% of customers, using 0.4% of the distribution system. These feeders supply the Adelaide CBD and surrounds. Due to the very low customer numbers and low targets, the performance of the CBD feeders can be significantly impacted by a single interruption.

7.2.b Normalised reliability performance

SA Power Networks achieved three of the four reliability targets (ie USAIDIn, CRoSn ≥ 1hour and CRoSn > 2hours) for the CBD Feeder category in 2022-23. The only target not achieved was the USAIFIn target where the performance was 0.18 compared with a target of 0.15 interruptions. This means that about 200 more customers supplied by CBD category feeders experienced an outage in 2022-23 than allowed by the target.

Table 12 - CBD reliability by interruption cause

	Asset failure	Weather	Other	Total
USAIDIn				
2022-23	4.4	**7.7**	0.9	13.0
TSP Ave	13.0	**2.1**	1.2	16.2
TSP RT	14.2	**4.1**	1.9	20.2
USAIFIn				
2022-23	0.021	**0.073**	**0.085**	0.178
TSP Ave	0.099	**0.029**	**0.019**	0.147
TSP RT	0.115	**0.051**	**0.034**	0.200

Table 12 above compares the cause contributions to USAIDIn and USAIFIn for 2022-23, the TSP average and the TSP Reporting Threshold (**RT**). It highlights that asset failures caused interruptions (mainly resulting from cable failures) were significantly lower in 2022-23 than the average during the TSP.

The cause categories, which were outside normal bounds, were both USAIDIn and USAIFIn due to weather and USAIFIn due to Other causes. The causes of the higher contribution were:

- weather related due to a single interruption in October 2022 which affected 480 customers for 94 minutes, where the cause could not be determined. This outage contributed 6.5 minutes to USAIDIn and 0.07 interruptions to USAIFIn,
- Other due to a single interruption in February which affected 535 customers for just over 3 minutes, where the cause was an operational issue (protection operated during trip testing). This outage contributed 0.2 minutes to USAIDIn and 0.08 interruptions to USAIFIn.

Figure 10 - CBD feeder category USAIDIn

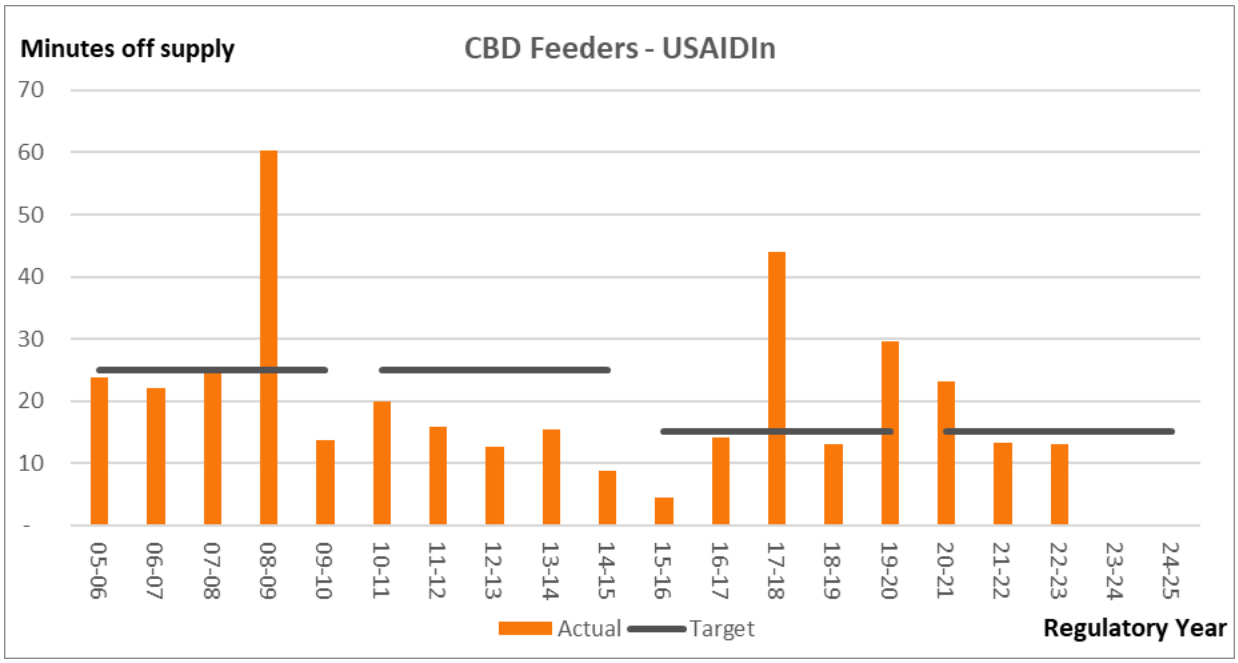


Figure 11 - CBD feeder category USAIFIn

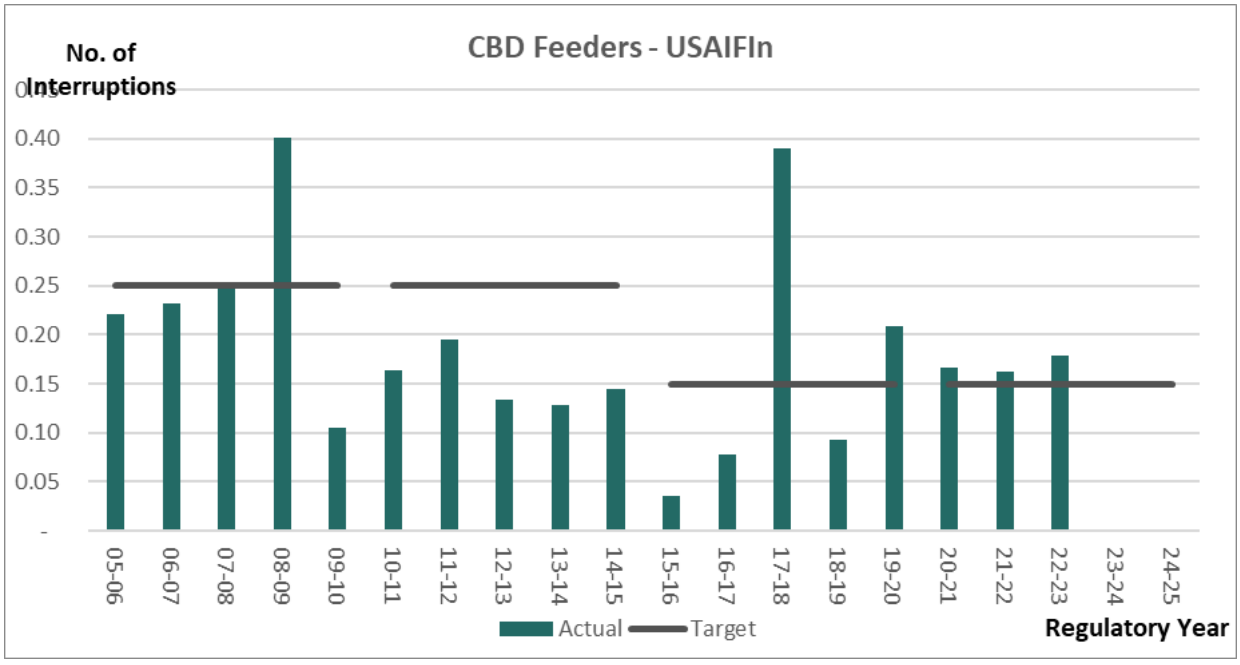
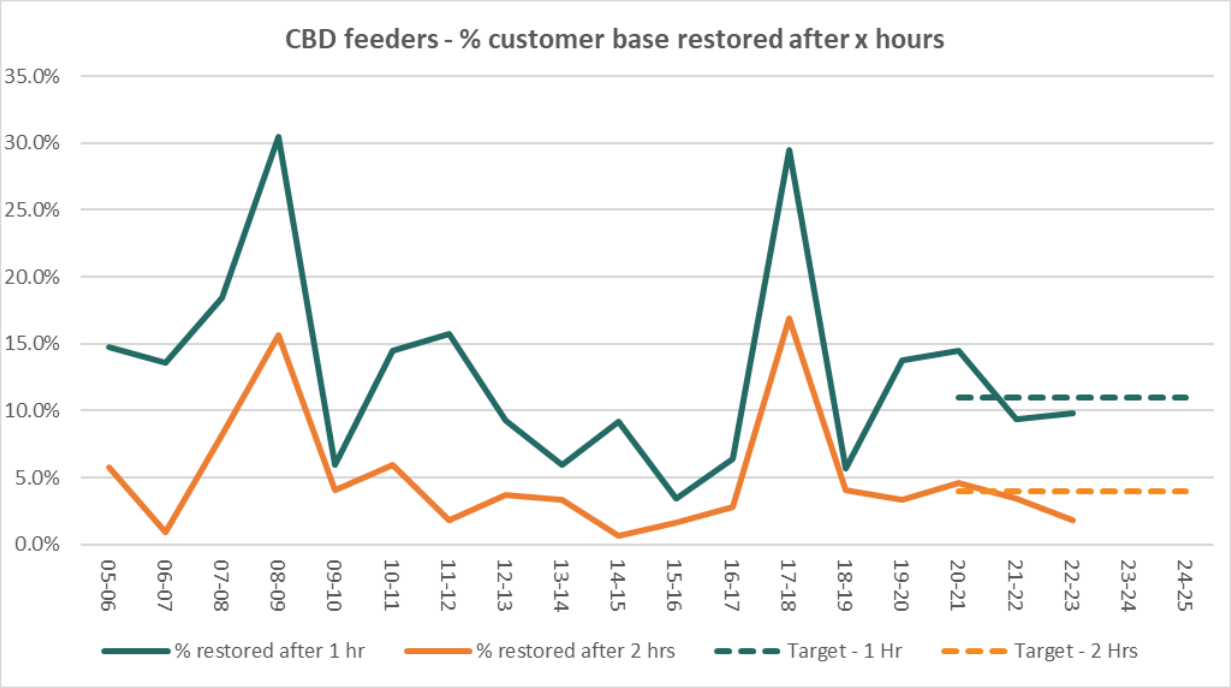


Figure 12 CBD feeder category CRoSn (≥ 1hour and > 2hours)



7.2.c Conclusion

Three of the four CBD feeder category targets were achieved in 2022-23, with only the USAIFIn target being marginally worse than target and less than the RT. SA Power Networks consider it has used best endeavours to achieve the CBD feeder category targets in 2022-23. We have identified a worsening performance of older cables in the CBD and have gained agreement from stakeholders to include funding in our Regulatory Proposal for the 2025-30 RCP to address this worsening performance.

