UTILITIES COMMISSION
OF THE NORTHERN TERRITORY

Northern Territory Power System Performance Review

2021-22

www.utilicom.nt.gov.au

Disclaimer

The Northern Territory Power System Performance Review (NTPSPR) is prepared using information sourced from participants in the electricity supply industry, Northern Territory Government agencies, consultant reports and publicly available information. The NTPSPR is in respect of the financial year ending 30 June 2022. The Utilities Commission understands the information received to be current as at March 2023.

The NTPSPR includes analysis and statements based on the Commission's interpretation of data provided by Territory electricity industry participants. The Commission has sought to align its data reporting with the other Australian jurisdictions where possible, to enable comparison. However, there are some differences and any comparisons should only be considered indicative.

Any person using the information in the NTPSPR should independently verify the accuracy, completeness, reliability and suitability of the information and source data. The Commission accepts no liability (including liability to any person by reason of negligence) for any use of the information in the NTPSPR or for any loss, damage, cost or expense incurred or arising by reason of any error, negligent act, omission or misrepresentation in the information in the NTPSPR or otherwise.

Any questions regarding the NTPSPR should be directed to the Utilities Commission, utilities.commission@nt.gov.au or by phone 08 8999 5480.

About this review

Since 2018, the Utilities Commission of the Northern Territory (Commission) has published an annual Northern Territory Power System Performance Review (NTPSPR), which focuses on overall power system, generation and network performance in the Darwin-Katherine, Alice Springs and Tennant Creek power systems. Where possible and relevant, the NTPSPR compares current performance with historical data to identify trends and industry benchmarks to provide context to the results.

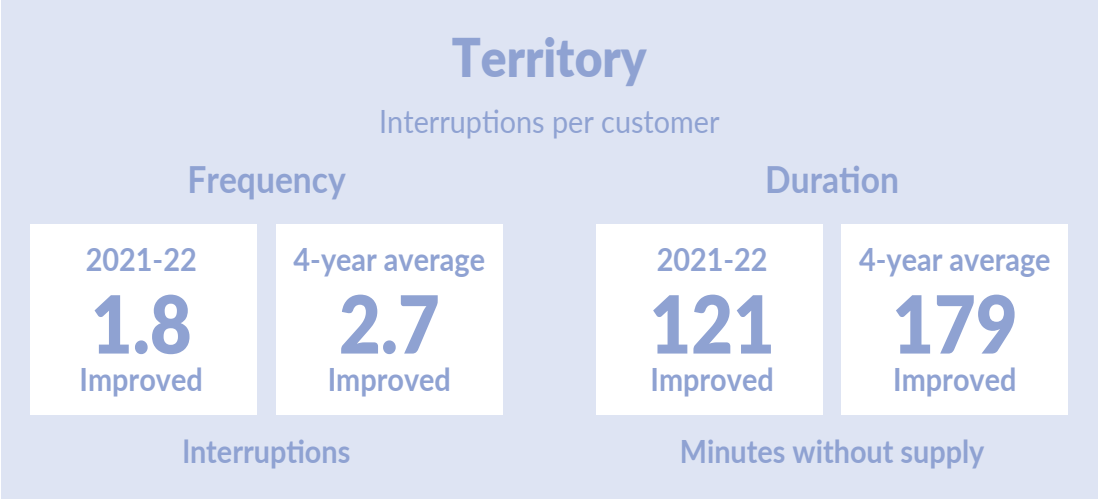
The NTPSPR's main purpose is to inform the responsible minister, government, electricity licensees and stakeholders on the performance of the Darwin-Katherine, Alice Springs and Tennant Creek power systems, and provide an assessment of generation and network performance in 2021-22, including highlighting any areas of concern.

Regular reporting on the electricity supply industry helps increase understanding and transparency of issues, with a view to improving planning and investment decisions, understanding of value for money (price compared with level of service) and general performance by holding electricity licensees accountable for their decisions and performance, and the subsequent impacts on customers.

The 2021-22 NTPSPR is prepared by the Commission in accordance with section 45 of the *Electricity Reform Act 2000* and is restricted to the Darwin-Katherine, Alice Springs and Tennant Creek power systems, with the Darwin-Katherine power system further segmented into the regions of Darwin and Katherine for some indicators. The 2021-22 NTPSPR has been prepared with input from licensees through stakeholder consultation.

The 2021-22 NTPSPR has a different 'look and feel' to recent years, with the Commission revising the focus of the NTPSPR from a technical and broad-based review of overall power system, network and generation performance, to a review that in general has a narrower scope and is focused on standards of service and outcomes of licensee performance as experienced by customers. This change in focus realigns the NTPSPR with the Commission's role as an economic regulator, noting the Commission is not a technical regulator. However, when and where necessary, the Commission will undertake a 'deep dive' on a particular issue or issues, including of a technical nature, either as part of this publication or another publication.

Key findings and recommendations



On average across the Territory, overall power system performance, as measured by interruptions to customers' electricity supply, is improving, with a five-year low in interruptions achieved in 2021-22. Although still lagging the National Electricity Market (NEM) benchmark in terms of frequency of interruptions and the four-year average, performance is improving.

However, performance is not consistent across regions. Customers in the Katherine and Tennant Creek regions receive a lower standard of service when compared with customers in the Darwin and Alice Springs regions. Customers in the Darwin and Alice Springs region are experiencing improvements in the standard of service, while the standard of service for customers in the Katherine and Tennant Creek regions is deteriorating in some aspects.

In 2021-22, customers in the Katherine region experienced eight times more frequent and three times longer interruptions than customers in the Darwin region, while customers in the Tennant Creek region experienced five times more frequent and two and a half times longer interruptions than customers in the Darwin region.

In 2021-22, there were three occasions in the Katherine region and five occasions in the Tennant Creek region when all or the majority of customers in the regions lost electricity supply. The Commission suspects that this level of interruption would not be tolerated in the Darwin and Alice Springs regions.

Network-related performance is driving the higher level of interruptions in the Katherine region. Network and generation-related performance, and the coordination between those assets, is driving the higher level of interruptions in the Tennant Creek region.

While the Commission acknowledges there is no formal reliability standard in the Territory for any of the power systems, given the disparity between power system performance in the Katherine and Tennant Creek regions compared with the Darwin and Alice Springs regions, there is a fundamental question for the Territory Government, and relevant stakeholders to consider, of whether customers in the Katherine and Tennant Creek regions should receive a level of service closer to that in the Darwin and Alice Springs regions.

Should the Territory Government, and relevant stakeholders conclude that the Katherine and Tennant Creek regions should receive a level of service that is more consistent with other regions, investment and or a fundamental shift in how the power system operates in those regions may need to be investigated. Any such investigation should consider the balance between costs, standard of service and customers' willingness to pay, noting increased costs would not flow through to the majority of customers due to protections under the electricity pricing order, and would be borne by government and ultimately taxpayers through the associated community service obligation (CSO) payment to retailers.

The Commission has not identified any concerns in 2021-22 in terms of broader network-related standards of service, such as those in relation to customer connections, guaranteed service levels (GSL), customer service and complaints.

More detail regarding the performance in the Darwin, Katherine, Alice Springs and Tennant Creek regions in terms of overall power system, network and generation performance can be found in the following regional summaries and relevant chapters.

NTPSPR recommendations

The Commission has made a number of recommendations in the NTPSPR since 2017-18, which the Commission is tracking progress against. Some progress has been made against these recommendations during 2021-22, with four recommendations assessed as complete as part of this review.

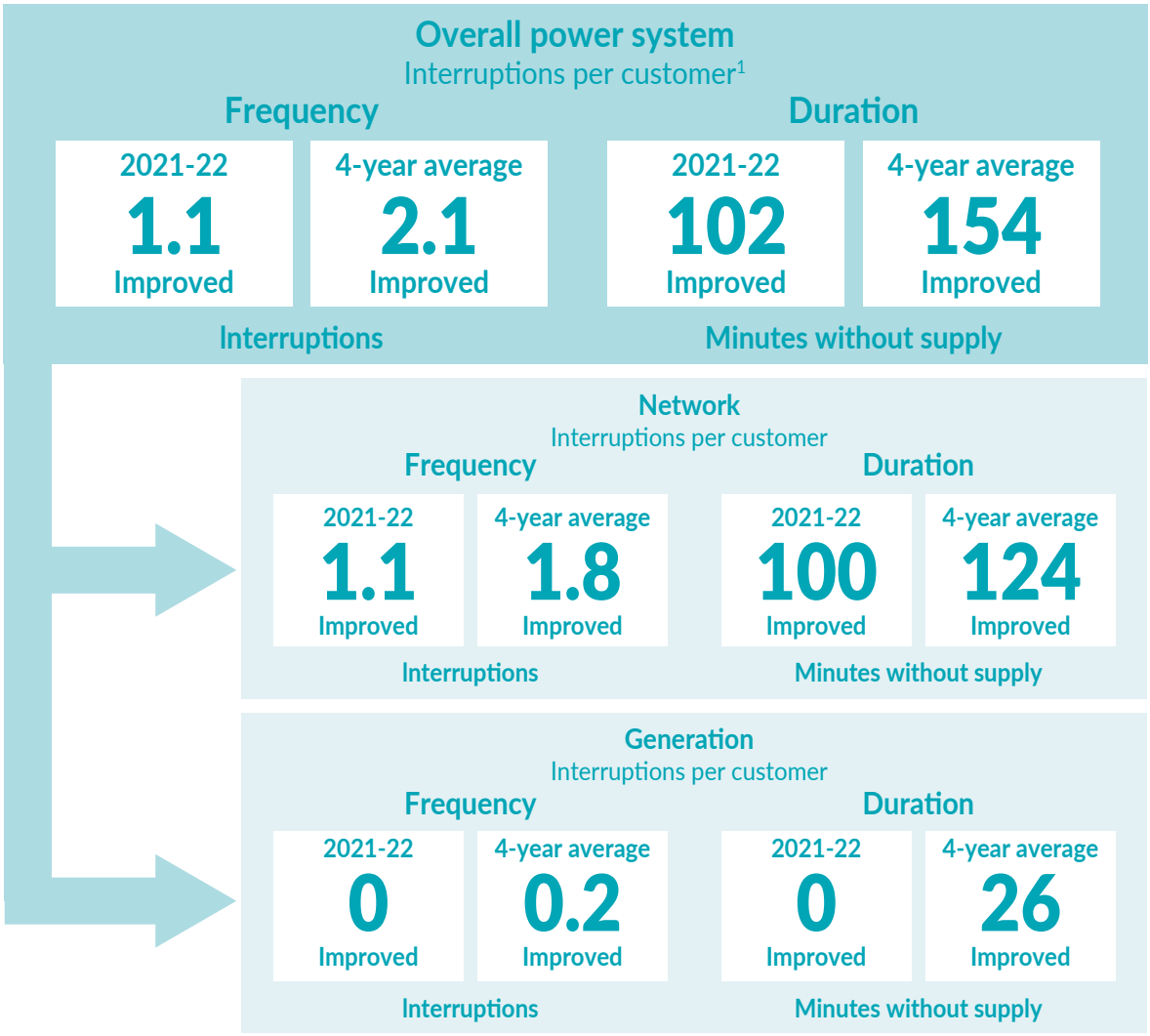
The Commission has not made any recommendations in this 2021-22 NTPSPR, noting it has made recommendations in previous NTPSPRs regarding the performance of the Katherine and Tennant Creek regions and these recommendations have been assessed as still in progress.

More information regarding the assessment of outstanding recommendations from previous NTPSPR can be found in the Previous NTPSPR recommendations chapter.

Darwin

The Darwin region is the highest performing of the four regions considered in the NTPSPR, with customers on average experiencing less frequent and shorter interruptions. Performance in the region has continued to improve over the last five years to its highest level in 2021-22. Had it not been for a significant interruption to customers in 2020-21, associated with a gas supply-related outage to the Channel Island power station, the four-year average performance would have been even better.

The majority of interruptions in the Darwin region are a result of network-related performance.



1 The sum of network and generation-related interruptions may not equal overall power system interruptions, which may include additional interruptions as a result of system control, safety or weather.

Network

Despite being the cause for the majority of interruptions in the Darwin region, network performance has improved over the last five years to its best result in 2021-22. The performance of the network in the Darwin region is only beaten by Alice Springs.

Customers on some feeders, such as those customers on the Ludmilla and Middle Point feeders, have consistently received a lower level of service over recent years, when compared with relevant Commission-approved network target standards, however Power and Water Corpation (PWC) appears to be taking appropriate steps to address the issues.

Generation

Had it not been for a gas supply-related outage to the Channel Island power station in 2020-21, generation performance would have had very little impact on customers in the Darwin region over the last six years.

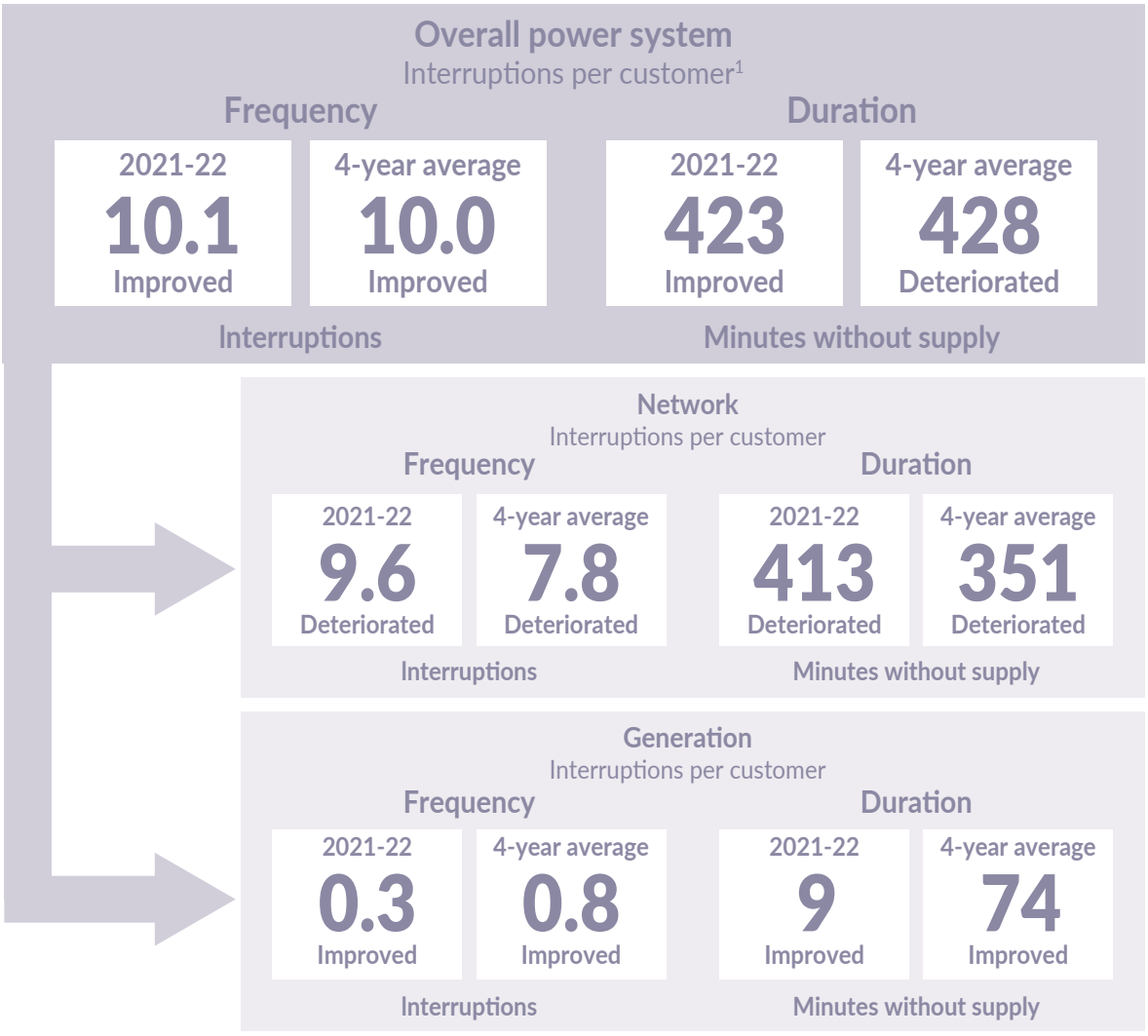
However, the Commission notes the improvements to generation performance, and the limited impact of that performance on customers, is likely due to PWC System Control changes to the operation of the power system a number of years ago, which included changes to the under frequency load shedding scheme settings, generation dispatch constraints and spinning reserve levels. The changes to generation dispatch constraints and spinning reserve levels have likely increased costs, particularly for Territory Generation. Under the current framework there is no competitive provision of essential system services to put downward pressure on these costs and limited regulatory requirements or oversight to ensure the efficient dispatch of essential system services by PWC System Control.