7.3 Urban feeder category normalised performance

7.3.a Introduction

The Urban feeders supply about 69% of customers utilising about 29% (ie 24,535 route kms) of the distribution system. They supply the Adelaide Metropolitan area (excluding part of the Adelaide CBD and some major regional towns (eg Mt Gambier, Pt Augusta).

7.3.b Normalised reliability performance

SA Power Networks achieved three of the four Urban feeder category targets for 2022-23. The only target not achieved was the percentage of customers restored after three hours, but the 2022-23 performance was within the normal expected bounds and was better than the reporting threshold. Figure 13, Figure 14 and Figure 15 below demonstrate that there has been an improvement in USAIFIn, and no decline in USAIDIn and CRoSn. The CRoSn > 3hours result for 2022-23 was like 2013-14 and 2016-17 and due to the severe weather events in November 2022 and underground cable faults.

Table 13 - Reliability performance of the Urban feeder category

Urban feeders	USAIDIn	USAIFIn	% Restored 2 Hrs	% Restored 3 hrs
2022-23	102	0.87	25	13
Target	110	1.15	27	11
Reporting threshold	125	1.35	29.5	13.5

Figure 13 - Urban feeder category USAIDIn

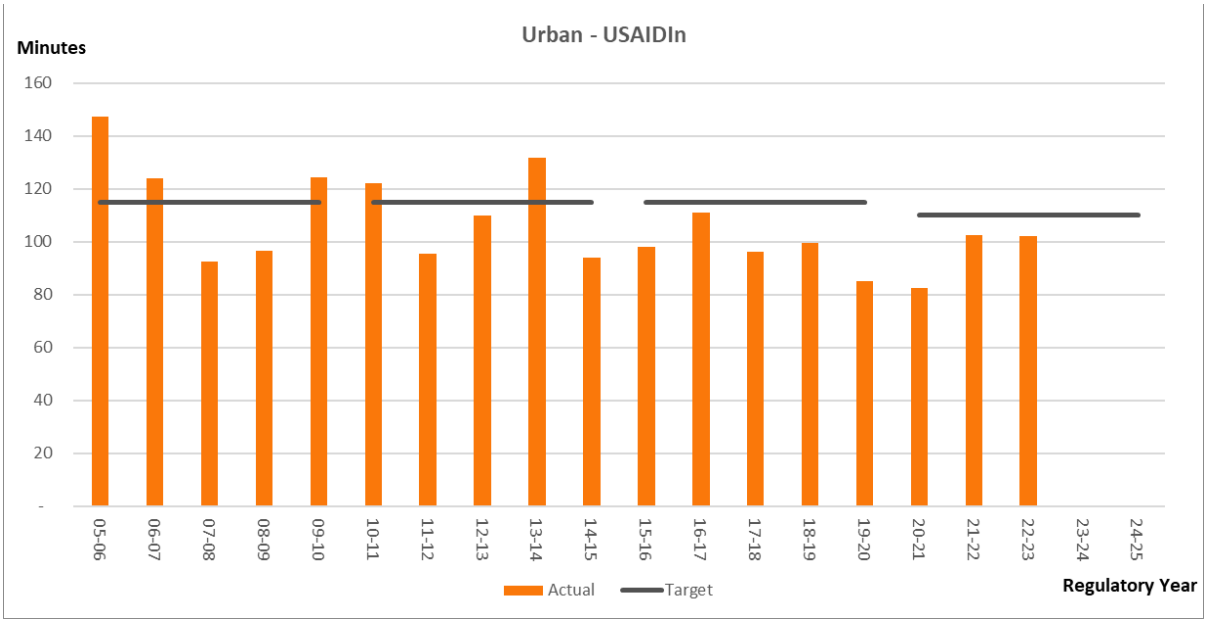


Figure 14 - Urban feeder category USAIFIn

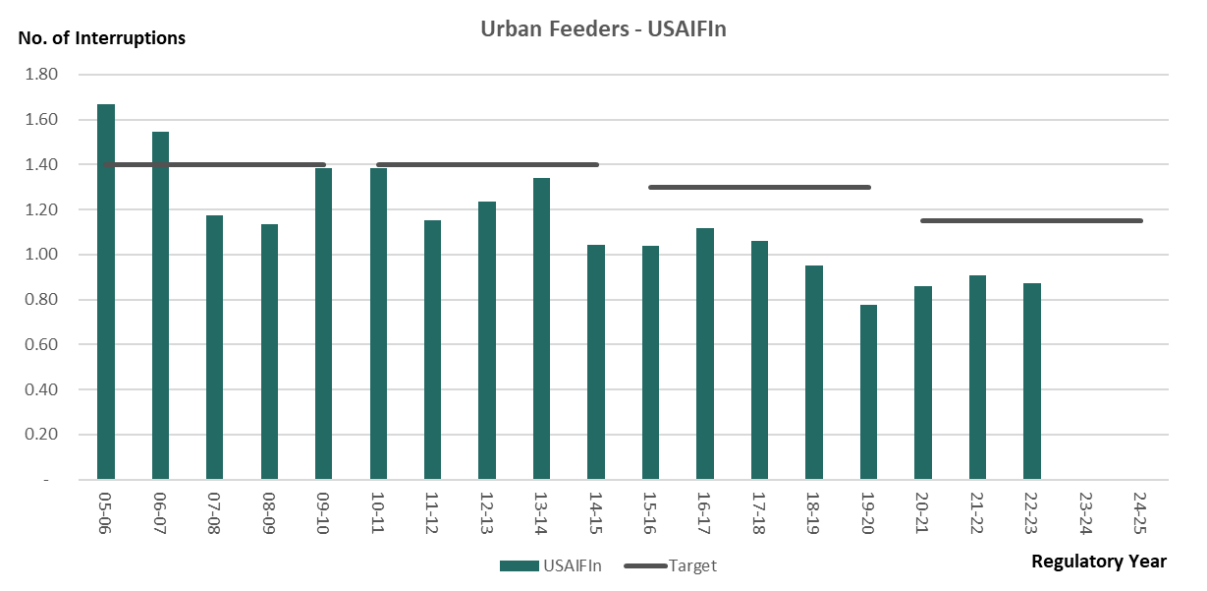
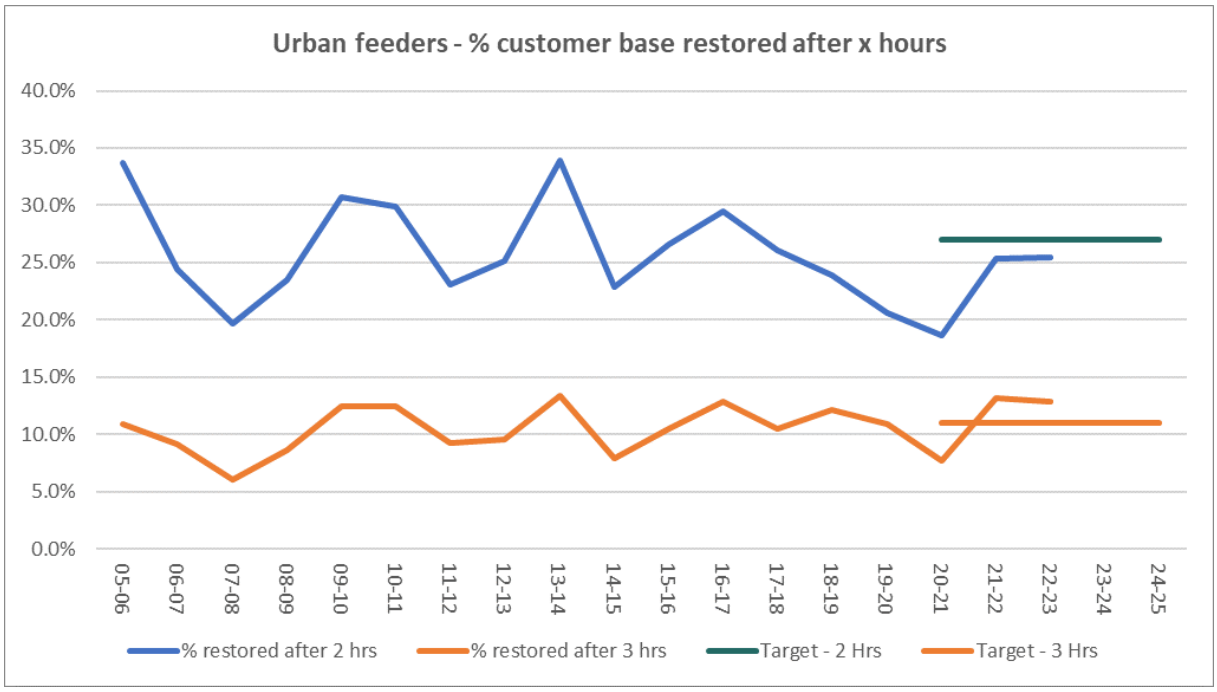


Figure 15 - Urban feeder category CRoSn (> 2hours and > 3hours)



SA Power Networks achieved one (ie > 2 hours) and did not achieve the other (ie > 3hours) network restoration of supply targets with 1.7% fewer customers experiencing an outage duration of more than 2 hours and 1.8% of customers experiencing an outage of more than three hours than the average during the target setting period. Consequently, SA Power Networks is not concerned with the CRoSn performance of Urban Feeders.

7.3.c Conclusion

As three of the four reliability targets were achieved in 2022-23, no performance was worse than the RT and there is no declining trend in the reliability measures, best endeavours have been employed to meet the EDC's Urban feeders USAIDIn, USAIFIn and customer restoration of supply targets in 2022-23.

7.4 Rural Short feeder category normalised performance

7.4.a Introduction

The Rural Short (**RS**) feeders supply about 15% of customers utilising about 15% (ie 12,587 route kms) of the distribution system. They supply customers in the fringe areas of the Adelaide Metropolitan area and most regional towns (eg Victor Harbor).

7.4.b Normalised reliability performance

SA Power Networks achieved three of the four RS feeder category targets for 2022-23. The table below shows the actual performance when compared with the target and the reporting threshold (ie normal bounds of the variation in performance). The graphs below demonstrate that there has been a gradual improvement in historic reliability performance and that there has been no decline in networks restoration performance for > 5 hours.

Table 14 - Reliability performance of the Rural short feeder category

Rural Short feeders	USAIDIn	USAIFIn	% Restored 3 Hrs	% Restored 5 hrs
2022-23	180	1.23	26.2	10.9
Target	200	1.65	27	8

Rural Short feeders	USAIDIn	USAIFIn	% Restored 3 Hrs	% Restored 5 hrs
Reporting threshold	220	1.85	29.5	10.5

Figure 16 - Rural short feeder category USAIDIn

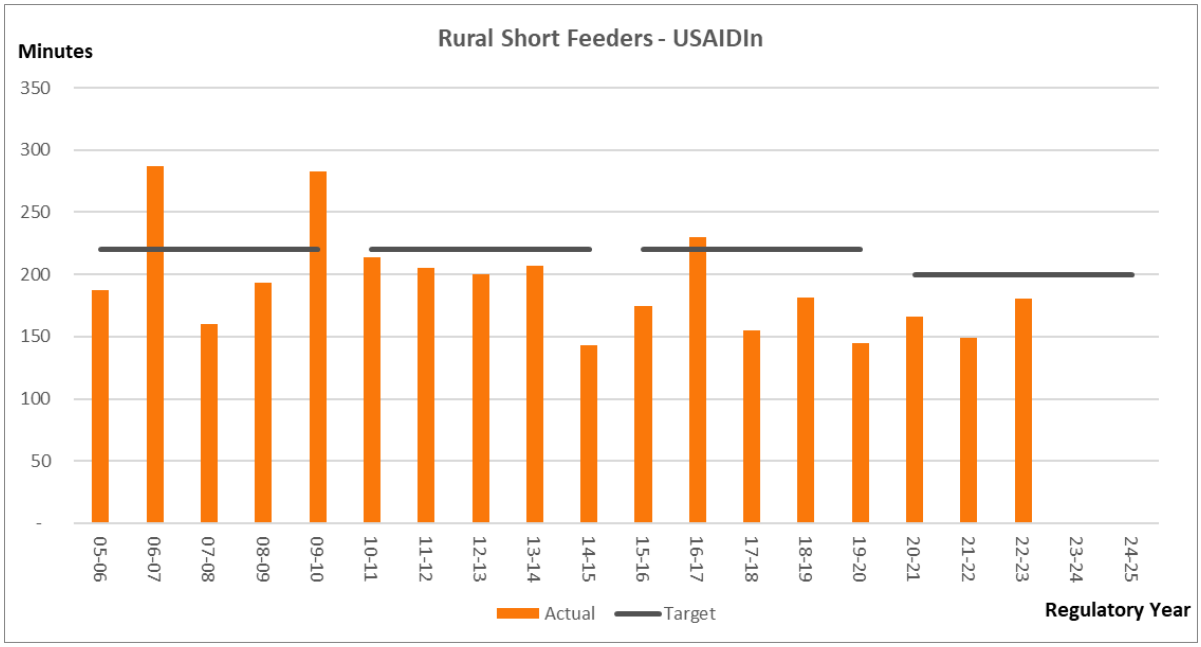


Figure 17 - Rural short feeder category USAIFIn

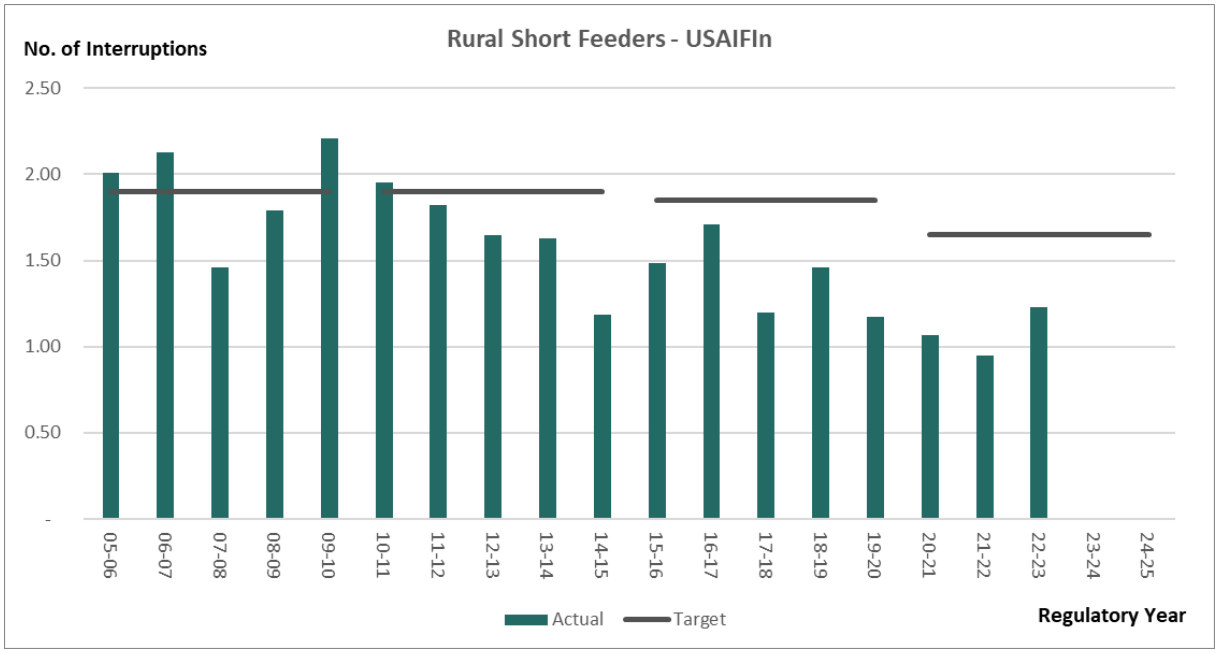
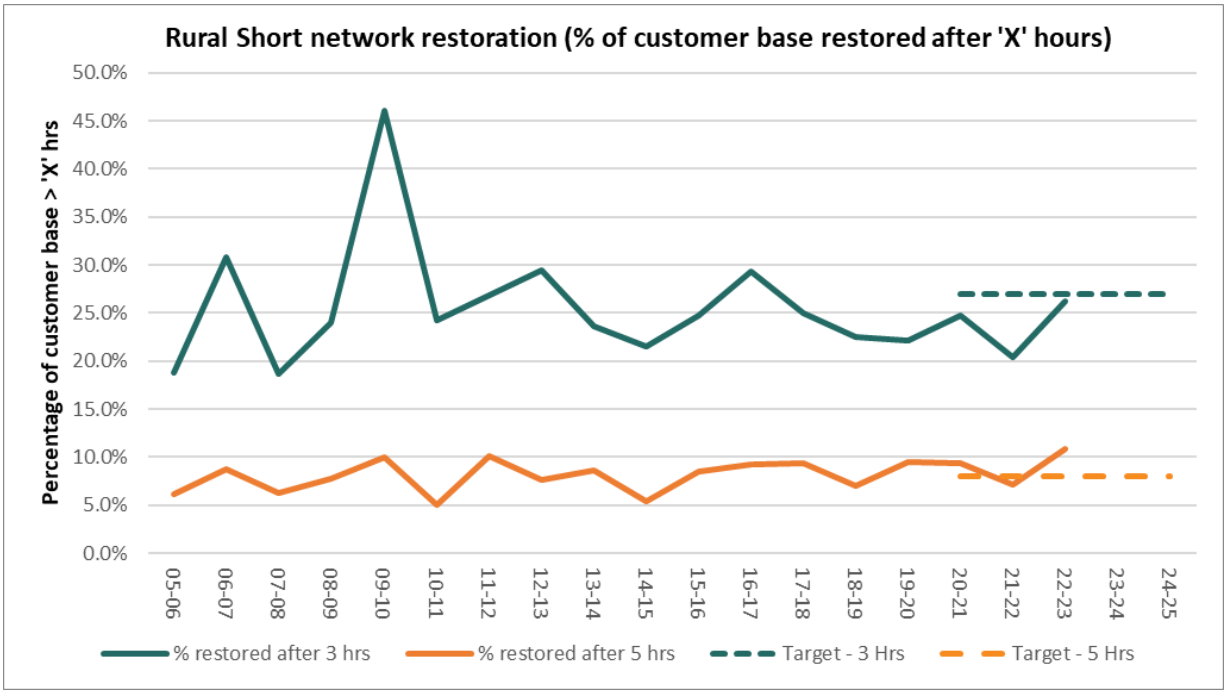


Figure 18- Rural short feeder category CRoSn (> 3hours and > 5hours)



Major factors influencing reliability performance

There were several severe weather events and two car hit poles caused interruptions that resulted in the network restoration (> 5 hours) exceeding the target and the reporting threshold in 2022-23.

7.4.c Conclusion

As three of the four reliability targets have been achieved and there is no long-term declining trend in reliability performance, best endeavours have been used to meet the EDC's Rural Short feeder's reliability targets in 2022-23.

7.5 Rural Long feeder category normalised performance

7.5.a Introduction

The Rural Long (**RL**) feeders supply about 15% of customers utilising about 55% (ie 49,277 route kms) of the distribution system and supply mainly rural areas.