Katherine

In contrast to the Darwin region and despite an improvement in 2021-22 compared with the previous year, the Katherine region, which is connected to Darwin by a transmission line, is the worst performing of the four regions considered in the NTPSPR. Customers on average experience more frequent and longer interruptions. In 2021-22, customers in Katherine experienced interruptions that were eight times more frequent and three times longer than customers in the Darwin region.

There were three occasions during 2021-22 when the entire Katherine region went without power, which is an improvement on the nine occasions in 2020-21. The Commission suspects this level of interruption and the overall performance in the Katherine region would not be tolerated in the Darwin or Alice Springs regions.

The majority of interruptions in the Katherine region are a result of network-related performance, and more specifically, issues associated with the transmission line connecting the region to the rest of the Darwin-Katherine power system.



1 The sum of network and generation-related interruptions may not equal overall power system interruptions, which may include additional interruptions as a result of system control, safety or weather.

Network

In terms of network-related performance, the Katherine region continued to deteriorate in 2021-22, recording the worst performance and highest four-year average over the last five years. Over the last five years, the network in the Katherine region has consistently performed worse than networks in other regions.

In addition to the overall network performance, customers on some feeders, such as those customers on the Katherine and Florina feeders have consistently received a lower level of service over recent years, when compared with relevant Commission-approved network target standards. In 2021-22, customers on the Katherine and Florina feeders experienced 430 and 1,358 minutes without supply, respectively. Further, while inside the relevant Commission-approved network target standard, customers on the Mataranka feeder experienced 1,477 minutes without supply in 2021-22.

Although customer notifications to PWC regarding the quality of supply in the Katherine region have been consistently higher over recent years than in relation to other regions, and complaints have also been higher in some of those years, the number of customers complaining is still relatively low.

Generation

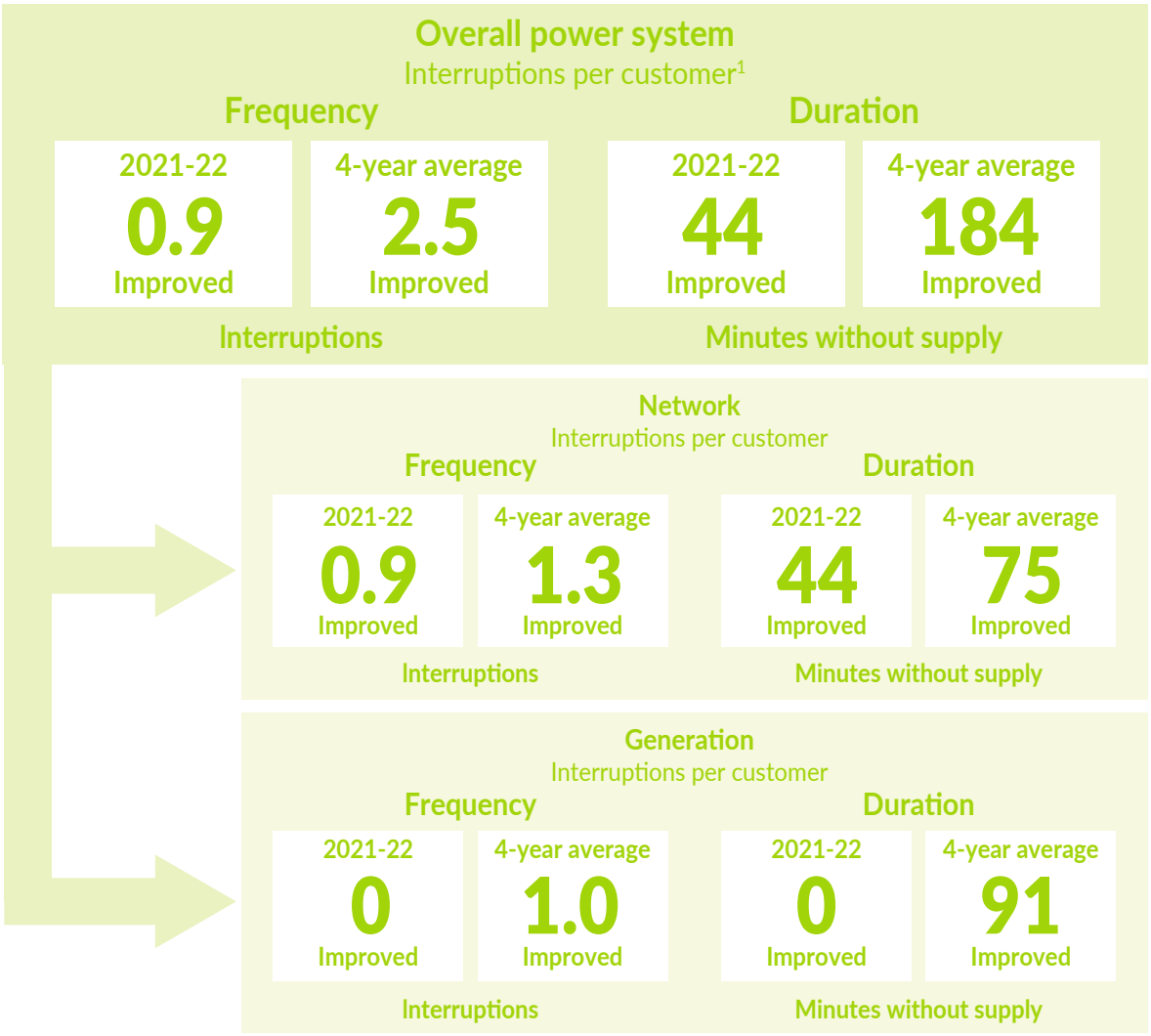
Similar to that in the Darwin region, had it not been for the gas supply-related outage to the Channel Island power station in 2020-21, generation performance over the last six years would have had very little impact on customers in the Katherine region in terms of interruptions when compared with the poor overall performance in the region. The level of generation performance in the Katherine region is not unexpected as the Commission understands that generation located in the Katherine region, is rarely dispatched (online) due to its higher cost to run. The Commission notes generation issues in the Darwin region can impact the Katherine region due to the operation of protection systems.

Despite being rarely called upon, generation availability improved in the Katherine region following a very high level of forced outages at the Katherine power station in 2020-21. Two major engine replacements were carried out at the power station in 2020-21, which has helped to reduce the level of forced outages in 2021-22.

Alice Springs

The Alice Springs region continued a general trend of improvement in 2021-22, with the region recording its best result over the last five years, and for the first time, better performance than the other three regions in terms of both the frequency and duration of customer interruptions. The four-year average in the Alice Springs region is not too dissimilar to the one seen in the Darwin region, which is encouraging given the widespread and prolonged outages experienced in the region in 2017 and 2019.

There have been improvements in the region in relation to both network-related performance and non-network-related performance, which includes generation.



1 The sum of network and generation-related interruptions may not equal overall power system interruptions, which may include additional interruptions as a result of system control, safety or weather.

Network

In terms of impacts on customers, the Alice Springs network has performed well over the last five years, with performance continuing to improve. Further, the network has consistently performed well compared with the other three regions.

Generation

Generation performance in the Alice Springs region has substantially contributed to customer interruptions over the last six years due to system blacks in 2017-18 and 2019-20. However, generation performance improved in the region in 2020-21 and 2021-22, particularly in terms of the duration of interruptions as a result of generation performance, with 15 and 0 minutes without supply, respectively. This level of improved performance is contributing to the overall improvement in the region.

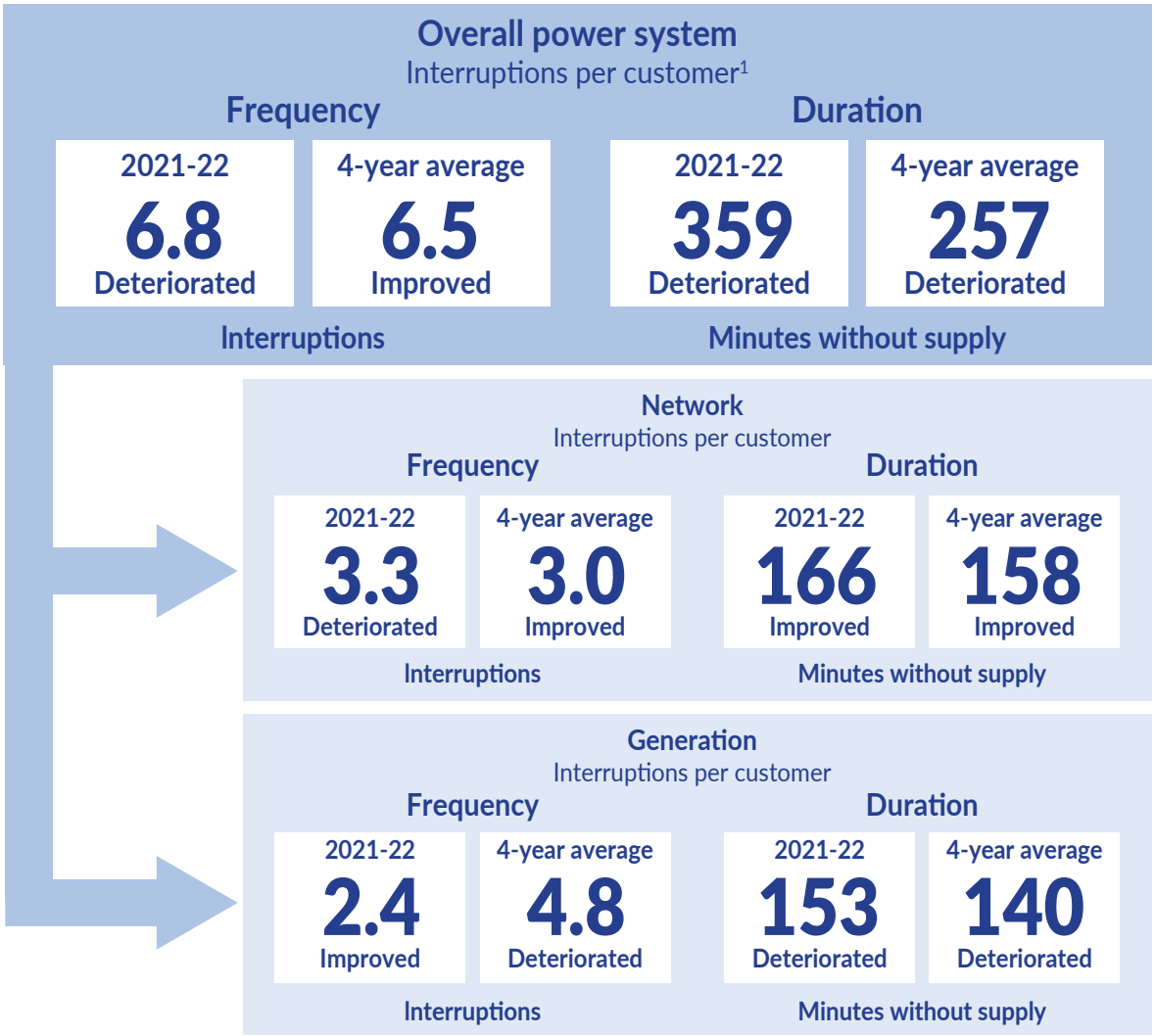
Notwithstanding the improved generation performance, generation availability in the Alice Springs region has been consistently lower than the other regions over the last five years. Availability of generation in the region was just over 78% in 2021-22, which compares poorly with 89% and 95% in the Darwin-Katherine and Tennant Creek regions, respectively. Two power stations at opposite ends of their lifecycle are driving the poor availability of generation in the Alice Springs region, and in particular, the end-of-life Ron Goodin power station, which recorded its lowest level of availability (51%) over the last five years in 2021-22. Reassuringly, the Owen Springs power station recorded its highest level of availability in 2021-22, at around 90%.

Despite the low level of availability, the Ron Goodin power station may still be relied on to provide a level of back-up to the region and is likely to continue to do so until the Owen Springs power station and Ron Goodin battery energy storage system have proven to operate without constraints. However, the availability of the Ron Goodin power station is likely to continue to diminish over time, noting Territory Generation has advised it will eventually be placed in a standby state. While the power station is being relied on, it will increase generation costs compared with running the newer, more efficient generators at Owen Springs power station. Hence, it is encouraging to see improvements at the Owen Springs power station.

Tennant Creek

The duration and frequency of interruptions in the Tennant Creek region deteriorated during 2021-22 when compared with the previous year, with the duration of outages reaching its highest level over the last five years. In terms of the Tennant Creek four-year average, interruptions are twice as frequent and about 70% longer than in the Darwin region, and one and a half times more frequent and 40% longer than in the Alice Springs region. There were five occasions during 2021-22 when the majority of customers in the Tennant Creek region went without power. Similar to the Commission's comments in relation to the Katherine region, the Commission suspects this level of interruption would not be tolerated in the Darwin or Alice Springs regions.

The lower level of performance in the Tennant Creek region is being driven by network and generation-related performance, and the coordination between those assets. However, the contribution from non-network-related performance, which includes generation, has increased over the last five years.



1 The sum of network and generation-related interruptions may not equal overall power system interruptions, which may include additional interruptions as a result of system control, safety or weather.

Network

In terms of customer interruptions, the network in Tennant Creek consistently performs worse than the Darwin and Alice Springs regions, although better than the Katherine region. While the frequency of network performance-related interruptions has improved over the last five years, the duration of interruptions has largely remained unchanged.

Generation

Generation performance in the Tennant Creek power system has consistently been the worst or second worst performing of the Territory power systems or regions over the last six years.

From PWC System Control incident reporting, the Commission has observed over recent years that when the Tennant Creek power system is dispatched in favour of the newer high-efficiency generation, a disturbance in the power system is often unable to be stopped by the newer generation, and results in an interruption to the majority of customers in the region. This appears to be due to the newer generators' slow response or lack of inertia.

While utilisation of the newer Jenbacher generators is resulting in system security-related issues, through the use of these generators, generation availability dramatically improved in the Tennant Creek region during 2021-22 to around 95%, from a five-year low of around 80% in 2020-21.

Contents

Introduction

The NTPSPR focuses on the 2021-22 performance of the Darwin-Katherine, Alice Springs and Tennant Creek power systems. Separate chapters consider overall and regional power system performance, generation and network performance, and the status of recommendations from previous NTPSPRs. Where possible and relevant, the review compares performance with historical data to identify trends and benchmarks to provide context.

Power system description

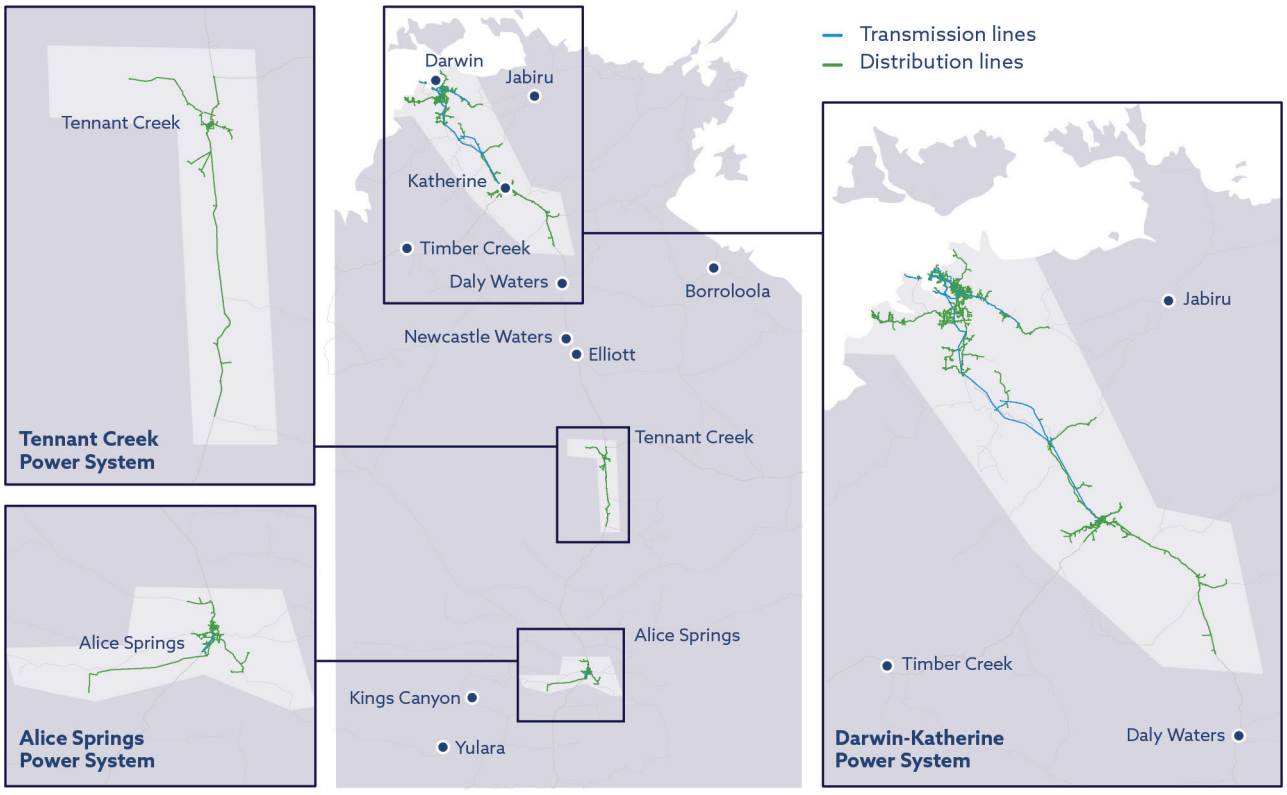
The Darwin-Katherine, Alice Springs and Tennant Creek power systems are the largest power systems in the Territory. They are the only Territory power systems where network access regulation applies and as such, they have the greatest level of regulatory oversight.