7.5.b Normalised reliability performance

As outlined in the table below, SA Power Networks achieved one of the four RL feeder category targets for 2022-23. Of the targets not achieved no performance was worse than the RT. The poorer than target performances were due to several severe weather events and some interruptions on the 33kV distribution lines (see below for more detail). The graphs below demonstrate that there has been a gradual improvement in historic reliability performance, but a slight decline in CRoSn. SA Power Networks is seeking funding to address the slight decline in CRoSn in its Regulatory Proposal for the 2025-30 RCP.

Rural Long feeders	USAIDIn	USAIFIn	% Restored 4 Hrs	% Restored 7 hrs
2022-23	299	1.43	31.5	11.3
Target	290	1.75	30	10
Reporting threshold	330	2.10	32.5	12.5

Figure 19 - Rural long feeder category USAIDIn

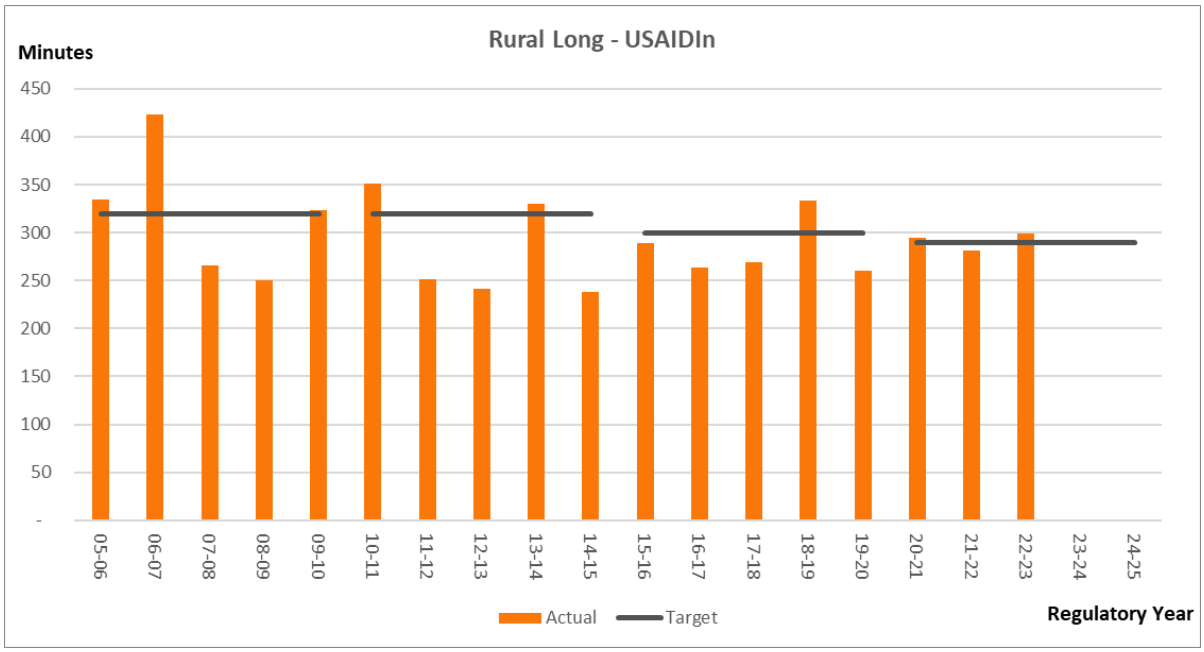


Figure 20 - Rural long feeder category USAIFIn

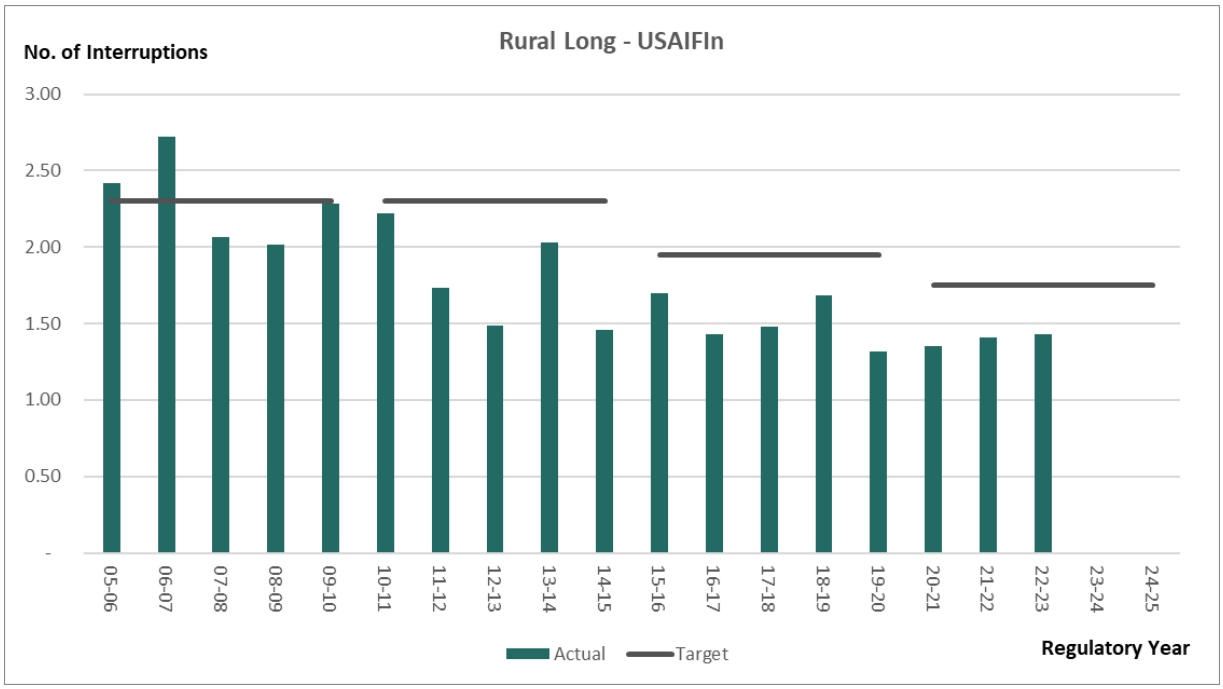
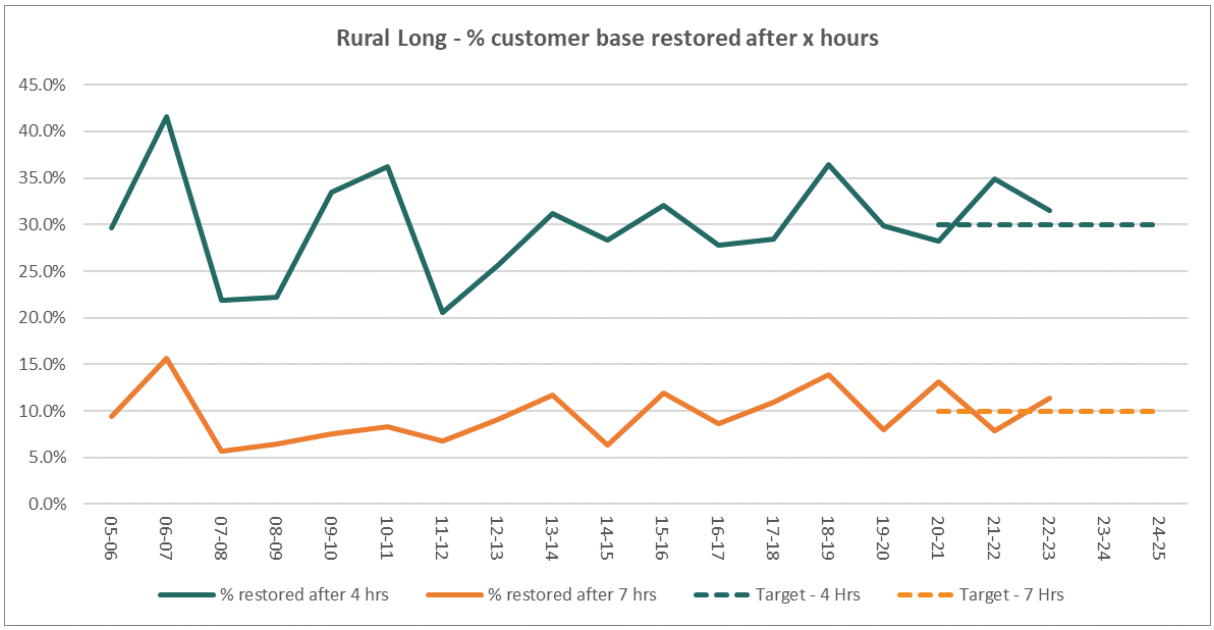


Figure 21 – Rural long feeder category CRoSn (> 4hours and > 7hours)



Major factors influencing reliability performance

The poorer networks restoration performance in 2022-23 was the result of:

- Severe weather events which contributed 4.5% to CRoSn > 4hours and 1% to CRoSn > 7 hours more than the average over the previous seven years; and
- Vehicles colliding with our infrastructure which contributed 1.4% to CRoSn > 4hours and 0.7% to CRoSn > 7hours than the historic average over the previous seven years.

There was a 4.2% reduction in CRoSn due to asset related failures. The overall contribution to USAIDIn from the interruptions where customers were restored after 4hours was 23.7 minutes compared to the historic average over the last seven years. Non-achievement of three reliability targets were the result of severe weather events and vehicles colliding with infrastructure.

7.5.c Conclusion

In summary, one of the four RL reliability targets were achieved, with the non-achievement of three reliability targets were the result of severe weather events and vehicles colliding with infrastructure. However, as highlighted in our MECS we are concern that there is an emerging trend in the RL customer restoration of supply performance that requires additional funding to address. We are seeking additional funding in our Regulatory proposal for the 2025-30 RCP to address this emerging decline in performance. We conclude that best endeavours have been used to meet the EDC's Rural Long feeder's category reliability targets in 2022-23.

7.6 Overall conclusion

The Table below compares the achievement of the reliability measures in 2022-23 in comparison to the best year, worst year and the average over the target setting period. It highlights that the performance in 2022-23 was slightly better than the average.

	2022-23	Average TSP	Best (2014-15)	Worst (2010-11)
Targets achieved	10	9	16	3
> target & < RT	5	4	0	7
> RT	1	3	0	6

The above feeder category analysis highlights that there is no declining trend and therefore SA Power Networks has used best endeavours to achieve all the reliability targets in 2022-23. Consequently, SA Power Networks has complied with its EDC reliability service standard obligations.

8. EDC Region reliability performance

8.1 Introduction

ESCoSA is concerned that establishing reliability standards on the four feeder categories may mask declines in regional areas performance. Consequently, ESCoSA requires us to report on nine geographic areas and another segmentation that comprises feeders in all the major rural townships. The ten regions are:

- Adelaide Business Area (**ABA** - same as those feeders classified as CBD);
- Greater Adelaide Metropolitan Area (**GAMA**);
- Major regional centres (**MRC** – includes the townships of Pt Lincoln, Whyalla, Pt August, Pt Pirie, Murray Bridge, Mt Gambier, Stirling-Aldgate, Mt Barker and Victor Harbour)
- Barossa and Mid-North (**BMN**);
- Eastern Hills (**EH**);
- Eyre Peninsula (**UNE**);
- Fleurieu Peninsula (**FP** – includes Kangaroo Island);
- Riverland and Murraylands (**RM**);
- Southeast (**SE**); and
- Upper North (**UN**).

The following sections detail the assessment criteria that SA Power Networks will use to determine if the historic reliability performance of the ten regions has been maintained. These criteria will then be used to assess whether or not each region's reliability performance has been maintained.

8.2 Assessment criteria for determining if a region's reliability has been maintained.

The two measures normally used to monitor reliability performance of a distribution system due to unplanned interruptions are:

- USAIDIn (the average time customers are without supply in minutes per annum); and
- USAIFIn (the average number of interruptions experience per annum).

These measures are normalised to exclude interruptions that start on a MED, as these can significantly impact on the reliability performance of a region. Once MEDs are excluded from a region's USAIDI and USAIFI result, the remaining variability is generally due to either:

- Localised or state-wide SWEs that don't result in a MED; or
- one off, non-systemic interruptions.

In the sections to follow, SA Power Networks assesses whether each region's reliability performance is being maintained by examining the long-term trend, over several years, in:

- normalised USAIDI (ie USAIDIn which excludes MEDs); and
- normalised USAIFI (ie USAIFIn which excludes MEDs)

Where the performance is outside normal variation[28] then we will detail the reasons for the excursion and, if not systemic, conclude that reliability performance is being maintained.

The process to determine if reliability has been maintained for a region will involve assessing the following two criteria:

- Is the historic reliability performance[29] being maintained (ie is there no long-term decline in performance and performance is better than the equivalent reporting threshold); and
- Is the non-achievement of the target related to one-off type events or SWE, (ie not a systemic issue).

Where the first criterion is achieved, it means that the performance in that year is better than the historic average, consequently, it is appropriate to conclude that reliability for that region has been maintained. Also,

[28] Outside normal variation means that it is outside the reporting threshold as introduced by ESCoSA for the 2020-25 RCP.

[29] Historic average is the average reliability performance over the 15-year period from 1 July 2005 to 30 June 2020.

if the second criterion is met, in that there is no declining trend, then the reliability for that region has been maintained. Consequently, where either of these two criteria are met the reliability for the region has been maintained.

8.3 Summary of regional performance

The information, tables and charts provided below demonstrate that there has not been a decline in any of the 10 region's reliability performance. The poorer than historic performance for the RM was due to one-off failures or SWEs. There were no systemic issues identified which contributed to some regions reliability being marginally worse than the historic average.

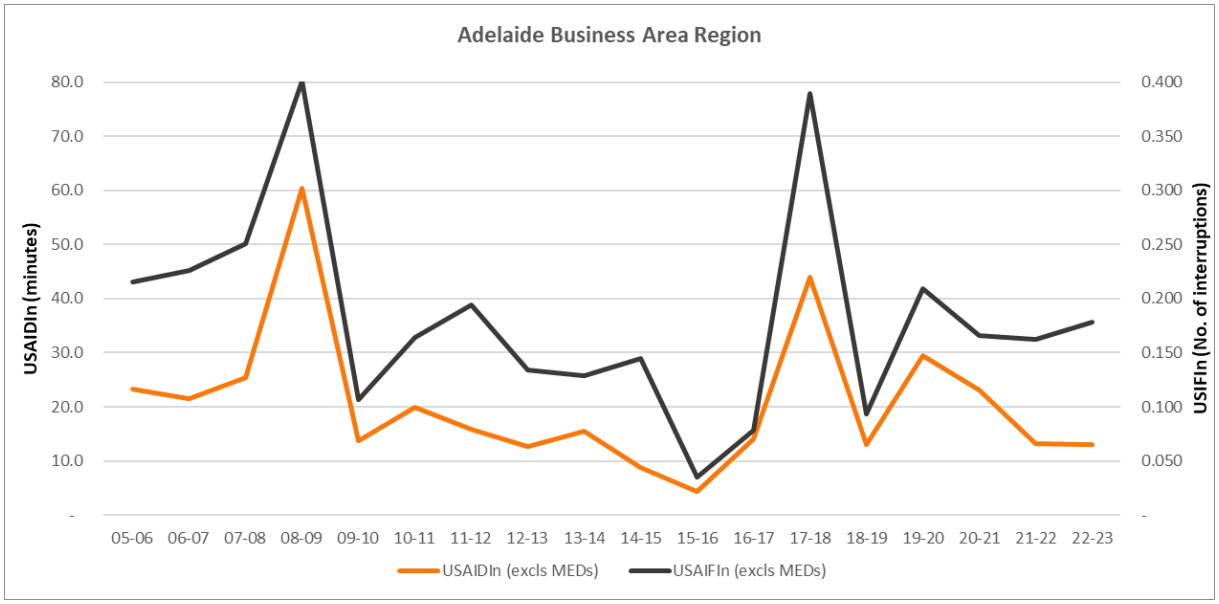
8.4 Adelaide Business Area

The Adelaide Business Area (**ABA**) feeder category feeders supply 1% of customers[30], using 0.3% of the distribution system. These feeders supply the Adelaide CBD and surrounds. Due to the very low customer numbers and low targets, the performance of the CBD feeders can be significantly affected by one-off interruptions.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Adelaide Business Area	2022-23	Historic Ave.	reporting threshold
USAIDIn	13	21	25
USAIFIn	0.18	0.18	0.23

Figure 22 - Adelaide Business Area reliability performance



See CBD feeder category for the major interruptions that affected the ABA.

Conclusion

The historic performance of the ABA has been maintained as both the USAIDIn and USAIFIn are better than the average historic performance and there is no long-term declining trend in either of the two measures. We have identified a worsening performance of older cables in the CBD and have gained agreement from stakeholders to include funding in our Regulatory Proposal for the 2025-30 RCP to address this worsening performance.

30 In addition, there are about 100,000 people living and working in the CBD each day.

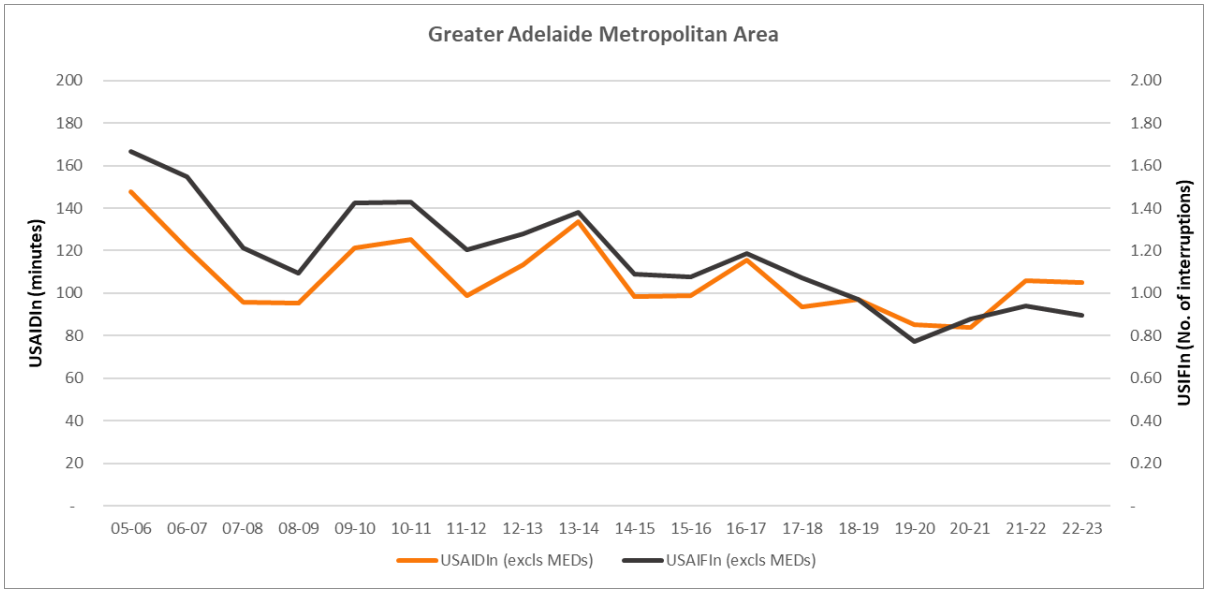
8.5 Greater Adelaide Metropolitan Area

The Greater Adelaide Metropolitan Area supplies about 600,000 customers representing about 65% of total customers. The graph below shows that the reliability performance has gradually improved since the 2005/06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Greater Adelaide Metropolitan Area	2022-23	Historic Ave.	reporting threshold
USAIDIn	105	109	121
USAIFIn	0.90	1.23	1.43

Figure 23 - Greater Adelaide Metropolitan Area reliability performance



Conclusion

The historic performance of the Greater Adelaide Metropolitan Area has been maintained as USAIDIn and USAIFIn performance for the 2022-23 regulatory year were better than the historic average performance and there is a gradual improvement in reliability performance since the 2005-06 regulatory year.