The Darwin-Katherine, Alice Springs and Tennant Creek power systems are not interconnected with each other, and they are not connected to power systems in other jurisdictions, such as the NEM, which supplies electricity to the majority of customers on the east coast of Australia. Accordingly, the Territory's power systems are smaller and do not have the same level of interconnectedness as other parts of Australia.

Further, within the Territory, there are significant differences between the three power systems, including in terms of size and density, customer numbers, geographical location and climate.

Figure 1 shows a map of the Territory with a visual representation of the location and size of the Darwin-Katherine, Alice Springs and Tennant Creek power systems.

Figure 1: Visual representation of the location and size of the Darwin-Katherine, Alice Springs and Tennant Creek power systems



Source: Power and Water Corporation

The Darwin-Katherine power system is the largest power system in the Territory. It supplies the Darwin and Palmerston city centres, suburbs and surrounding areas, and the township of Katherine and its surrounding rural areas. The major transmission lines in the system are lines from Channel Island to Katherine and Channel Island to Hudson Creek. A double-circuit overhead 132 kilovolt (kV) transmission line from Channel Island to Hudson Creek (Channel Island-Hudson Creek) serves the Darwin area, while a 300 km single circuit 132 kV transmission line (Channel Island-Katherine) runs south from Darwin to Manton, Batchelor, Pine Creek and Katherine.

The Alice Springs power system is the second largest power system in the Territory. It supplies the township of Alice Springs and surrounding rural areas from the Owen Springs, Ron Goodin and Uterne (solar) power stations.

The Tennant Creek power system is the smallest power system covered in the NTPSPR. The power system supplies the township of Tennant Creek and surrounding rural areas from a centrally located power station.

Table 1 highlights some of the differences between the Darwin-Katherine, Alice Springs and Tennant Creek power systems, and the NEM, to provide context on the scale of the Territory power systems.

Table 1: Differences between the Darwin-Katherine, Alice Springs and Tennant Creek power systems, and the NEM (during 2021-22)

		Power System		
	NEM	Darwin-Katherine	Alice Springs	Tennant Creek
Customer numbers	7 453 440[1]	71 000	13 000	1 600
System consumption (GWh)	189 100[2]	1 546	197	31
Demand (MW)	12 936[3] to 32 761[4]	76 to 285	8 to 49	2 to 7

GWh: Gigawatt hours; MW: Megawatts

1 AER Schedule 2 – Retail Performance Data Q4 2021-22 spreadsheet: https://www.aer.gov.au/retail-markets/performance-reporting/retail-energy-market-performance-update-for-quarter-4-2021%E2%80%9322.

2 AER Annual electricity consumption – NEM:https://www.aer.gov.au/wholesale-markets/wholesale-statistics/annual-electricity-consumption-nem.

3 AEMO – New low winter demand records observed while solar generation continues to rise: https://aemo.com.au/newsroom/news-updates/new-low-winter-demand-records-observed-while-solar-generation-continues-to-rise#:~:text=The%20all%2Dtime%20NEM%20minimum,MW%20(17%20October%2020-21).

4 AER Annual generation capacity and peak demand – NEM: https://www.aer.gov.au/wholesale-markets/wholesale-statistics/annual-generation-capacity-and-peak-demand-nem.

1 Power system

This chapter focuses on the overall performance of the Darwin-Katherine, Alice Springs and Tennant Creek power systems. The overall performance is assessed by considering the duration and frequency of customer interruptions. These interruptions may be a result of issues related to, among others, the network, generation, system control, safety or weather. The Commission notes this is the level of performance a customer experiences, with the customer often unaware, or not necessarily interested in, the cause of an interruption. The level of overall performance is shown by the green line and columns in Figure 2.

In terms of reporting, relevant licensees record the frequency and duration of customer interruptions, and two indices are then derived to show the average frequency and duration of interruptions per customer in the given system and period of time, which enables fair comparisons to be made between systems and time periods. The two indices are System Average Frequency Interruption Index (SAIFI) and System Average Interruption Duration Index (SAIDI), which show frequency (average interruptions per customer) and duration (average customer minutes without supply per customer), respectively.

The frequency and duration of customer interruptions as a result of all outages in the power system are referred to as unadjusted or unadjusted SAIFI and SAIDI. These outages can be as a result of numerous issues, including those listed above. Again, this level of performance is shown by the green line and columns in Figure 2.

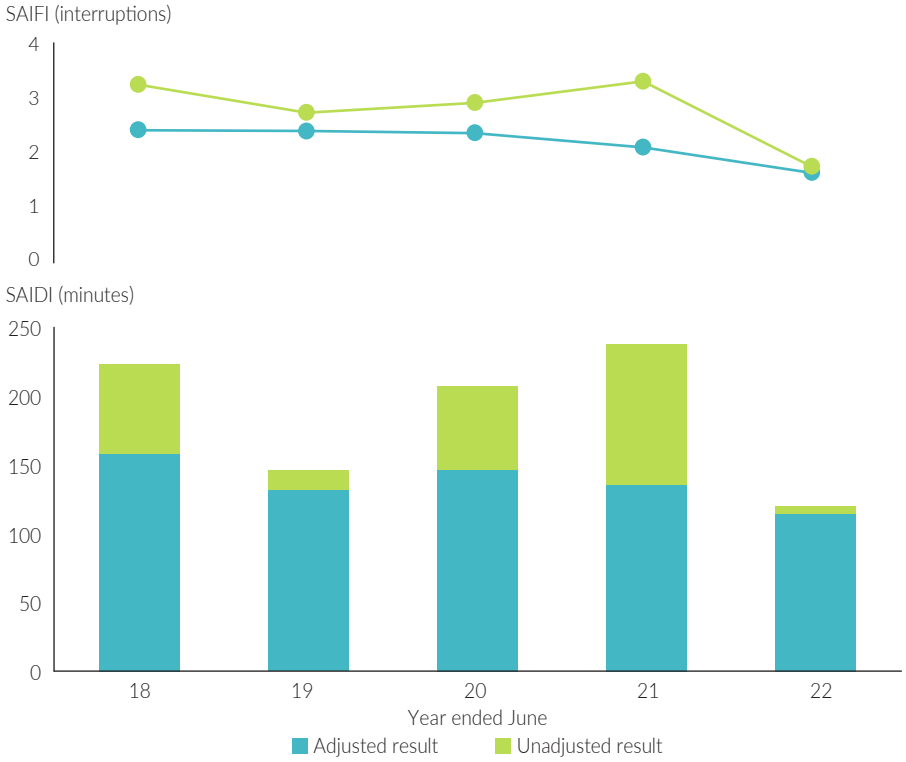
To separate out and understand what contribution network performance has to the overall level of performance experienced by customers (unadjusted SAIFI and SAIDI), interruptions that are not a direct result of network performance are excluded. Once these are removed, the remaining interruptions are referred to as the adjusted result, or adjusted SAIFI and SAIDI. Adjusted SAIFI and SAIDI provide insight into the performance of the network (shown by the blue line and columns in Figure 2), and this performance is assessed in more detail in the Network chapter of the NTPSPR.

As discussed above, another important contribution to the overall level of performance experienced by customers, and one which is assessed in the NTPSPR, is the performance of generation. Some of this contribution is accounted for in the difference between the unadjusted SAIFI and SAIDI and the adjusted SAIFI and SAIDI, or the difference between the green and blue lines and columns in Figure 2, respectively. A more detailed assessment of generation performance is included in the Generation chapter of the NTPSPR.

Territory

Figure 2 shows the level of power system performance (or interruption) experienced by customers in the Territory over the last five years (unadjusted SAIFI and SAIDI), shown by the green line and columns, which includes customers in the Darwin-Katherine, Alice Springs and Tennant Creek regions. Figure 2 also shows adjusted SAIFI and SAIDI (blue line and columns), which as discussed above, is the level of interruption as a result of network-related performance.

Figure 2: Territory unadjusted and adjusted SAIFI and SAIDI



The frequency and duration of interruptions experienced by customers in the Territory dropped from a five-year high in 2020-21 to the lowest level over the last five years in 2021-22, with customers on average experiencing 1.8 interruptions and 121 minutes without supply. Further, the frequency and duration of interruptions experienced by customers in the Territory during 2021-22 was well below the four-year average of 2.7 interruptions and 179 minutes without supply.

The Commission notes there was a large gas supply-related outage to the Channel Island power station in 2020-21, which impacted about 49,000 customers and resulted in about 7,712,000 customer minutes without supply. The outage was the second largest customer interruption in the Territory since the start of 2015, with the largest associated with Tropical cyclone Marcus in Darwin in March 2018 (191,842,000 customer minutes without supply). Unlike the outage associated with Tropical Cyclone Marcus, the gas supply-related outage is not excluded from the data in this review as a major event day, as it does not meet the criteria to be considered a natural event, as defined by the Electricity Industry Performance (EIP) Code.

Accordingly, the gas-related outage has a large impact on the results shown this review, and in particular, the 2020-21 results and historical averages of unadjusted SAIFI and SAIDI (and generation SAIFI and SAIDI) at a Territory level, and at the Darwin and Katherine regional level. While it could be argued that the root cause of the interruption was not directly related to the electricity supply industry, and therefore does not reflect underlying power system performance, as discussed above, customers are often unaware, or not necessarily interested in, what caused an interruption.

The frequency and duration of interruptions experienced by customers in the Territory can be volatile from year to year, such as in 2020-21, and as shown by the green line and columns in Figure 2. However, although not shown in Figure 2, the four-year rolling average shows that the overall level of performance experienced by customers has improved over the last five years. When considering the four-year average SAIFI and SAIDI, the improvement is being driven by both network and non-network-related performance.

Australian Energy Regulator comparison

To provide context to the Territory result in terms of the frequency and duration of interruptions experienced by customers, the Commission collated data from the Australian Energy Regulator (AER) to create a benchmark (AER benchmark).

The Commission collated SAIFI, SAIDI and customer number data from regulatory information notices for the 13 distribution network service providers (DNSP) the AER regulates outside the Territory. The Commission used the data published by the AER to create a customer number weighted unadjusted (and adjusted) SAIFI and SAIDI average for the 13 DSNPs from 2015-16 to 2021-22 (blue line and columns in Figure 3).

While the Commission acknowledges the distribution networks regulated by the AER are not directly comparable to the Territory, there is a high level of diversity in the AER-regulated distribution networks, and on this basis, the Commission considers the AER benchmark to be a useful benchmark.

Figure 3 shows the Territory and AER benchmark unadjusted SAIFI and SAIDI results from 2017-18 to 2021-22. The Territory unadjusted results are shown by the green line and columns, and the AER benchmark unadjusted results are shown by the blue line and columns.

Figure 3: Territory and AER benchmark unadjusted SAIFI and SAIDI

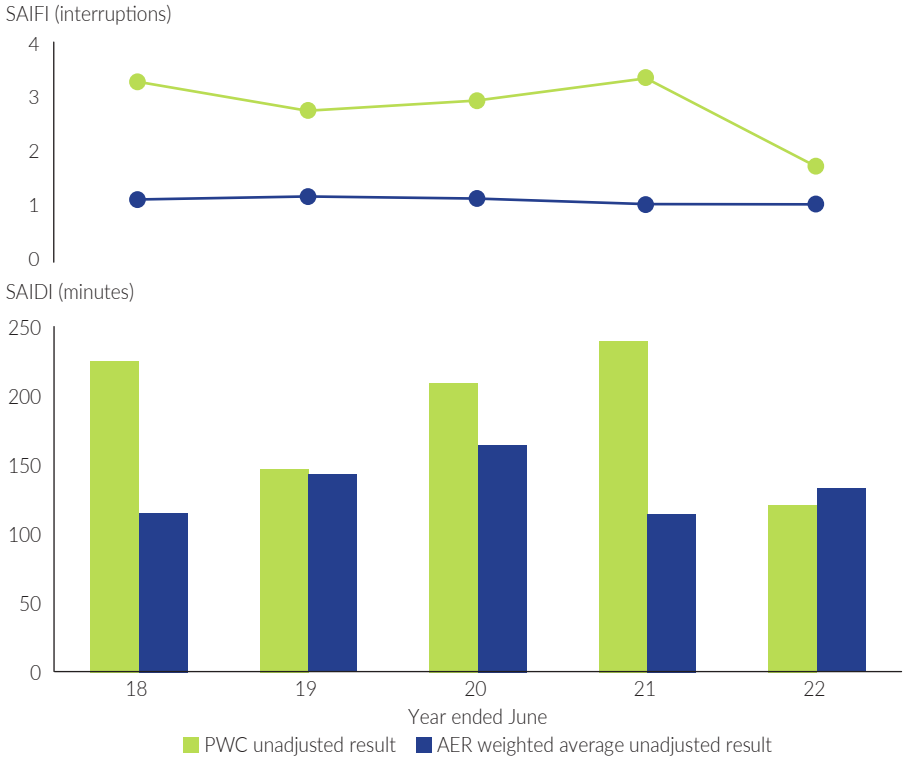


Table 2 presents the average frequency and duration of interruptions (unadjusted SAIFI and SAIDI, respectively) per customer in the Territory and the weighted average of the 13 DNSPs regulated by the AER in 2021-22, and a four-year average.

Table 2: Territory and AER weighted average unadjusted and adjusted SAIFI and SAIDI in 2021-22, and four-year average

	SAIFI (interruptions)		SAIDI (minutes without supply)	
	2021-22	4-year average	2021-22	4-year average
Territory				
Unadjusted (all interruptions)	1.8	2.7	121	179
Adjusted (network-related)	1.6	2.1	115	133
AER weighted average				
Unadjusted (all interruptions)	1.1	1.1	132	138
Adjusted (network-related)	1.0	1.0	120	116

When considering the four-year average, in 2021-22 a customer in the Territory is likely to experience one and a half times more frequent interruptions and 30% more minutes without supply than the AER benchmark.

However, in terms of the duration of interruptions, 2021-22 is the first time over the last five years that the overall performance in the Territory has been better than the AER benchmark, as shown by the green column being lower than the blue column in Figure 3. The Commission considers this a positive result for the Territory.

Although not shown in Figure 3, when comparing the four-year rolling averages in the Territory with the AER benchmark, there is a greater contribution in the Territory to the overall level of performance from non-network-related interruptions (which includes generation) than in the 13 other DNSPs regulated by the AER. The Commission has discussed in previous publications that generation performance has a bigger impact on overall performance in the Territory than in other, interstate power systems or regions, such as the NEM. This is due to the relative size of the generation compared with the power systems in the Territory, and the lack of redundancy and interconnectedness in those systems. This observation supports those statements.

While the level of performance in the Territory has improved over recent years, the level of performance experienced by customers is not consistent across power systems, or regions within those power systems in the case of Darwin-Katherine. The next section assesses those differences and, at a high-level, the main driving forces behind the level of performance in each region, with more detail on network and generation-related performance in subsequent chapters.

Regional

Figure 4 shows the average frequency and duration of interruptions (unadjusted SAIFI and SAIDI, respectively) per customer in the Darwin-Katherine, Alice Springs and Tennant Creek power systems, with the Darwin-Katherine power system further segmented into the regions of Darwin and Katherine.

Figure 4: Regional unadjusted SAIFI and SAIDI

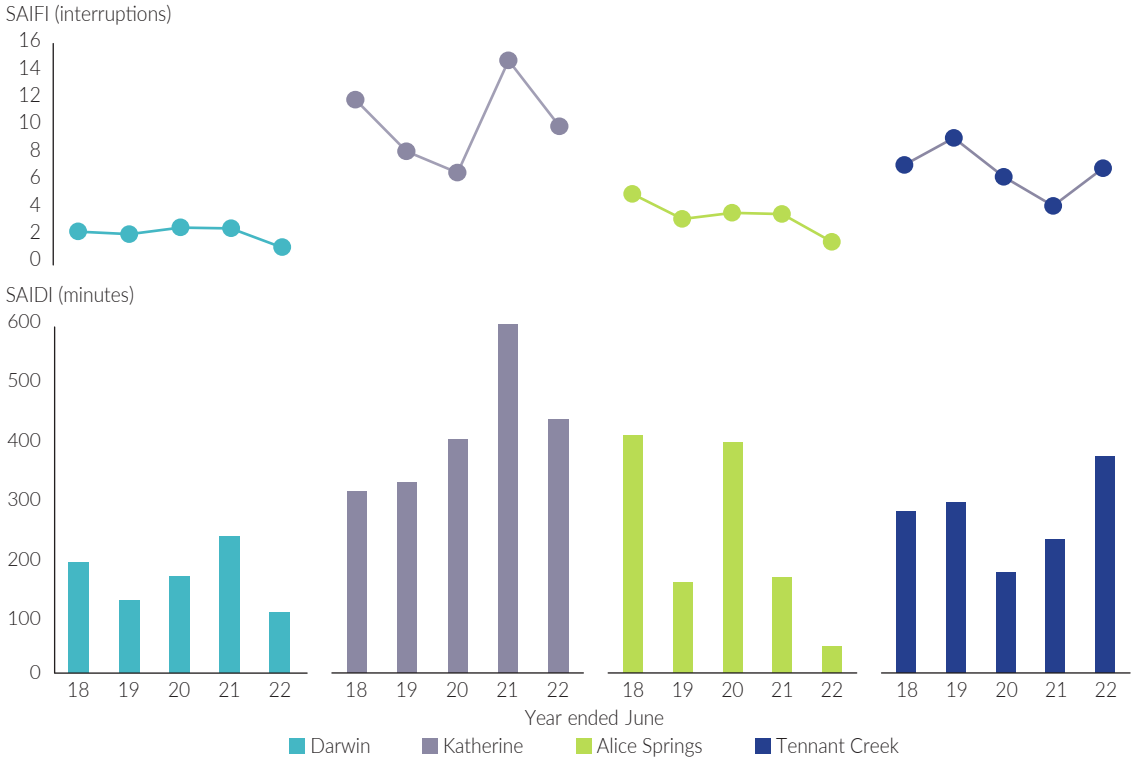


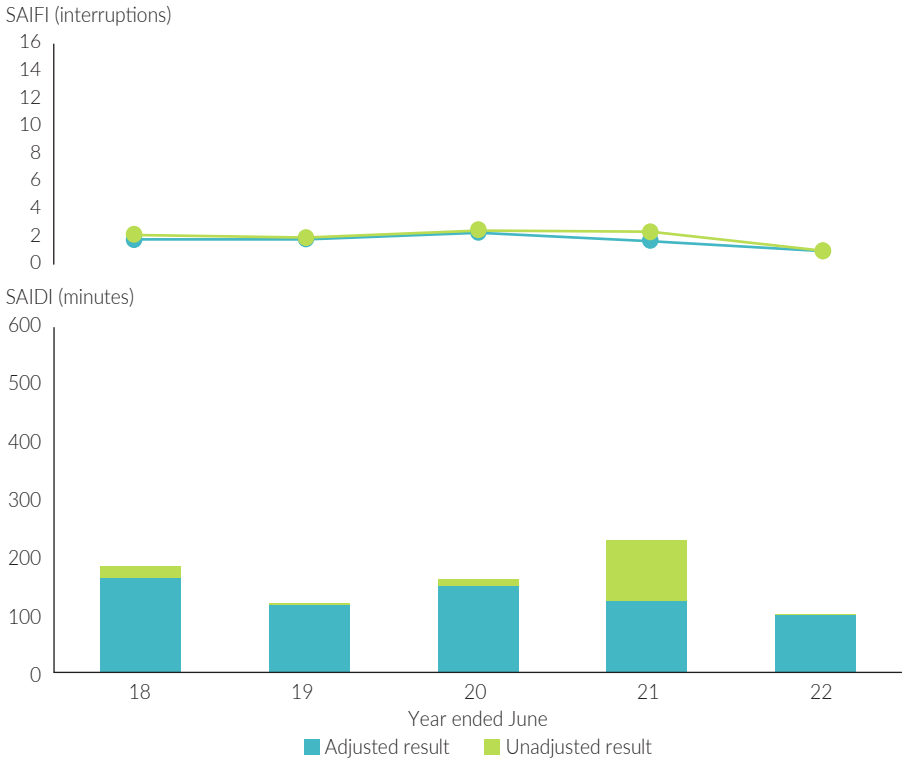
Table 3 presents the average frequency and duration of interruptions (unadjusted SAIFI and SAIDI, respectively) per customer in 2021-22, and the four-year average by region.

Table 3: Regional unadjusted SAIFI and SAIDI, 2021-22 and four-year average

	SAIFI (interruptions)		SAIDI (minutes without supply)	
	2021-22	4-year average	2021-22	4-year average
Darwin	1.1	2.1	102	154
Katherine	10.1	10.0	423	428
Alice Springs	0.9	2.5	44	184
Tennant Creek	6.8	6.5	359	257

Darwin

Figure 5: Darwin region unadjusted and adjusted SAIFI and SAIDI



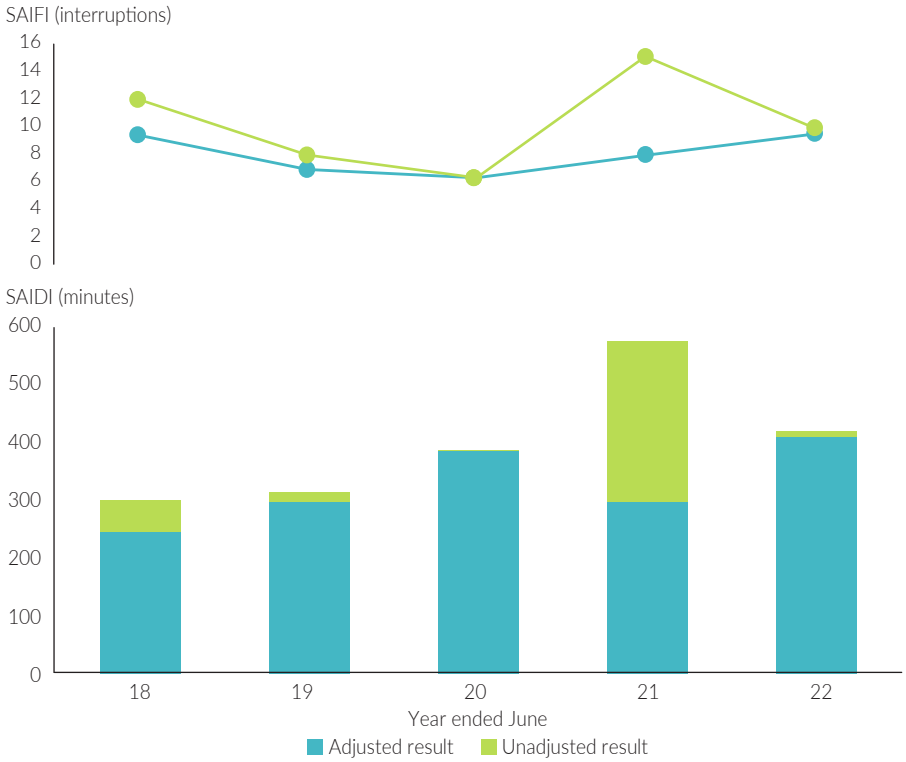
The frequency and duration of interruptions experienced by customers in the Darwin region of the Darwin-Katherine power system reduced in 2021-22 compared with the previous year, to the lowest level over the last five years with 1.1 interruptions and 102 minutes without supply per customer. Similarly, the four-year average reached its lowest level over the last five years in 2021-22 with 2.1 interruptions and 154 minutes without supply per customer.

Generally, the frequency and duration of interruptions in the Darwin region is lower than the other regions in the Territory (discussed below).

Figure 5 shows that while reducing, on average the majority of interruptions in the Darwin region over the last five years are network-related. Non-network-related interruptions, which include those related to generation, have also reduced over the last five years.

Katherine

Figure 6: Katherine region unadjusted and adjusted SAIFI and SAIDI



The frequency and duration of interruptions experienced by customers in the Katherine region of the Darwin-Katherine power system improved in 2021-22 compared with the previous year, to a level of 10.1 interruptions and 423 minutes without supply per customer. However, both the frequency and duration of interruptions remains very high when compared with the other Territory regions. For example, the frequency and duration of interruptions in the Katherine region was eight and three times higher, respectively, than in the Darwin region during 2021-22.

This disparity between regions is not isolated to 2021-22, with the Katherine region more often than not being the worst performing region in the Territory over the last five years. The current four-year average for the frequency and duration of interruptions in the Katherine region is 10 interruptions and 428 minutes without supply (just over 7 hours) per customer, which is nearly four and two times greater than the Darwin region, respectively. Further, the four-year rolling average is showing a deteriorating trend in performance over recent years both in terms of the frequency and duration of interruptions.

The deteriorating performance is being driven by network-related outages, with non-network-related outages slightly decreasing over the last five years, to account for around one fifth of the total interruptions experienced by customers.

As part of its assessment, and noting a direct comparison is not possible due to differences in reporting requirements, the Commission analysed PWC System Control reported incident data to get a better understanding of the deterioration in network performance in the region.

Based on the Commission's assessment, which included consideration of additional information provided by licensees, while some improvements may be found in distribution-related performance in the Katherine region, the poor level of performance in the region is being driven by the performance of the transmission network, and more specifically, the 132 kV transmission between Channel Island and Katherine, which connects the Katherine region to the rest of the Darwin-Katherine power system where most of the dispatched generation is generally located.

Relevantly, the Commission has raised power system performance in the Katherine region as an issue in several NTPSPRs, and made a number of associated recommendations as far back as 2017-18 (three recommendations directly related). Through the tracking of those recommendations, licensee reporting, regular interactions with licensees and general monitoring of power system performance, the Commission is aware that work has been completed or is underway that attempts to improve performance in the Katherine region, however the level of performance in 2021-22 demonstrates that this is not yet having a meaningful impact.

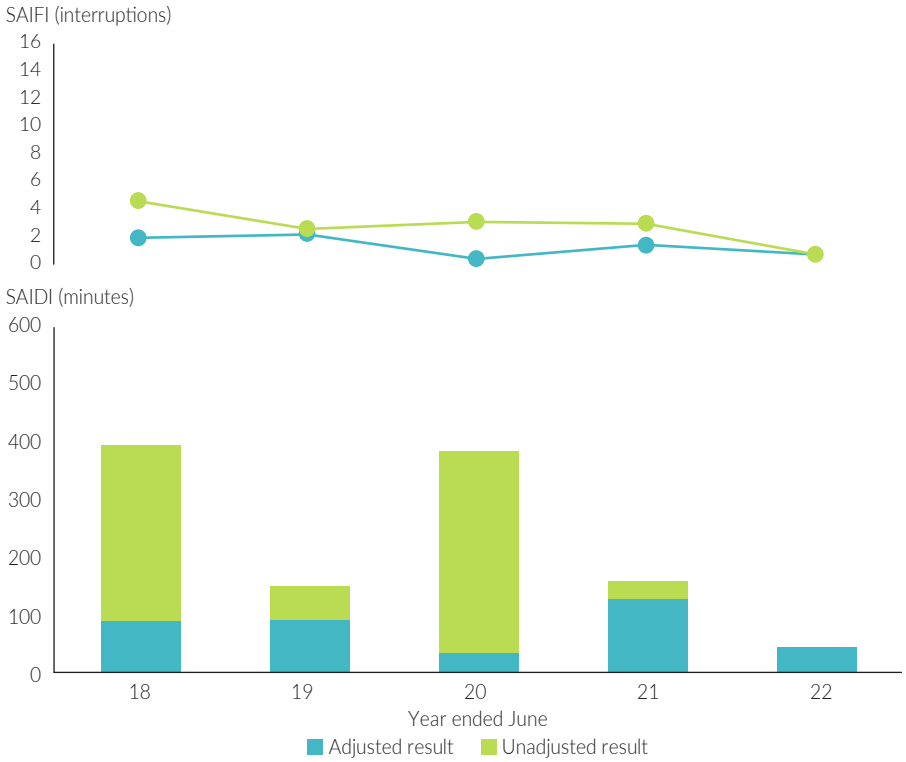
PWC System Control incident reporting shows that there were three occasions during 2021-22 when the entire Katherine region went without power, which is an improvement from the nine occasions in 2020-21. Notwithstanding this improvement, the Commission suspects this level of interruption and the overall poor power system performance in Katherine would not be tolerated in the Darwin or Alice Springs regions.

Katherine is a regional economic centre, has access to local generation and is connected to the rest of the power system by a transmission line, albeit a single transmission line. Accordingly, while the Commission acknowledges there is no formal reliability standard in the Territory for any of the power systems, given the disparity between power system performance in Katherine compared with the other regions, there is a fundamental question for the Territory Government and relevant stakeholders to consider of whether customers in the Katherine region should receive a level of service closer to that in the other regions.

Should the Territory Government and relevant stakeholders conclude that the Katherine region should receive a level of service that is more consistent with other regions, investment and or a fundamental shift in how the power system operates in the region may need to be investigated. Any such investigation should consider the balance between costs, standard of service and customers' willingness to pay, noting increased costs that do not flow through to the majority of customers due to protections under the electricity pricing order flow through to government and ultimately taxpayers through the associated CSO payment to retailers.

Alice Springs

Figure 7: Alice Springs region unadjusted and adjusted SAIFI and SAIDI



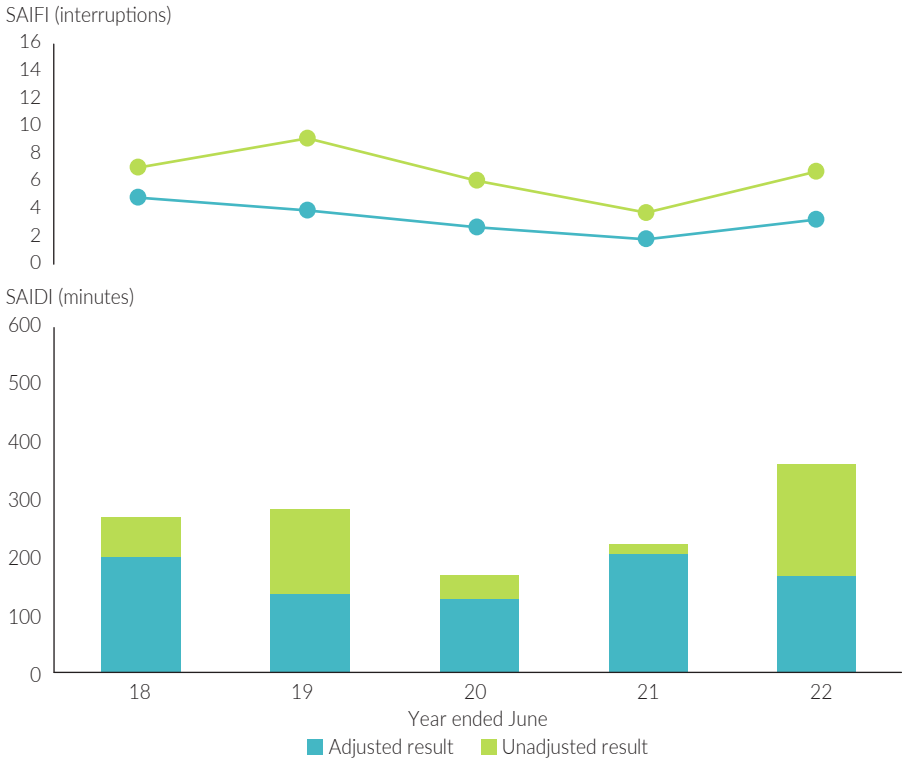
Performance in the Alice Springs region continued a general trend of improvement in 2021-22, with the best result over the last five years of 0.9 interruptions and 44 minutes without supply per customer. Further, Alice Springs was the best performing region of the four considered in the NTPSPR in terms of the frequency and duration of interruptions in 2021-22.

The level of performance in 2021-22 was better than the four-year average of 2.5 interruptions and 184 minutes without supply, with the average continuing to improve. The four-year average is not too dissimilar to the one seen in the Darwin region, which is encouraging given the widespread and prolonged outages experienced in the region in 2017 and 2019.