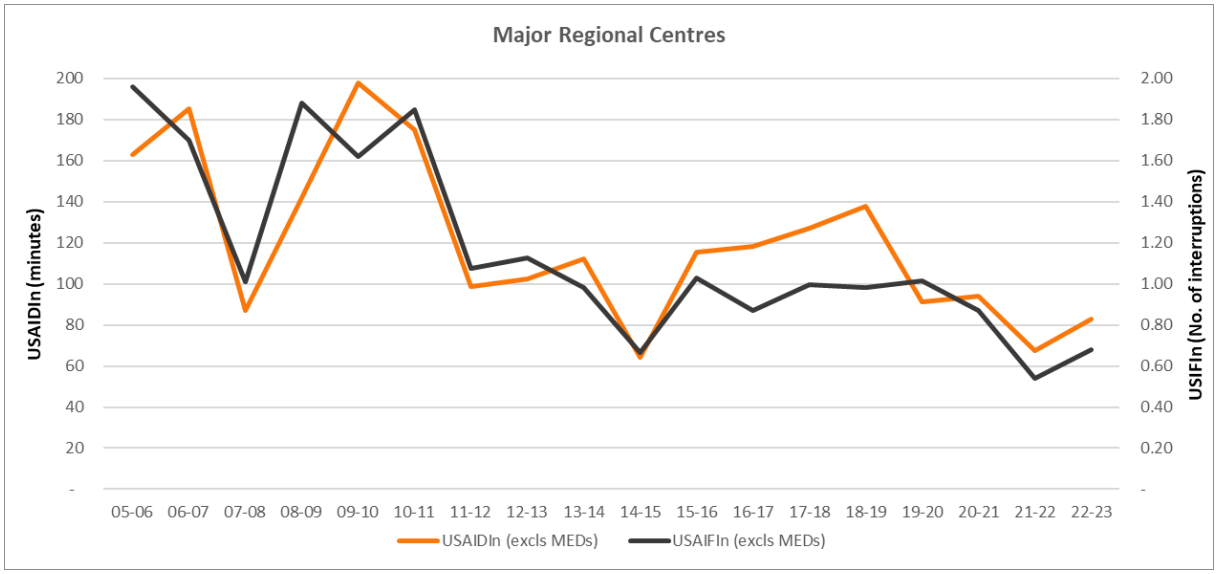
8.6 Major Regional Centres

About 86,000 customers are supplied in major regional cities that make up the Major Regional Centres. The graph below shows that the reliability performance has improved since the 2005/06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Major Regional Centres	2022-23	Historic Ave.	reporting threshold
USAIDIn	83	128	147
USAIFIn	0.68	1.25	1.70

Figure 24 - Major Regional Centres reliability performance



Conclusion

The historic performance of the Major Regional Centres has been maintained as USAIDIn and USAIFIn performance for the 2022-23 regulatory year were better than the historic average performance and there is a gradual improvement in reliability performance since the 2005-06 regulatory year.

8.7 Barossa, Mid-North and Yorke Peninsula Region

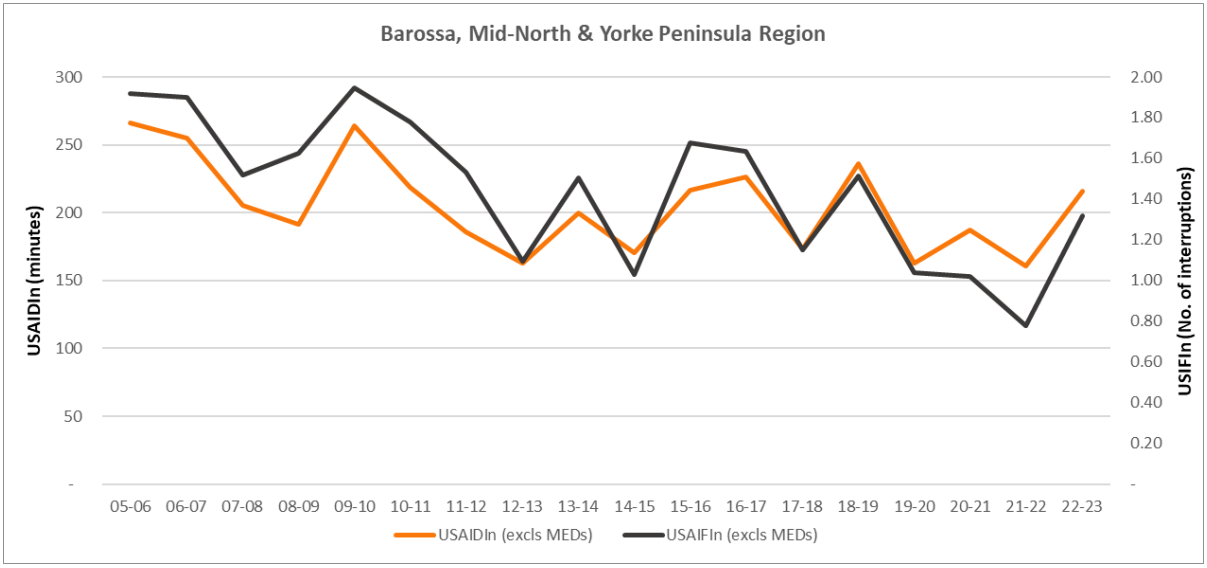
About 59,000 customers (ie 5.4% of total customers) are supplied in the Barossa, Mid-North and Yorke Peninsula (BMNY) region. The graph below shows that the reliability performance has gradually improved since the 2005/06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Barossa, Mid-North and Yorke Peninsula	2022-23	Historic Ave.	reporting threshold
USAIDIn	216	209	236
USAIFIn	1.32	1.52	1.78

The poorer USAIDIn performance in 2022-23 was impacted by several severe weather events in November and December 2022.

Figure 25 - Barossa, Mid-North & Yorke Peninsula Region reliability performance



Conclusion

The historic performance of the BMNY has been maintained as USAIDIn is marginally worse than the historic average but better than the reporting threshold and USAIFIn performance is better than the historic average performance and there is a gradual improvement in reliability performance since the 2005-06 regulatory year.

8.8 Eastern Hills Region

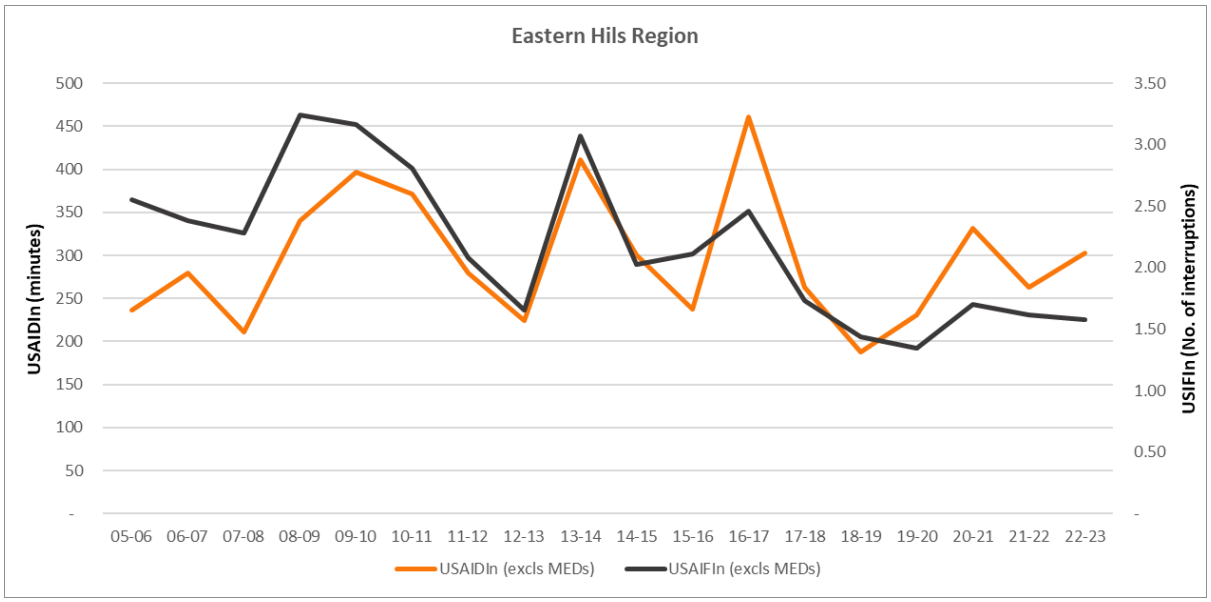
About 32,000 customers are supplied in the Eastern Hills region (which exclude customers in Stirling/Bridgewater and Mt Barker townships areas). The graph below shows that the reliability performance has had significant variation and there has been no decline since the 2005/06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Eastern Hills	2022-23	Historic Ave.	reporting threshold
USAIDIn	303	295	371
USAIFIn	1.58	2.29	2.81

The USAIDIn performance was impacted by several severe weather events in June 2023 and November 2022.

Figure 26 - Eastern Hills Region reliability performance



Conclusion

The historic performance of the Eastern Hills has been maintained as USAIDIn is marginally worse than the historic average but better than the reporting threshold and USAIFIn performance is better than the historic average performance and there is a gradual improvement in USAIFIn performance and no decline in the USAIDIn performance since the 2005-06 regulatory year.

8.9 Eyre Peninsula Region

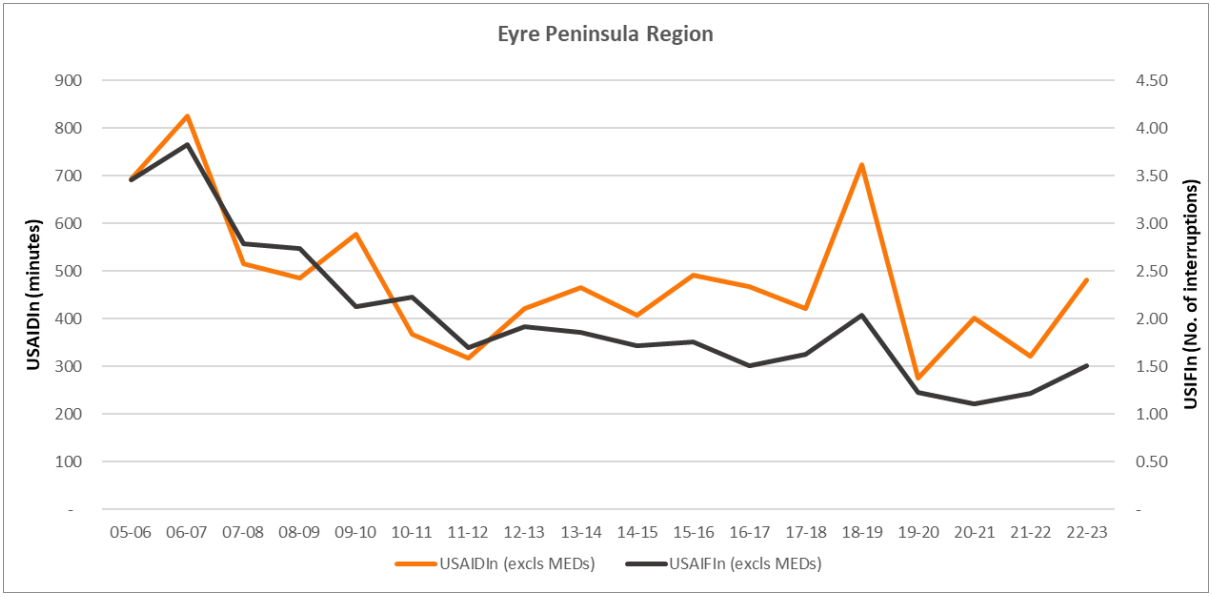
About 16,000 customers are supplied in the Eyre Peninsula region which excludes selected HV feeders[31] in the cities of Pt Lincoln and Whyalla. The graph below shows that the reliability performance has improved since the 2005-06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Eyre Peninsula	2022-23	Historic Ave.	reporting threshold
USAIDIn	481	497	577
USAIFIn	1.51	2.17	2.74

The poorer USAIDIn performance in 2022-23 compared to recent history was due to severe weather events in November 2022 and a vehicle damaging infrastructure in March 2023, these events contributed 130 minutes to USAIDIn.

Figure 27 - Eyre Peninsula Region reliability performance



Conclusion

The historic performance of the Eyre Peninsula has been maintained as the USAIDIn and USAIFIn performance for the 2022-23 regulatory year were better than the historic average performance and there is a gradual improvement in reliability performance since the 2005-06 regulatory year.

[31] Selected HV feeders in the Cities of Pt Lincoln and Whyalla are included in MRC.

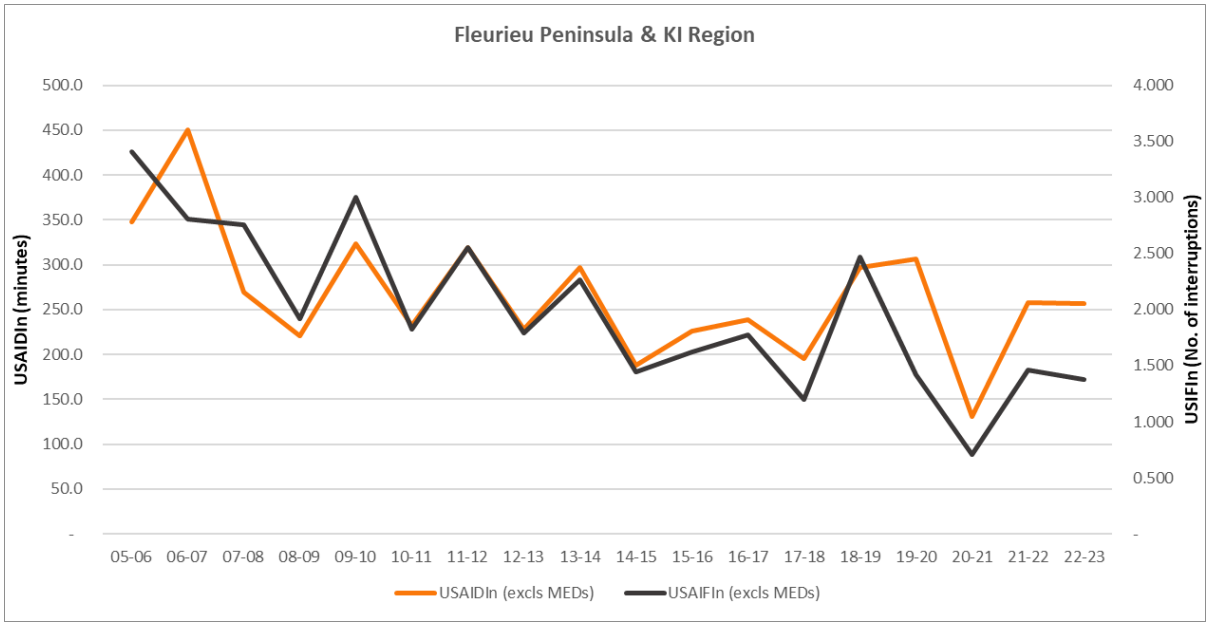
8.10 Fleurieu Peninsula

About 35,000 customers are supplied in the Fleurieu Peninsula region (includes Kangaroo Island). The graph below shows that the reliability performance has improved since the 2005-06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Fleurieu Peninsula	2022-23	Historic Ave.	reporting threshold
USAIDIn	257	276	319
USAIFIn	1.38	2.15	2.76

Figure 28 - Fleurieu Peninsula & KI Region reliability performance



Conclusion

The historic performance of the Fleurieu Peninsula has been maintained as the USAIDIn and USAIFIn performance for the 2022-23 regulatory year were better than the historic average performance and there is a gradual improvement in reliability performance since the 2005-06 regulatory year.

8.11 Riverland & Murrayland Region

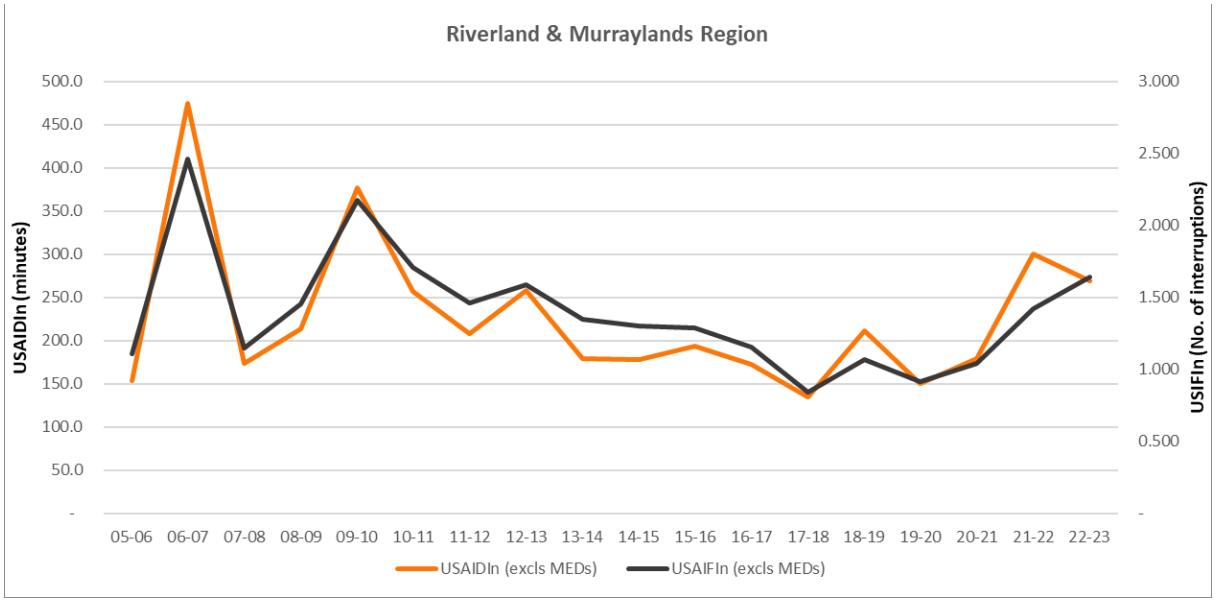
About 39,000 customers are supplied in the Riverland and Murrayland region, which excludes selected HV feeders[32] in the City of Murray Bridge. The graph below shows that the reliability performance has improved since the 2005-06 regulatory year.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Riverland & Murrayland	2022-23	Historic Ave.	reporting threshold
USAIDIn	269	222	257
USAIFIn	1.64	1.40	1.59

The poorer reliability performance in 2022-23 was the result an increase in weather related outages (mainly due to SWEs), and Other outages and asset failure outages, compared to the historic average, which contributed an additional 50 minutes to USAIDIn and 0.25 interruptions to USAIFIn. The cause Asset failure increase was due to a single sub-transmission conductor down due to vibration (not one of the two sub-transmission lines outages in 2021-22 which contributed 80 minutes to USAIDIn) which contributed 13 mins to USAIDIn and 0.05 interruptions to USAIFIn.

Figure 29 - Riverland & Murraylands Region reliability performance



Conclusion

The USAIDIn performance of 2022-23 was better than 2021-22 but still worse than the average historical performance and against the historic trend shown in Figure 29. The caused of the poorer performance in 2022-23 was weather related, cause Other and a single outage on a sub-transmission line. Therefore there is no systemic issue with the reliability performance of the Riverland and Murrayland Region but just normal variations. Even with the 2022-23 performance there is no decline in historic trend in reliability performance for the Riverland and Murrayland Region since 2005-06 regulatory year.

[32] Selected HV feeders in the City of Murray Bridge are included in MRC.