In terms of the driving force behind the improved performance, over the last five years this has come from both a decrease in network and non-network-related outages. Towards the start of the last five years, when considering the four-year rolling average, non-network-related interruptions accounted for over half of the total frequency and duration of interruptions experienced by customers in the Alice Springs region. However, the four-year rolling average reduced to a more even contribution between network and non-network-related causes in 2021-22. Notably, there were no non-network-related interruptions in 2021-22, which is a positive result given the poor performance of generation in the region over recent years (discussed in more detail in the Generation chapter).

Tennant Creek

Figure 8: Tennant Creek region unadjusted and adjusted SAIFI and SAIDI



The frequency and duration of interruptions in the Tennant Creek region deteriorated during 2021-22, compared with the previous year, to 6.8 interruptions and 359 minutes without supply per customer. The duration of outages reached its highest level over the last five years.

The level of performance in 2021-22 was worse than the four-year average of 6.5 interruptions and 257 minutes without supply. For comparison, the Tennant Creek four-year average is twice as frequent and 67% longer than interruptions in the Darwin region, and around one and a half times more frequent and 40% longer than interruptions in the Alice Springs region.

PWC System Control incident reporting shows that there were five occasions during 2021-22 when the majority of customers in the Tennant Creek region went without power. Similar to the Commission's comments in relation to the Katherine region, the Commission suspects this level of interruption would not be tolerated in the Darwin or Alice Springs regions.

While the duration of interruptions increased during 2021-22, it has generally been the frequency of interruptions in the Tennant Creek region which has been of concern to the Commission, noting electricity is often restored and the power system returned to a normal operating state relatively quickly (around 52 minutes on average when looking at PWC System Control incident reporting).

The lower level of performance in the Tennant Creek region, and in turn higher level of interruptions experienced by customers when compared with the Darwin and Alice Springs regions, appears to be driven by network and generation performance, and the coordination between those assets. However, the contribution from non-network-related performance to overall performance in the region, which again includes generation, has increased over the last five years.

PWC Power Services' reporting shows that the majority of excluded events in 2021-22, those that account for the gap between the green (unadjusted) and blue (adjusted) line and columns, are related to under frequency load shedding. From PWC System Control incident reporting, the Commission has observed over recent years that when the newer high-efficiency generators at Tennant Creek power station are dispatched in favour of other generators, a disturbance in the power system which leads to a decline in frequency is often unable to be stopped by the generation. This results in an interruption to customers in the region through automatic under frequency load shedding. Under frequency load shedding is intended to reduce the likelihood of a cascading failure, which may result in a system black. The inability of the newer high-efficiency generation to stop a decline in system frequency appears to be due to the generators' slow response or lack of inertia, noting these capabilities could also be provided by other technologies.

The Commission made a recommendation in the 2019-20 NTPSPR in relation to the coordination of generation and network requirements, which mainly relates to Tennant Creek. The Commission is aware that following this recommendation work has been completed or is underway that attempts to improve performance in the Tennant Creek region. However, as discussed in previous NTPSPRs, investment and or a change in how the power system is operated may need to be investigated if performance is to improve to a level that is more consistent with the Darwin and Alice Springs regions.

As with the Katherine region, any such investigation should consider the balance between costs, standard of service and customers' (or taxpayers in relation to customers protected by the electricity pricing order) willingness to pay.

2 Network

This chapter focuses on network performance at the Territory, regional and feeder category level in the Territory's three largest power systems, Darwin-Katherine, Alice Springs and Tennant Creek. The chapter also considers network performance in terms of customer connections, guaranteed service levels, customer service and complaints.

Table 4 details the maximum voltage, line lengths and number of zone substations in each region in the Territory to provide context on the size of the networks.

Table 4: Maximum voltage, line length (including underground cables) and zone substations by region in 2022[1]

		Line length (km)			
Network	Maximum voltage (kV)	Transmission (132 and 66 kV)	Distribution (22 and 11 kV)	Low voltage	Substation[2]
Darwin-Katherine	132	718	3 417	1 623	22
Alice Springs	66	47	602	222	3
Tennant Creek	22	0	343	45	1

1 PWC Transmission and distribution planning report: Transmission and Distribution Planning Report, Power and Water Corporation (powerwater.com.au).
2 Includes transmission and zone substations.

Network performance

Similar to overall power system performance and generation performance, one way to assess the level of network performance is to consider the impact on the frequency and duration of interruptions experienced by customers as a direct result of that performance. This is again achieved through the reporting of SAIFI and SAIDI.

Territory

Figure 9 shows the frequency and duration of customer interruptions as a direct result of network performance (adjusted SAIFI and SAIDI, respectively). This is shown by the blue line and columns in Figure 9.

As with overall power system performance, to provide context to the Territory result in terms of the frequency and duration of interruptions experienced by customers, the Commission has collated data from the AER in relation to the 13 DSNPs that it regulates, excluding PWC, to create a benchmark from 2017-18 to 2021-22 (AER benchmark). This is shown by the purple line and columns in Figure 9. Again, due to the high level of diversity in the AER-regulated distribution networks, the Commission considers the AER benchmark to be a useful benchmark.

Figure 9: Territory adjusted and AER weighted average SAIFI and SAIDI

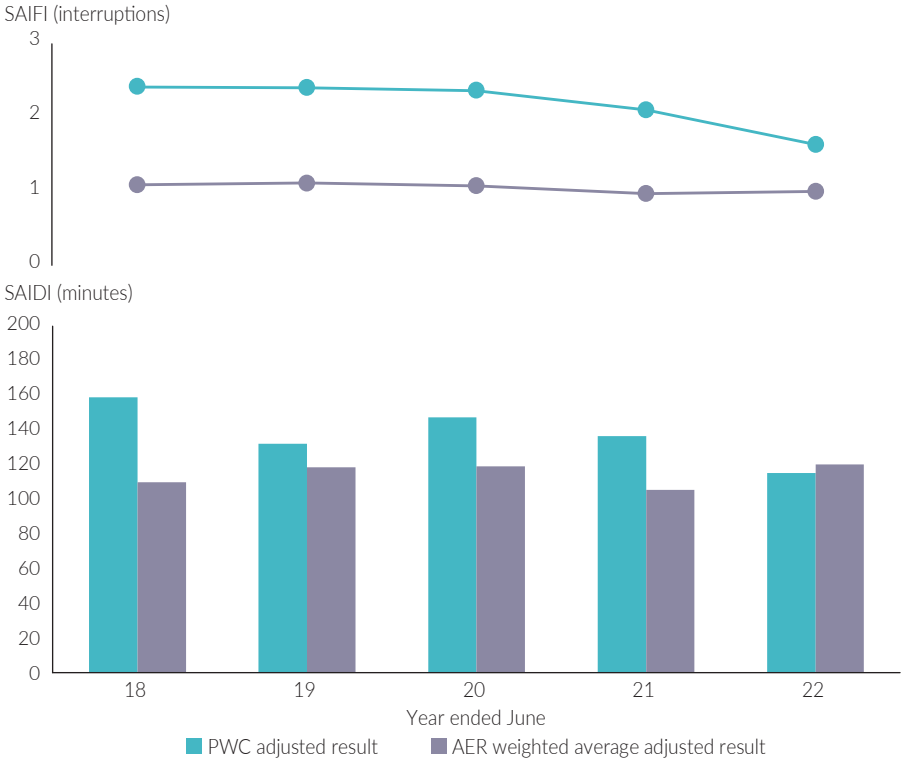


Figure 9 shows that network performance in the Territory has been improving over the last five years in terms of both the frequency and duration of customer interruptions. This improvement continued in 2021-22 with customers on average experiencing 1.6 interruptions and 115 minutes without supply due to network performance. The result in 2021-22 was also better than the four-year average of 2.1 interruptions and 133 minutes without supply per customer as a result of network performance.

Further, when compared with the AER benchmark, network performance in the Territory is trending closer towards the benchmark, particularly in relation to the duration of interruptions, with the duration of network-related interruptions lower in the Territory in 2021-22 than the AER benchmark for the first time in the last five years. Comparing the four-year averages in 2021-22, network performance in the Territory resulted in interruptions which were 110% more frequent and 15% longer than in the networks of the 13 DNSPs regulated by the AER.

As with overall power system performance in the Territory, the level of network performance in the Territory has improved over recent years, including against the AER benchmark. However the level of performance, or interruptions experienced by customers, is not consistent across Territory networks or regions within those networks. The next section assesses those differences between regions.

Regional

Figure 10 shows the average frequency and duration of interruptions per customer in the Darwin-Katherine, Alice Springs and Tennant Creek regions directly as a result of network performance (adjusted SAIFI and SAIFI, respectively), with the Darwin-Katherine network further segmented into the regions of Darwin and Katherine.

Figure 10: Regional adjusted SAIFI and SAIDI

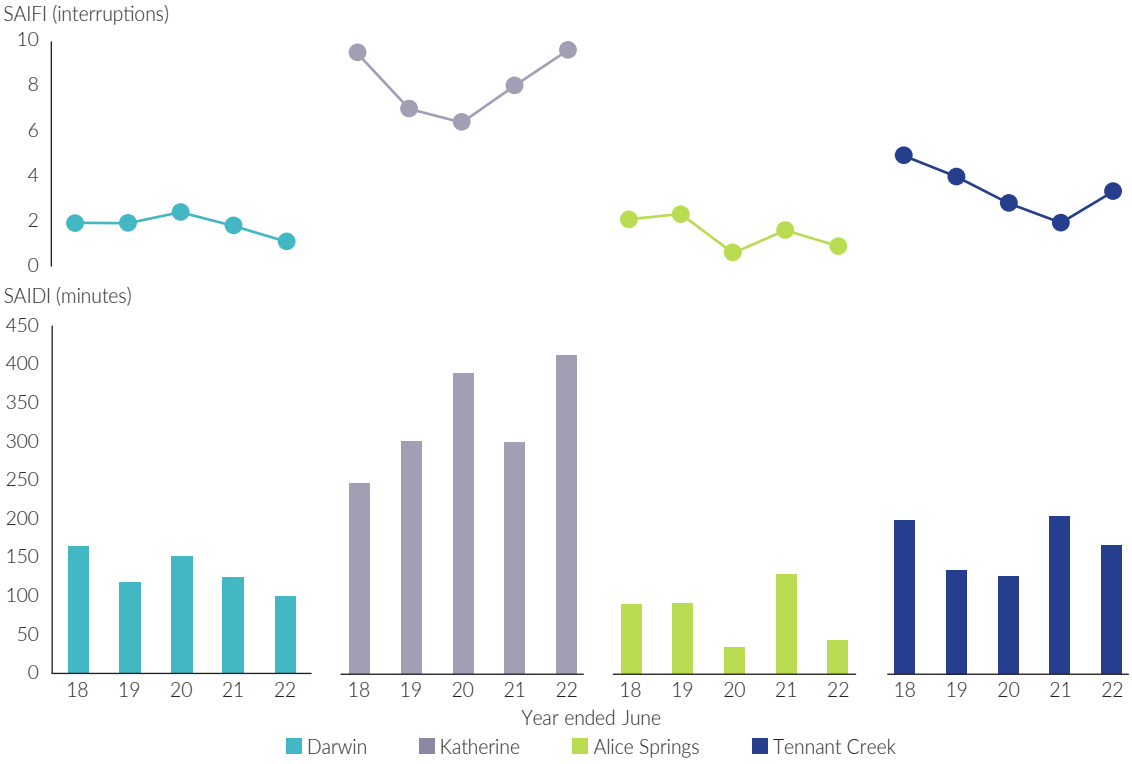


Table 5: Regional adjusted SAIFI and SAIFI, 2021-22 and four-year average

	SAIFI (interruptions)		SAIDI (minutes without supply)	
	2021-22	4-year average	2021-22	4-year average
Darwin	1.1	1.8	100	124
Katherine	9.6	7.8	413	351
Alice Springs	0.9	1.3	44	75
Tennant Creek	3.3	3.0	166	158

Darwin

The network performance in the Darwin region has improved over the five years (shown in Figure 10), with customers in 2021-22 experiencing on average 1.1 interruptions and 100 minutes without supply due to network performance. This is the lowest level of interruption over the last five years, and is below the falling four-year rolling average of 1.8 interruptions and 124 minutes without supply per customer as a result of network performance. The Darwin region compares well with the other regions in the Territory, although is outperformed by the Alice Springs region over the last five years.

Katherine

Performance in the Katherine region deteriorated in 2021-22, recording the worst performance and highest four-year average over the last five years. In 2021-22, customers in the Katherine region experienced on average 9.6 interruptions and 413 minutes without supply (almost 7 hours) as a result of network-related performance. This is above the already high four-year rolling average of 7.8 interruptions and 351 minutes without supply per customer.

Network performance in the Katherine region compares poorly with the other Territory regions. As a result of network performance, customers in 2021-22 were interrupted nearly eight times more frequently and experienced three times more minutes without supply than customers in the Darwin region, despite being part of the same Darwin-Katherine power system.

The issues facing the network in the Katherine region are discussed in more detail in the Power system chapter of this Review.

Alice Springs

The Alice Springs network has performed well over the last five years when measured by customer interruptions. Although not as good as the best result over the last five years (2019-20), customers in Alice Springs in 2021-22 experienced on average 0.9 interruptions and 44 minutes without supply as a result of network performance. This level of performance was better than the four-year average of 1.3 interruptions and 75 minutes without supply per customer due to network performance.

Tennant Creek

In terms of customer interruptions, the network in Tennant Creek consistently performs worse than the Darwin and Alice Springs regions, although better than the Katherine region. In 2021-22, customers experienced on average 3.3 interruptions and 166 minutes without supply as a result of network performance. The level of performance in 2021-22 was worse than the four-year average of 3 interruptions and 158 minutes without supply per customer due to network performance.

Network performance in the Tennant Creek region has improved over the last five years in terms of the frequency of interruptions, however the duration of interruptions has largely remained unchanged.

Feeder

As well as by region, PWC Power Services record and report network performance against feeder categories. Feeders from across the Territory's Darwin-Katherine, Alice Springs and Tennant Creek networks are grouped together into the feeder categories of central business district (CBD), urban, rural short and rural long.

Under the EIP Code, PWC Power Services is required to develop and submit network target standards for each feeder category to the Commission for approval for each regulatory control period. The current target standards apply for the five-year period from 1 July 2019 to 30 June 2024. PWC Power Services must use its best endeavours to meet the target standards.

PWC Power Services is also required to report on the top five worst-performing feeders in each feeder category over the year, as determined by the SAIDI performance of the feeder. The Commission acknowledges that feeders will perform poorly from time to time due to unforeseen issues, and therefore has limited its focus to those that have performed worse than the feeder category target standard over multiple years.

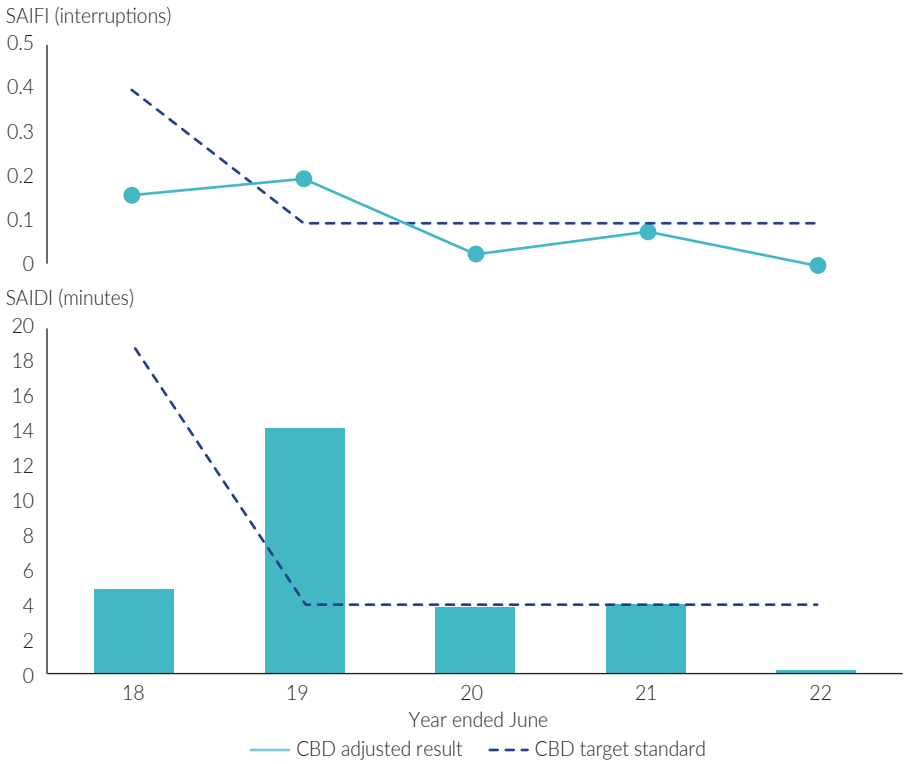
CBD

A CBD feeder is defined as a feeder mostly supplying commercial high-rise buildings predominately through an underground distribution network that contains significant interconnection and redundancy when compared to urban areas. CBD feeders account for around 12% of feeders in the Territory.