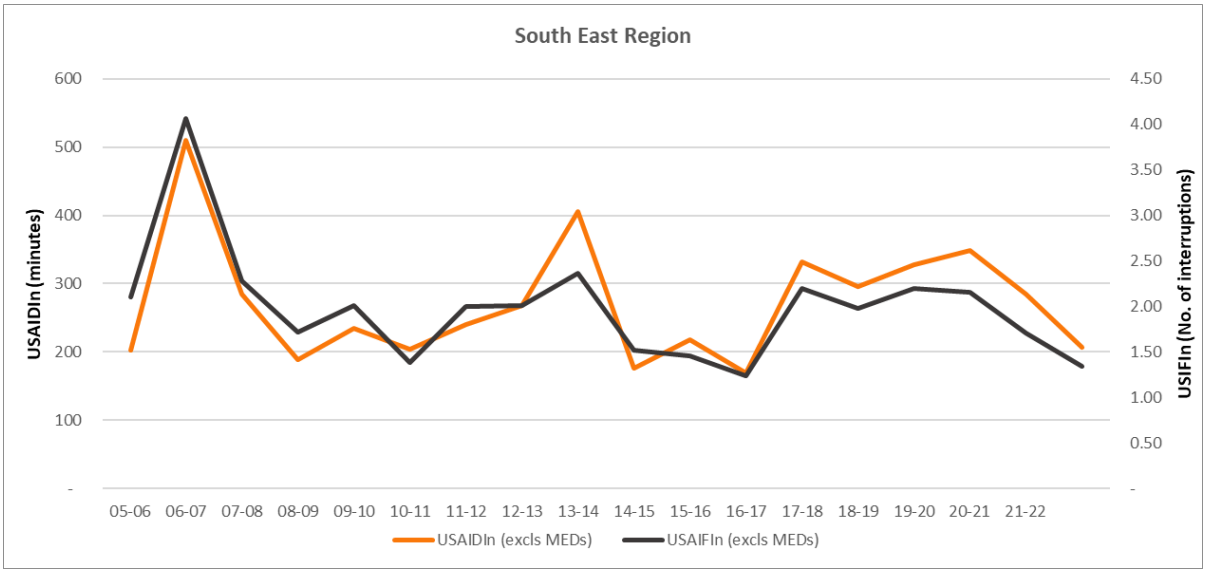
8.12 Southeast region

About 29,000 customers are supplied in the Southeast region, which excludes selected HV feeders[33] in the City of Mt Gambier. The graph below shows that the reliability performance has improved since the 2005-06 regulatory year. Reliability performance in the four years to 2020-21 has been impacted by severe weather events (mainly lightning strikes) and possum issues on sections of 33kV sub-transmission feeders. Consequently, we have installed lightning resistant insulators on selected sections of the 33kV sub-transmission system and installed possum guards on affected sections of lines to prevent possums climbing our Stobie poles.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Southeast	2022-23	Historic Ave.	reporting threshold
USAIDIn	206	271	328
USAIFIn	1.34	2.03	2.20

Figure 30 - South East Region reliability performance



The recent work we have undertaken to improve the reliability is having an effect with the USAIDIn being better than the historic average. The USAIFIn performance for 2022-23 is better than the historic average.

Conclusion

The historic performance of the Southeast has been maintained as the USAIDIn and USAIFIn performance is better than the historic average.

[33] There are selected HV feeders in Mt Gambier are included in the MRC.

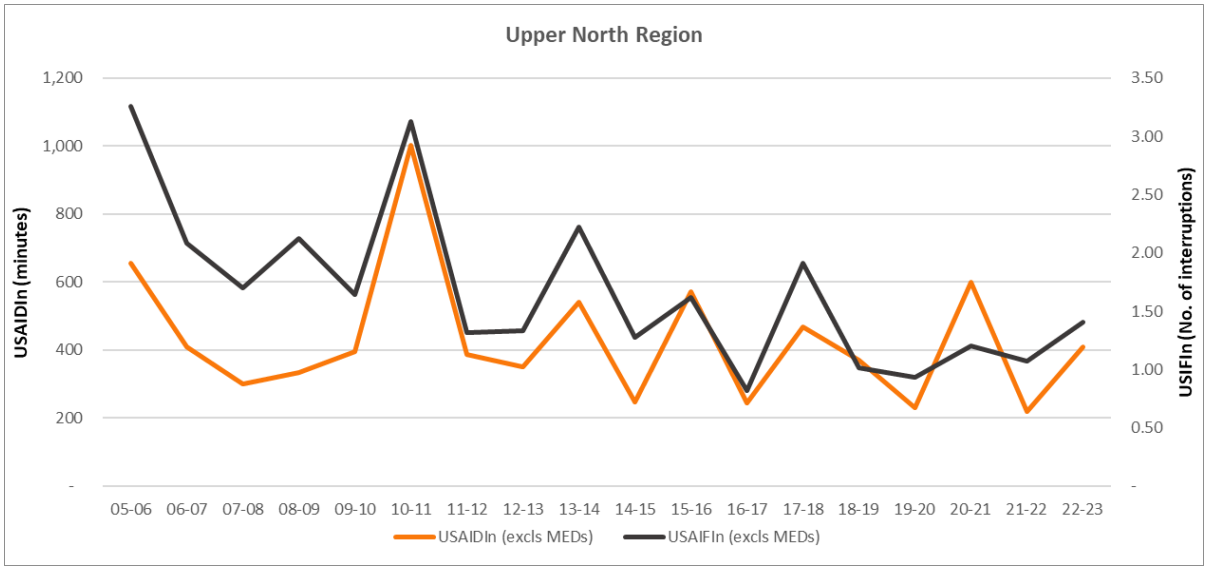
8.13 Upper North Region

About 12,000 customers are supplied in the Upper North region, which excludes selected HV feeders[34] in the Cities of Pt Augusta and Pt Pirie.

The Table below highlights the performance of USAIDIn and USAIFIn for 2022-23, the historic 15-year period 1 July 2005 to 30 June 2020 average performance and the reporting threshold.

Upper North	2022-23	Historic Ave.	reporting threshold
USAIDIn	410	434	540
USAIFIn	1.41	1.76	2.12

Figure 31 - Upper North Region reliability performance



Conclusion

The historic performance of the Upper North has been maintained as both the USAIDIn and USAIFIn were better than the historic average in 2022-23. The Figure above highlights that there is a gradual improvement in the performance of the Upper North Region.

[34] There are selected HV feeders in the Cities of Pt Augusta and Pt Pirie are included in the MRC.

9. Reliability Improvements

SA Power Networks prepares a Reliability Management Plan annually, with the aim of maintaining reliability performance and achieving the EDC reliability targets. The Plan details the initiatives that SA Power Networks undertakes to maintain reliability performance, and where cost effective, to improve reliability, in response to the AER's STPIS. Further it aims to minimise customer inconvenience and reliability GSL payments.

SA Power Networks has a Reliability Operational Group which:

- Reviews interruptions on a daily basis to identify areas of poor performance or potential systemic causes of interruptions to initiate actions to remedy where warranted; and
- Annually prepares reliability improvement projects for the following calendar year.

The reliability improvement actions contribute to two basic outcomes which are:

- Reducing the number of interruptions experienced by customers by:
    - Installing mid-line reclosers and sectionalisers (which reduces the numbers of customers affected by a fault);
    - Installing spur fuses (meaning that only a small proportion of a feeder's customers experience a sustained interruption arising from some faults);
    - 'No Cause Found' patrols for interruptions affecting more than 500 customers (which reduce in some cases future interruptions);
    - 'Reclose' Patrols for switchgear reclose events affecting more than 1,000 customers (which reduce in some cases future interruptions);
    - Replacing lightning-damaged insulators in lightning prone areas (including adjacent insulators in the area) with improved lightning resistant insulators;
    - Removing trees (where possible) that result in multiple interruptions;
    - Installing powerline covering where outages are caused by tree limbs and debris; and
    - Implementing a 'Switched on whilst switching' campaign (which highlights the importance of employees being attentive whilst switching to avoid interruptions that result from switching errors); and
- Improving response times of field crews to interruptions by:
    - Implementing 'find the cause' training, tools and performance reporting for field crews;
    - Network protection training;
    - Application of an 'Isolate and Restore Half First' policy (which requires crews to isolate the affected section of the network before restoring supply to customers supplied from the unaffected section of the network); and
    - Promotion of 'Time to Arrive' reporting and focus (being the time taken for crews to arrive at the location of the outage and commence patrols, permitting us to assess both the time to arrive and the time taken to then restore supply, to better determine if further improvements can be identified and implemented).

Appendix A – Classifying Major Event Days

Section 3.5 of IEEE 1366™-2012 states:

"3.5 Major Event Day classification

The following process—2.5 Beta Method—is used to identify Major Event Days (MED), provided that the natural log transformation of the data closely resembles a Gaussian (normal) distribution. Its purpose is to allow major events to be studied separately from daily operation, and in the process, to better reveal trends in daily operation that would be hidden by the large statistical effect of major events. For more technical detail on derivation of the methodology, refer to Annex B.

A MED is a day in which the daily system SAIDI exceeds a threshold value, T_{MED}. The SAIDI index is used as the basis of this definition since it leads to consistent results regardless of utility size and because SAIDI is a good indicator of operational and design stress. Even though SAIDI is used to determine the MEDs, all indices should be calculated based on removal of the identified days.

In calculating daily system SAIDI, any interruption that spans multiple days is accrued to the day on which the interruption begins.

The MED identification T_{MED} value is calculated at the end of each reporting period (typically one year) for use during the next reporting period, as follows:

a) Collect values of daily SAIDI for five sequential years, ending on the last day of the last complete reporting period. If fewer than five years of historical data are available, use all available historical data until five years of historical data are available.

b) Only those days that have a SAIDI/Day value will be used to calculate TMED (do not include days that did not have any interruptions).

c) Take the natural logarithm (ln) of each daily SAIDI value in the data set.

d) Find α (Alpha), the average of the logarithms (also known as the log-average) of the data set.

e) Find β (Beta), the standard deviation of the logarithms (also known as the log-standard deviation) of the data set.

f) Compute the MED threshold, T_{MED}

$$T_{MED} = e(\alpha + 2.5\beta)$$

g) Any day with daily SAIDI greater than the threshold value T_{MED} that occurs during the subsequent reporting period is classified a major event day.

Activities that occur on days classified as major event days should be separately analysed and reported."