Figure 11 shows the frequency and duration of CBD customer interruptions as a direct result of network performance (adjusted SAIFI and SAIDI, respectively), and the approved target standard. This is shown by the light blue line and columns (SAIFI and SAIDI, respectively) and dark blue dotted lines (approved target standards) in Figure 11.

The current Commission-approved PWC target standard for CBD feeders is 0.1 interruptions and four minutes without supply per year.

Figure 11: CBD feeder category adjusted SAIFI and SAIDI



Note: The Commission approved new network target standards in 2018, which apply to PWC between 2018-19 and 2022-23.

Feeders in the CBD category performed within the Commission-approved target standard during 2021-22, and have done so over the last five years, apart from the SAIFI target in 2018-19, and the SAIDI target in 2018-19 and 2020-21.

Although not shown in Figure 11, the four-year rolling averages indicate that the performance of CBD feeders has improved over the last five years, with the SAIFI four-year average now better than the Commission-approved target standard.

No individual CBD feeders were above the category target standard during 2021-22, and no individual feeders have consistently performed worse than the category target standard over the last three years.

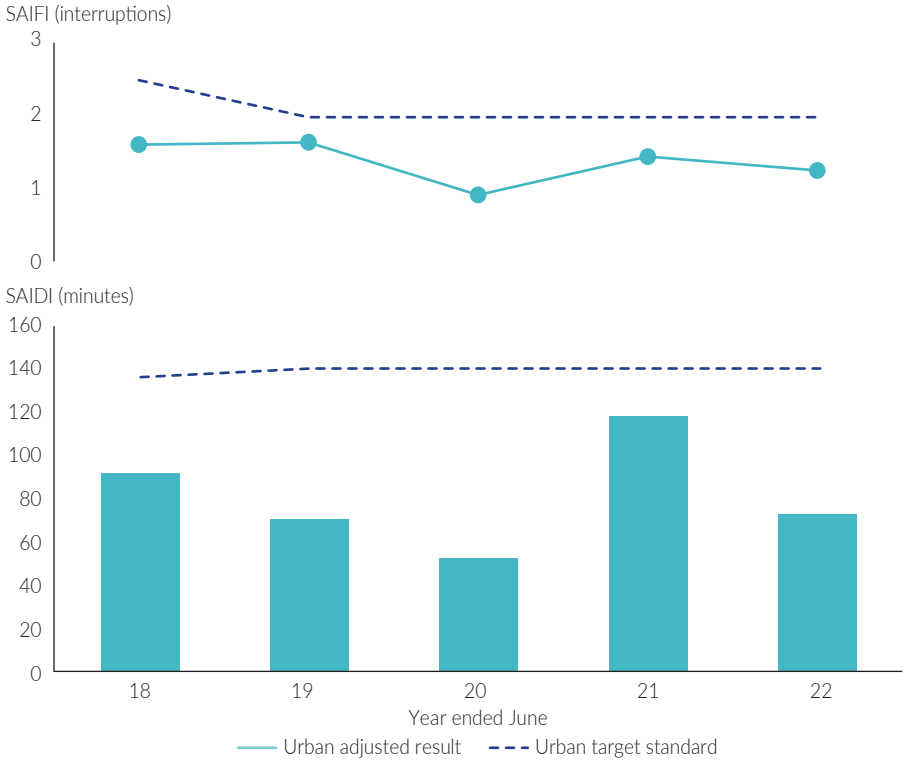
Urban

An urban feeder is defined as a feeder that is not a CBD feeder and has a maximum demand over the feeder route length greater than 0.3 megavolt ampere (MVA)/km. Urban feeders account for just over 40% of all feeders in the Territory.

Figure 12 shows the frequency and duration of urban customer interruptions as a direct result of network performance (adjusted SAIFI and SAIDI, respectively), and the approved target standards. This is shown by the light blue line and columns (SAIFI and SAIDI) and dark blue dotted line (approved target standard) in Figure 12.

The current Commission-approved PWC target standard for urban feeders is 140 minutes without supply and two interruptions per year.

Figure 12: Urban feeder category adjusted SAIFI and SAIDI



Note: The Commission approved new network target standards in 2018, which apply to PWC between 2018-19 and 2022-23.

Feeders in the urban category have performed within the Commission-approved target standard over the last five years in terms of both SAIFI and SAIDI. When considering the four-year rolling average, there has been little change in the level of performance over the last five years.

However, some individual urban feeders have consistently performed poorly during the last five years, with the 11WN22 Ludmilla (Darwin region) and 22KA22 Katherine (Katherine region) feeders worse than the feeder category target standard for three of the last five years, including in 2021-22. Customers serviced by the 11WN22 Ludmilla and 22KA22 Katherine feeders experienced 308 and 430 minutes without supply during 2021-22, respectively, which compares poorly with the feeder category target standard of 140 minutes without supply. In the worst performing year for customers served by the 11WN22 Ludmilla feeder, 2017-18, customers experienced 467 minutes without supply. In the worst performing year for customers served by the 22KA22 Katherine feeder, customers experienced 472 minutes without supply.

PWC Power Services advised in its reporting that during 2021-22 most of the poor performance for the 11WN22 Ludmilla feeder was attributed to trees blowing onto power lines and, for the 22KA22 Katherine feeder, to bats contacting overhead lines. PWC Power Services advised the actions being taken to reduce the impact of these causes are increasing the level of vegetation management and installing electrostatic animal protection in relation to the 11WN22 Ludmilla and 22KA22 Katherine feeders, respectively.

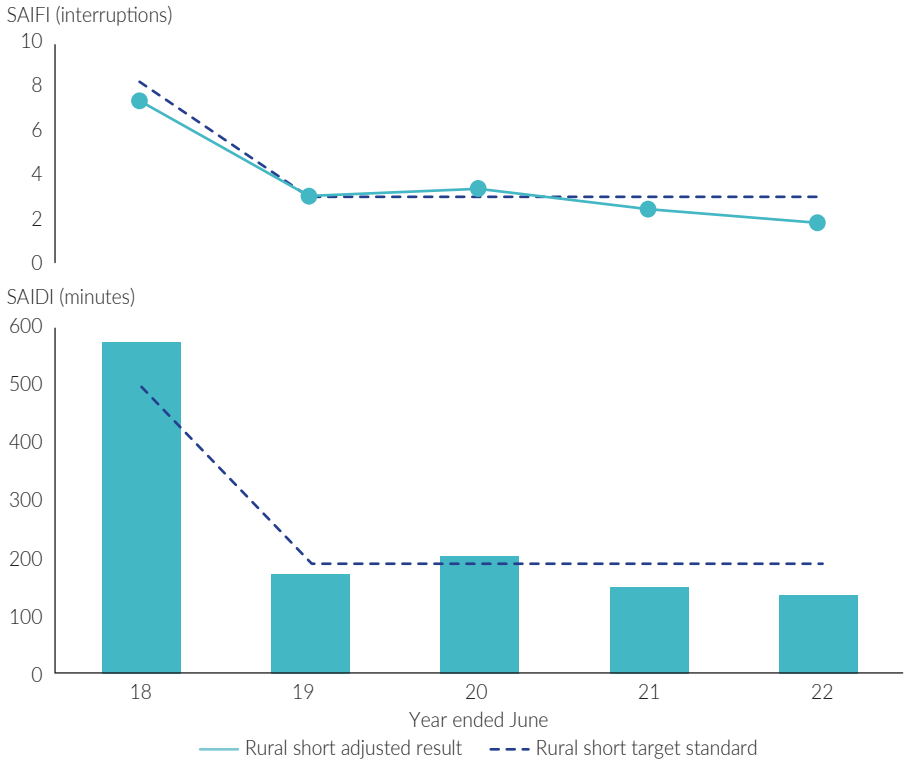
Rural short

A rural short feeder is defined as a feeder that is not a CBD or urban feeder and has a total feeder route length of less than 200 km. Rural short feeders account for just over 45% of all feeders in the Territory.

Figure 13 shows the frequency and duration of rural short customer interruptions as a direct result of network performance (adjusted SAIFI and SAIDI), and the approved target standard. This is shown by the light blue line and columns (SAIFI and SAIDI) and dark blue dotted line (approved target standard) in Figure 13.

The current Commission-approved target standard for rural short feeders is 190 minutes without supply and three interruptions per year.

Figure 13: Rural short feeder category adjusted SAIFI and SAIDI



Note: The Commission approved new network target standards in 2018, which apply to PWC between 2018-19 and 2022-23.

Feeders in the rural short category performed within the Commission-approved target during 2021-22, and have done so over the last five years, apart from the SAIFI target in 2018-19 and 2019-20, and the SAIDI target in 2017-18 and 2019-20.

When considering the four-year rolling averages, the performance of rural short feeders over the last five years has improved, with both SAIFI and SAIDI four-year averages now better than the Commission-approved target standard.

However, some individual rural short feeders have consistently performed poorly during the last five years, with the 22HD403 Middle Point (Darwin region) and 22KA03 Florina (Katherine region) feeders above the feeder category target standard for three of the last five years, including in 2021-22. Customers serviced by the 22HD403 Middle Point and 22KA03 Florina feeders experienced 787 and 1358 minutes (around 13 and 23 hours) without supply during 2021-22, respectively. This compares poorly with the feeder category target standard of 190 minutes without supply. The performance of the 22KA03 Florina feeder in 2021-22 was the worst of any rural short feeder over the last five years.

PWC Power Services advised that the poor performance of the 22KA03 Florina feeder in 2021-22 was related to bats contacting overhead lines and that electrostatic animal protection was installed on part of the feeder to address the issue.

PWC Power Services advised the poor performance of the 22HD403 Middle Point feeder in 2021-22 was related to a tree that fell onto the power line and there has been increased vegetation management in the problem areas along the feeder to address the issue.

Based on PWC Power Services' reporting, the rural short feeder category has received the most capital expenditure over the last three years compared with the other feeder categories.

The Commission notes it is positive to see an improved level of performance on the 22SY03 Virginia feeder (Darwin region) following the feeder consistently performing poorly between 2017-18 and 2019-20.

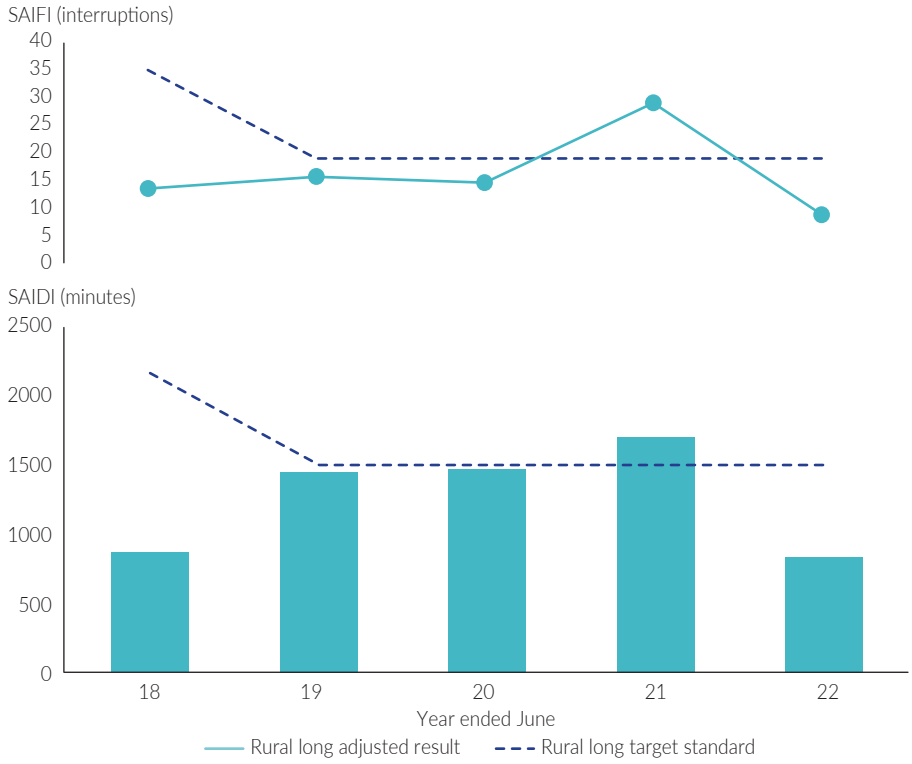
Rural long

A rural long feeder is defined as a feeder that is not a CBD or urban feeder and has a total feeder route length greater than 200 km. There are only three rural long feeders in the Territory, which account for under 2% of feeders.

Figure 14 shows the frequency and duration of rural long customer interruptions as a direct result of network performance (adjusted SAIFI and SAIDI, respectively), and the approved target standard. This is shown by the light blue line and columns (SAIFI and SAIDI) and dark blue dotted line (approved target standard) in Figure 14.

The current Commission-approved PWC target standard for rural long feeders is 1500 minutes without supply and 19 interruptions per year.

Figure 14: Rural long feeder category adjusted SAIFI and SAIDI



Note: The Commission approved new network target standards in 2018, which apply to PWC between 2018-19 and 2022-23.

Feeders in the rural long category performed within the Commission-approved target during 2021-22, and have done so over the last five years, apart from 2020-21.

When considering the four-year rolling averages, the performance of rural long feeders over the last five years has improved slightly in terms of the frequency of interruptions, and both SAIFI and SAIDI four-year averages are better than the Commission-approved target standard.

All three rural long feeders performed better than the feeder category target standard of 1,500 minutes without supply during 2021-22.

The 22SY04 Dundee feeder (Darwin region) consistently performed poorly against the feeder category target standard between 2018-19 and 2020-21, with an average of 1,889 minutes without supply (around 31 hours) over those years. However, performance improved in 2021-22 with the customer minutes without supply reducing to around 590 minutes. In its reporting, PWC Power Services advised the improvements are due to the installation of fuse savers (which saves fuses from blowing due to transient faults or completely replaces the need to use fuses) and animal protection. The Commission notes this capital expenditure is evident in PWC's reporting.

Based on PWC Power Services' reporting, the rural long feeder category has received the second highest level of capital expenditure over the last three years compared with the other feeder categories.

Notifications

Figure 15 shows the percentage of customers in the Territory notifying PWC of supply quality issues, including in relation to no power, and part, fluctuating or low power.

Figure 15: Territory quality of supply notifications per customer, by notification type

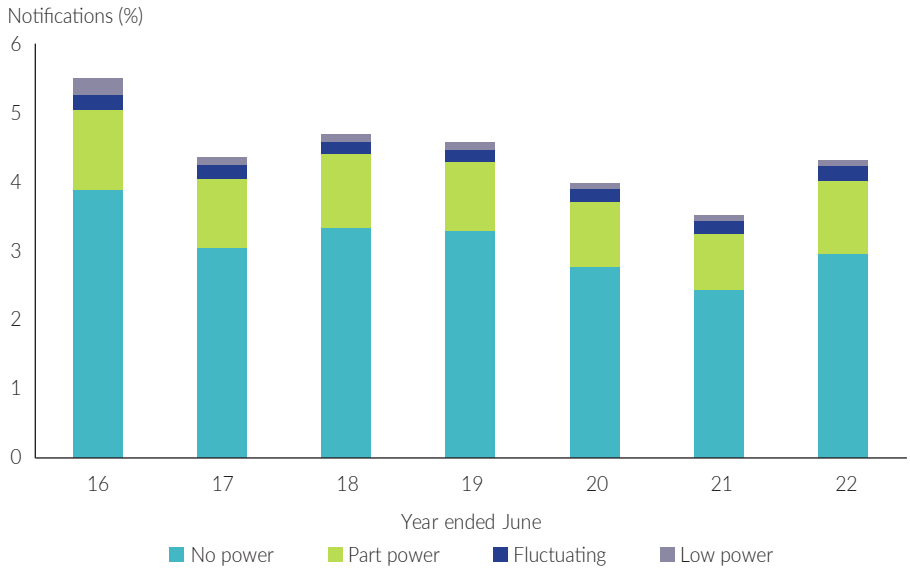
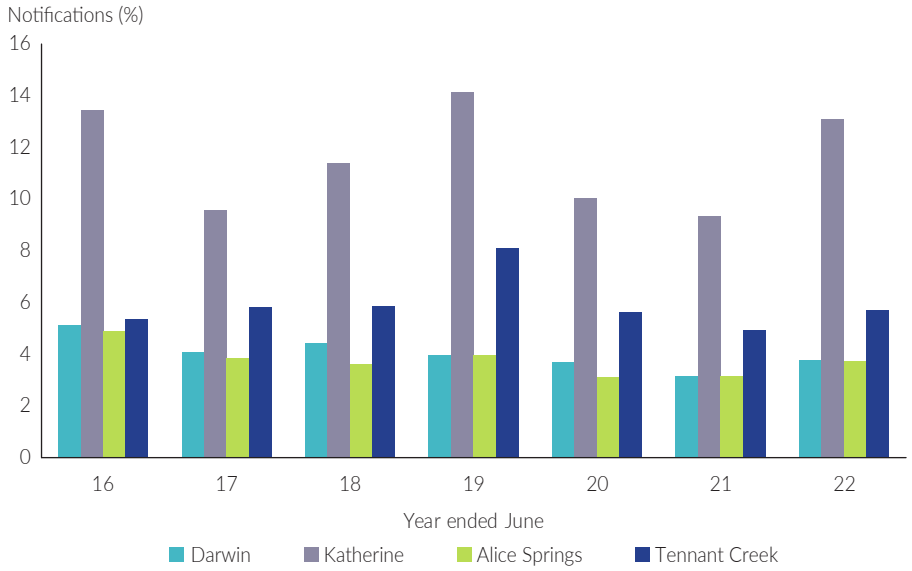


Figure 15 shows that over the last seven years, notifications to PWC Power Services in relation to the quality of supply were mostly related to no power, rather than part, fluctuating or low power. In 2021-22, 3% of customers in the Territory notified PWC Power Services of no power, which compares with 1.3% of customers making a notification in relation to other quality of supply issues.

However, notifications regarding the quality of supply are not evenly distributed across regions, as shown by Figure 16.

Figure 16 shows the same total customer notifications regarding supply quality issues as in Figure 15, however shown as the percentage of customers in each region in the Territory.

Figure 16: Quality of supply notifications from customers (as a percentage of total customers, by region)



Over the last seven years, there have been relatively more notifications from customers in the Katherine region, and to a lesser extent Tennant Creek, than in the Darwin and Alice Springs regions regarding the quality of supply. This is consistent with the higher duration and frequency of interruptions in those regions, which is discussed earlier in this chapter, and elsewhere in the NTPSPR.

Customer connections

Figure 17 shows the number of new connections (segmented by region) and the average time to complete those connections across the Territory. Under the EIP Code, the Commission has set a standard of service of within five business days for new connections of premises (excluding connections requiring network extension or augmentation).

Figure 17: Territory average new customer connection time and total connections, further segmented by region

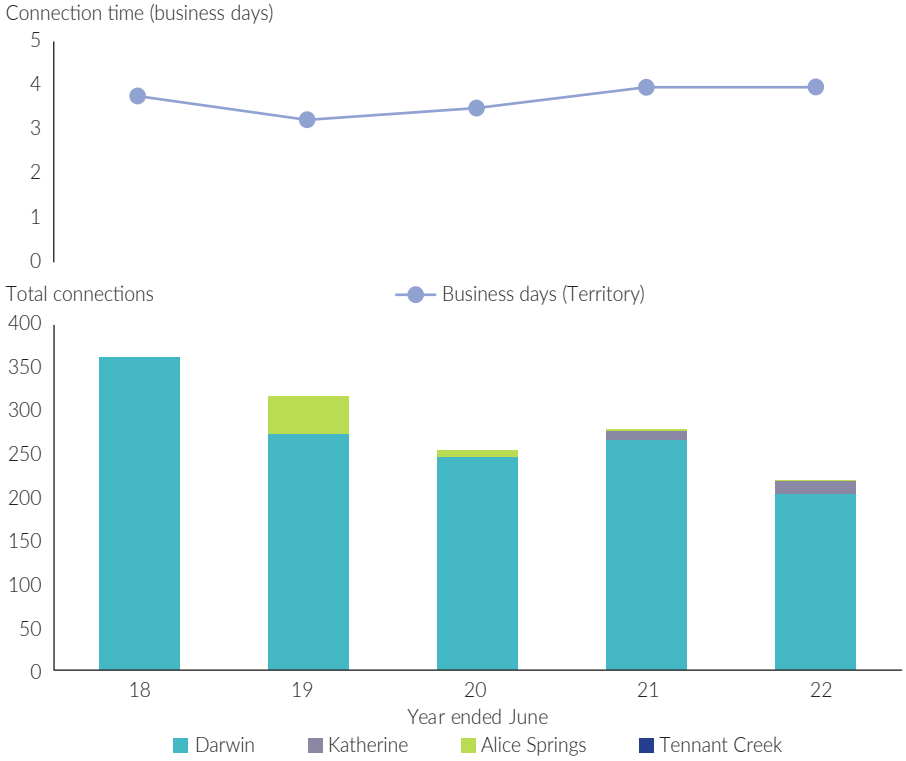


Figure 17 shows that the number of new connections in the Territory has fallen over the last five years, with around 220 new connections in 2021-22. The majority of new connections over the last five years have been in the Darwin region.

The average time to establish a new connection in the Territory has varied between 3.3 and 4 days over the last five years, which is within the Commission's standard of service of within five business days. However, as shown in the next section in relation to guaranteed service level payments, the Commission notes that the number of new connections not completed within the required five business days jumped from 20 in 2020-21 to 86 in 2021-22. This accounts for around 39% of new connections across the Territory in 2021-22.

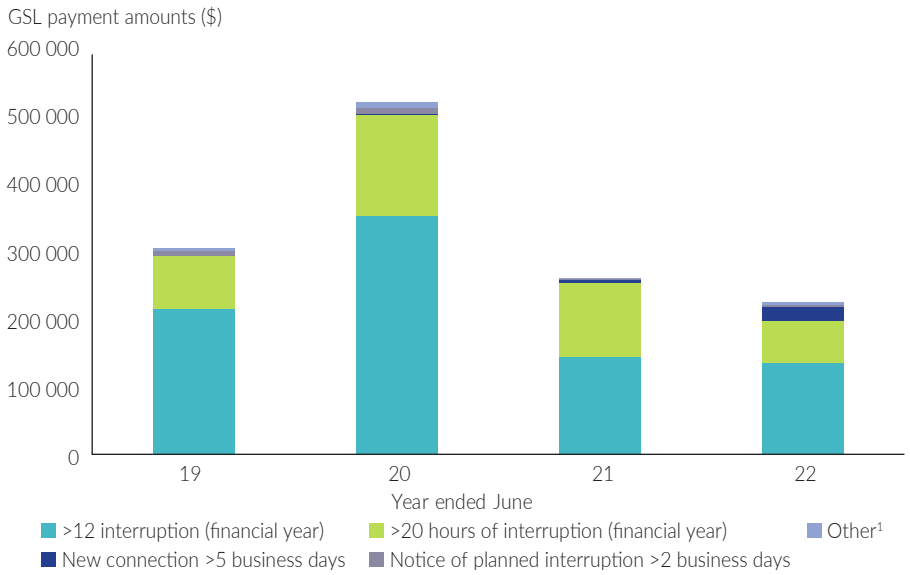
Guaranteed service levels

Guaranteed service levels provide for payments to eligible customers when performance does not meet the defined standard of service. The Commission sets these payment amounts and standards of service in the EIP Code.

Guaranteed service level payment amounts are intended to acknowledge the inconvenience eligible customers experience due to interruptions associated with network performance, and act as an incentive for the network entity to provide an appropriate level of service. Importantly, guaranteed service level payments are not intended to provide insurance-style compensation for any loss or damage that a customer may suffer from an interruption, noting the costs for making guaranteed service level payments to eligible customers are ultimately borne by all customers (and taxpayers in relation to the majority of customers protected by government's electricity pricing order) through network charges.

Figure 18 shows the dollar amount of guaranteed service level payments PWC made over the last four years for not meeting the required standard of service across the Territory, segmented by guaranteed service level.

Figure 18: Guaranteed service level payment amounts, by guaranteed service level



1 The 'other' category includes the following guaranteed service levels: >12 and <20 hours of interruption (single event); >20 hours of interruption (single event); re-connection of existing premises >24 hours; and >30 Minutes late for appointment.

The number and amount of GSL payments continued to fall in 2021-22 to around 2,050 payments totalling just over $227,800, following a high in 2019-20 of around 5,320 payments totalling $529,500. Over the four years shown in Figure 18, most GSL payments have been in relation to customers experiencing more than 12 interruptions and greater than 20 hours without supply over a financial year.

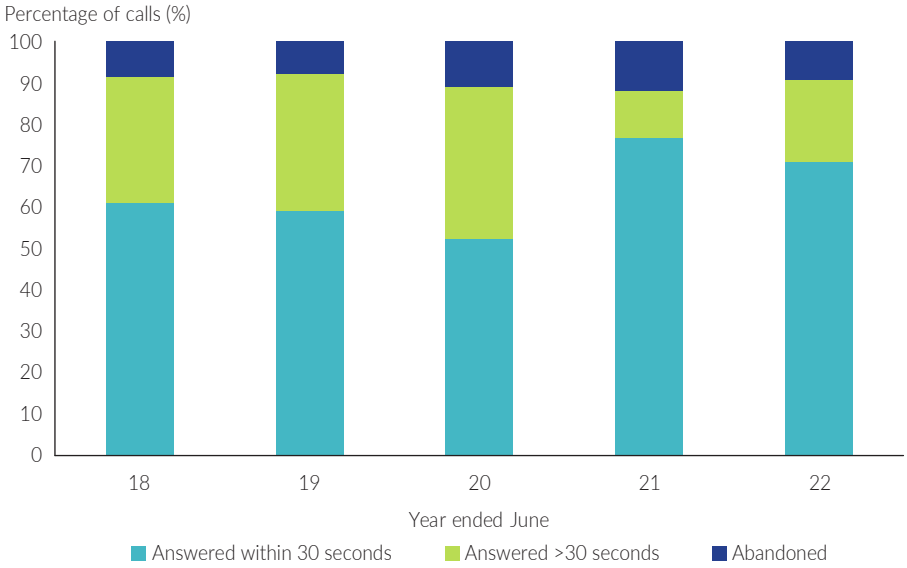
Customer service

The EIP Code (S.3.6.3) requires licensees providing network services in the Darwin-Katherine, Alice Springs and Tennant Creek power systems to report on customer service performance indicators, which includes telephone answering-related indicators. As the only licensee providing network services in the Darwin-Katherine, Alice Springs and Tennant Creek power systems, Figure 19 shows PWC Power Services' telephone answering performance at a Territory level over the last five years.[1]

Figure 19 shows the percentage of calls answered within 30 seconds (light blue sub-bars) and calls abandoned (dark blue sub-bars), and the percentage of calls that were answered, but fall outside of those criteria (green sub-bars).

1 During business hours.

Figure 19: Network telephone answering performance



Changes in the total number of calls to a network provider may be an indicator of the level of customer satisfaction with the standard of service. The percentage of calls answered within 30 seconds, the average waiting time before a call is answered, and the percentage of calls abandoned before being answered provide an indication of how long a customer has to wait to speak to the network operator, and whether this wait is considered reasonable by a customer. The Commission considers it is not always reasonable for a customer to expect to speak to an operator within 30 seconds, especially during spikes in call volumes. However, the Commission considers it is reasonable to expect a customer's call to be answered before the point where a customer feels the need to abandon their attempt to speak to the network operator, potentially leading to issues going unresolved, which may cause distress. Accordingly, the Commission is particularly interested in the percentage of calls being abandoned before being answered.

PWC Power Services reported a large reduction in the total number of calls received in 2021-22 to about 12,500, compared with a five-year high in 2020-21 of over 18,000. Noting the high level of calls in 2020-21 was related to a gas supply-related outage in Darwin, the level of calls in 2021-22 is more consistent with other reporting periods over the last five years.

Despite the reduction in calls, the level of performance in terms of calls answered within 30 seconds deteriorated in 2021-22, while the percentage of calls abandoned before being answered improved. The average call wait time before a call was answered substantially improved from a high over the last five years of 55 seconds in 2020-21 to a low of 4 seconds in 2021-22.

As a useful benchmark, the AER uses a rating system in its 2021-22 Annual Retail Markets report[2] to provide an overview of retailers' performance in relation to call centre responsiveness-related indicators. In terms of calls taken within 30 seconds, the AER's highest 'best' category is assigned to a retailer with 80% or more calls taken within 30 seconds. PWC Power Services' 2021-22 performance of 71% of calls answered within 30 seconds continues to fall in the AER's middle 'within range' category, which includes retailers that achieved 51% to 79% of calls taken within 30 seconds.

2 AER Annual Retail Markets Report 2021-22: https://www.aer.gov.au/system/files/Annual%20Retail%20Market%20Report%2020-21-22%20-%2030%20November%202022_3.pdf.

In relation to PWC Power Services' performance of 9% of calls abandoned before being answered, when compared with the AER's rating system, PWC Power Services improved from the AER's lowest 'poor' category in 2020-21 (10% or more calls abandoned), to the 'within range' category, which includes retailers that achieve 6% to 9% of calls abandoned before being answered.

PWC Power Services' average call wait time of 4 seconds in 2021-22 achieves the AER's highest 'best' category, which includes retailers with call wait times of 30 seconds or less.

Complaints

The EIP Code requires PWC Power Services to report on the percentage and total number of complaints it receives that are associated with network-related activities.

Figure 20 shows the percentage of Territory customer complaints to PWC by complaint category, including complaints related to administration processes and customer service, reliability of supply, customer connections, technical quality of supply, and other.

Figure 20: Territory network complaints per customer, by complaint category

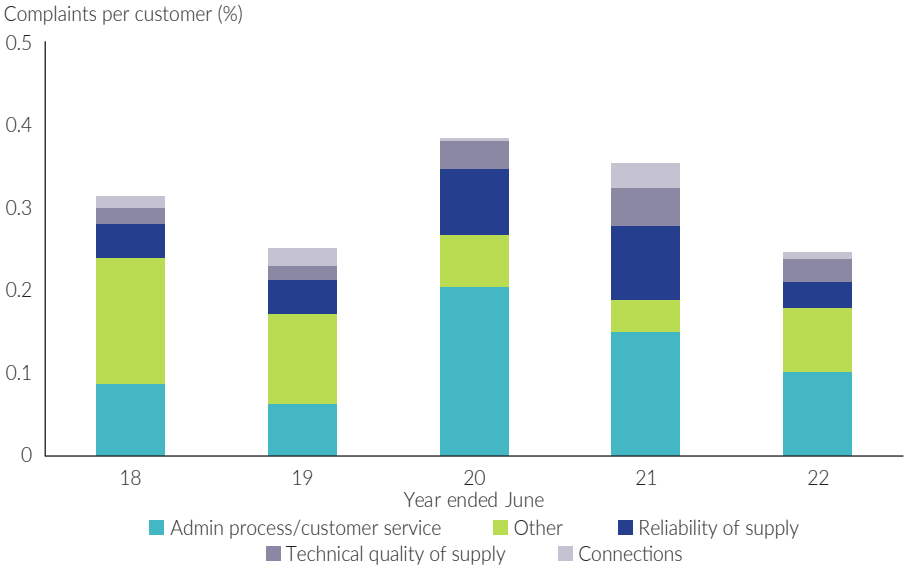


Figure 20 shows that as a percentage of total customers in the Territory, few customers are making complaints to PWC. Further, there has been little change in the level of complaints over the five years shown.

The Commission noted in its 2021-22 Northern Territory Electricity Retail Review that the Ombudsman NT has discussed in a number of its annual reports that both PWC and Jacana Energy are heavily involved in the consumer experience in the Territory through their respective roles as network provider and retailer. Accordingly, it is possible that customers may contact their electricity retailer regarding a network-related complaint, and this may contribute to the low level of complaints reported by PWC.

Figure 21 shows the same total customer complaints as in Figure 20, however it is segmented by region and shown as the percentage of customers in the respective regions.

Figure 21: Regional network complaints per customer

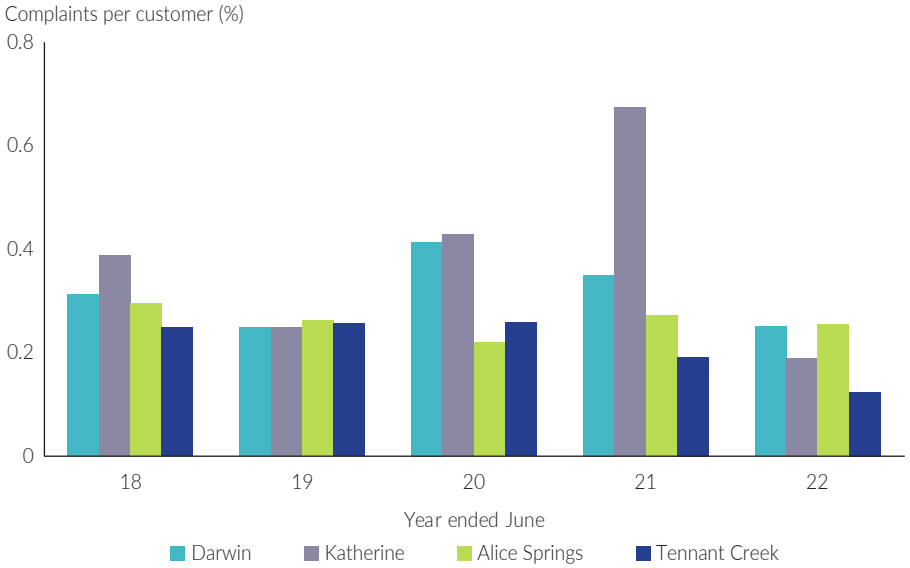


Figure 21 shows that while few customers in each region are making complaints to PWC, the complaints are not always evenly distributed across regions. On average, customers in the Katherine region made the most complaints and customers in Tennant Creek made the least complaints over the last five years.

An example of the disparity between regions is particularly seen in the Katherine region in 2020-21. The higher level of complaints in the Katherine region during 2020-21 (when compared with other regions) coincides with Katherine region customers experiencing the worst performance of any of the regions over the last five years. This is reflected in the types of complaints received, with an increase in customers complaining about the reliability of supply in the Katherine region during 2020-21. While performance in the Katherine region has not drastically improved in 2021-22, as discussed elsewhere in this review, the level of complaints has more than halved.

3 Generation

This chapter focuses on the performance and availability of generation in the Darwin-Katherine, Alice Springs and Tennant Creek power systems. More specifically, it covers generation at Territory Generation's Channel Island, Weddell, Katherine, Owen Springs, Ron Goodin and Tennant Creek power stations, and EDL NGD (NT) Pty Ltd's (EDL) Pine Creek power station. While there were other generators operating in or connecting to the power systems during 2021-22, they were not required to report against the EIP Code, and therefore the Commission's assessment of generator performance and availability in this chapter does not include them.

For generators that reported against the EIP Code, their power station location, fuel type and capacities are shown in Table 6.

Table 6: Generator power station locations, fuel type and capacities

	Fuel type	Capacity (MW)[1]
Darwin-Katherine		471.4
Territory Generation		
Channel Island	Gas/diesel and heat recovery steam	278.4
Weddell	Gas	129.0
Katherine	Gas/diesel	37.0
EDL		
Pine Creek	Gas and heat recovery steam	27.0
Alice Springs		115.9
Territory Generation		
Owen Springs	Gas/diesel	80.6
Ron Goodin	Gas/diesel	35.3
Tennant Creek		19.5
Territory Generation		
Tennant Creek	Gas/diesel	19.5

1 As reported by the licensee in EIP Code reporting.

Generation performance

Similar to overall power system performance and network performance, one way to assess the level of generation performance is to consider the impact on the frequency and duration of interruptions experienced by customers as a direct result of that performance. This is again achieved through the reporting of SAIFI and SAIDI.

The Commission has discussed the limitations of assessing generation performance using the metrics of SAIFI and SAIDI in previous NTPSPRs. One of the main limitations is associated with the potential for unplanned interruptions being negatively impacted by the performance of power system assets, such as generation, which are not directly related to the root cause. These assets are not allocated a 'share' of the SAIFI and SAIDI. This is related to another limitation, in that there is no explicit responsibility in apportioning the impact between power system assets, or licensees. In some cases, it may be unclear or too complex to apportion SAIFI and SAIDI between licensees.

These limitations may result in licensees under or over reporting, and double counting across licensees.

The Commission intends to consider generation performance reporting in a future review of the EIP Code. In the interim, the Commission made a recommendation in the 2020-21 NTPSPR for PWC System Control to clearly identify and apportion the customer impact for customer interruptions between relevant licensees in each major incident report as appropriate. However, this recommendation is not enforceable.

Regardless of the limitations, the Commission still considers that generator SAIFI and SAIDI reporting provides a level of insight into the performance of generators. Figure 22 shows the average frequency and duration of interruptions per customer, respectively, as a result of generation performance in the Darwin-Katherine, Alice Springs and Tennant Creek power systems, with the Darwin-Katherine power system further segmented into the regions of Darwin and Katherine.

Figure 22: Generation SAIFI and SAIDI performance by region

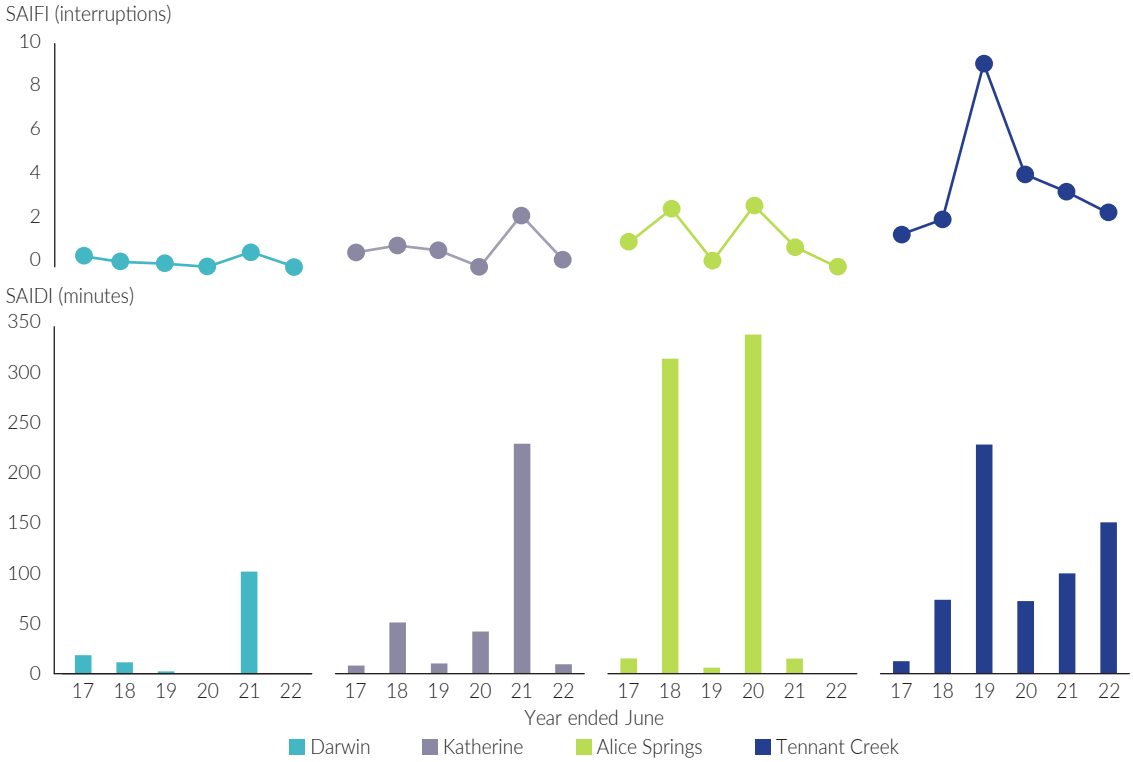


Table 7 presents the average frequency and duration of interruptions (SAIFI and SAIDI, respectively) per customer as a result of generation in 2021-22, and the four-year average by region.

Table 7: Generation SAIFI and SAIDI performance by region, 2021-22 and four-year average

	SAIFI (interruptions)		SAIDI (minutes without supply)	
	2021-22	4-year average	2021-22	4-year average
Darwin	0.0	0.2	0	26
Katherine	0.3	0.8	9	74
Alice Springs	0.0	1.0	0	91
Tennant Creek	2.4	4.8	153	140

Darwin

As discussed earlier in this review, there was a gas supply-related outage to the Channel Island power station in 2020-21. If it was not for this outage, generation performance over the last six years would have had very little impact on customers in the Darwin region in terms of interruptions.

Notwithstanding the inclusion of the gas supply-related outage in the generation performance reporting, when generation performance is measured in terms of the impact on customer interruptions, it performed well in the Darwin region, especially when compared with other power systems or regions in the Territory. This is highlighted by the current four-year average of 0.2 interruptions and 26 minutes without supply per customer in the region as a result of generation performance.

The Commission has noted in previous NTPSPRs that historically the Darwin-Katherine power system was dispatched in such a way that under frequency load shedding (interruptions to some customers) was inevitable to protect the overall power system following a trip of most large generating units in the region. PWC System Control made changes in an attempt to improve power system performance through, among other things, changes to the under frequency load shedding scheme settings, generation dispatch constraints and spinning reserve levels.

PWC System Control's changes have achieved a stark reduction in interruptions due to generation performance, however has likely increased costs, particularly for Territory Generation, noting under the current framework, there is no competitive provision of essential system services to put downward pressure on these costs and limited regulatory requirements or oversight to ensure the efficient dispatch of essential system services by PWC System Control.

Katherine

Similar to that in the Darwin region, including in relation to the gas supply-related outage to the Channel Island power station in 2020-21, generation performance over the last six years would have had very little impact on customers in the Katherine region in terms of interruptions when compared with the poor overall performance in the region, as discussed in the earlier chapters.

The four-year average in the Katherine region in 2021-22 was 0.8 interruptions and 74 minutes without supply per customer as a result of generation performance.

This level of generation performance is not unexpected as the Commission understands that generation located in the Katherine region is rarely dispatched (online) due to its higher cost to run. It is the Katherine region's unreliable connection to the rest of the power system, or management of the region once islanded, that primarily causes the poor performance, not generation.

It is important to note that generation issues in the Darwin region can result in interruptions in the Katherine region due to the application of power system protection settings. While less likely, the reverse is true, although this may become a greater risk as more generation connects to the region and flow on the 132 kV transmission line reverses at times in the direction of the Darwin region.

Alice Springs

Generation performance has significantly contributed to customer interruptions over the last six years in the Alice Springs region due to system blacks in 2017-18 and 2019-20. The system blacks have negatively impacted the four-year rolling average in the region, which was 1 interruption and 91 minutes without supply as a result of generation performance per customer in 2021-22.

However, generation performance in the region in 2020-21 and 2021-22 is better than the four-year rolling average, particularly in terms of the duration of interruptions as a result of generation performance, with 15 and 0 minutes without supply, respectively.

This level of improved performance is contributing to the overall improvement in the region discussed earlier in the Power System chapter, and is reassuring given the issues in the region in previous years.

Tennant Creek

Generation performance in the Tennant Creek power system has consistently been the worst or second worst performing of the Territory power systems or regions over the last six years.

The four-year average in 2021-22 was 4.8 interruptions and 140 minutes without supply per customer as a result of generation performance, which is higher than the other Territory power systems (and regions) covered in the NTPSPR. The duration of interruptions due to generation performance appears to be on a deteriorating trend. However, there has been a sustained reduction in the frequency of interruptions since a peak in 2018-19, to 2.4 interruptions per customer in the current reporting period.

The improved performance in terms of the frequency of interruptions due to generation performance is positive given Tennant Creek has generally seen a higher frequency of interruptions when compared with the Darwin-Katherine (as a whole) and Alice Springs power systems.

Generation availability

A number of indices are calculated to provide insight into the availability of the generating units, and to some degree allow an assessment to be made of the adequacy of condition monitoring and preventative maintenance. These include:

- availability factor
- unplanned availability factor
- equivalent availability factor
- forced outage factor
- equivalent forced outage factor.

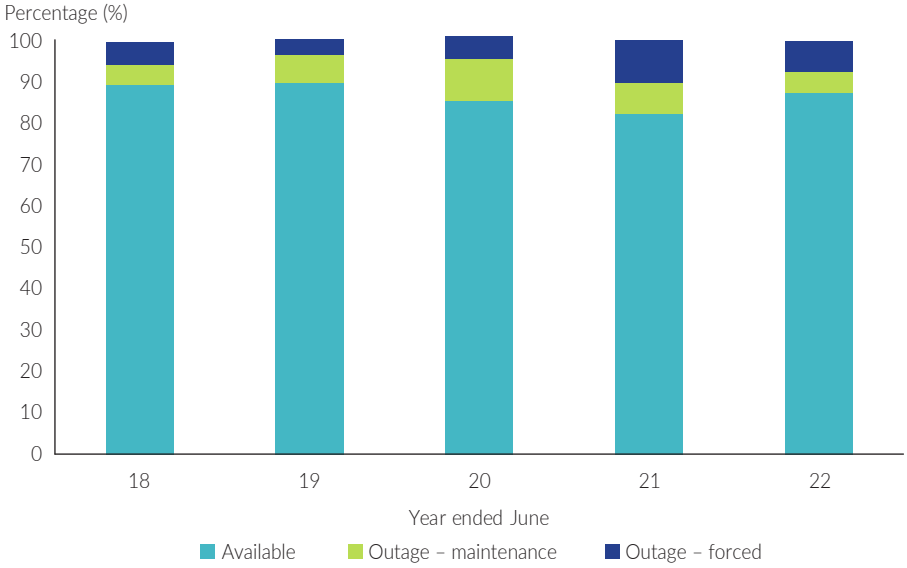
Territory

Figure 23 combines the generators' reported indices against the EIP Code in the Territory to show the capacity weighted generation availability over the last five years, including the level of both planned maintenance and forced outages.

Ideally, planned maintenance (green sub-bars) should be to a level that maximises generation availability (light blue sub-bars) while minimising unplanned maintenance or forced outages due to faults (dark blue sub-bars) as much as reasonably practicable, noting it is unreasonable to expect zero unplanned maintenance or forced outage events.

Maximising generation availability provides generators and system controllers greater flexibility in managing the generation fleet and the power system, and improves generation reliability. While planned maintenance activities are part of standard operations, and generators and system controllers can plan for them, unplanned maintenance or forced outages can lead to system reliability and security risks, and therefore should be minimised where possible.

Figure 23: Generation availability weighted by capacity, Territory



Following a two year decline in 2019-20 and 2020-21, generation availability in the Territory improved in 2021-22. The improvement was due to a reduction in planned maintenance and forced outages, however the level of forced outages is still elevated.

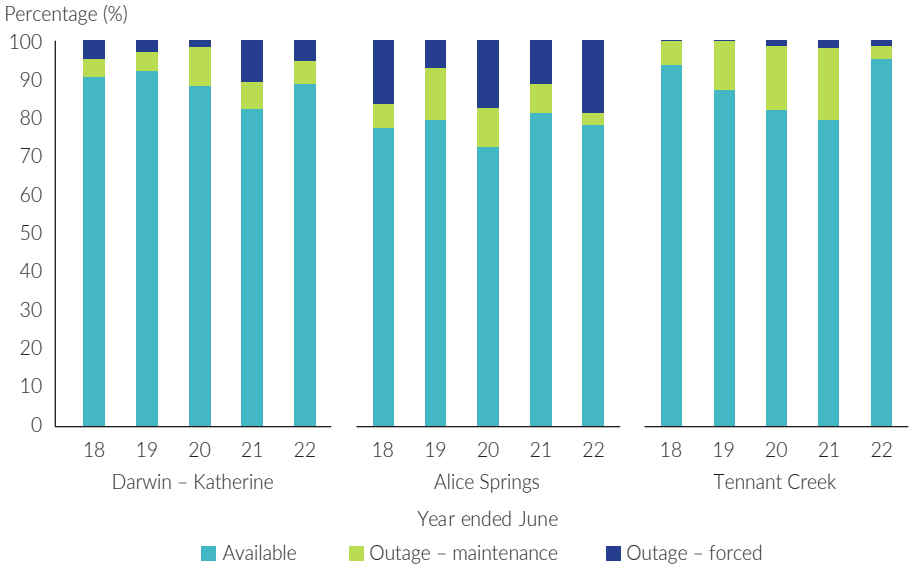
During 2020-21, the level of forced outages in the Territory was driven by high levels in Darwin-Katherine and Alice Springs. In 2021-22 this changed, with the level driven by the Alice Springs region only, and in particular the ageing Ron Goodin power station, which is discussed more below.

The availability of generation at the Territory level during 2021-22 (87%) is consistent with the median over the last five years.

Regional

As with the chart above, Figure 24 combines generators' reported indices, however this time segmented by power system to show the capacity weighted generation availability in the Darwin-Katherine, Alice Springs and Tennant Creek power systems over the last five years, including the level of both planned maintenance and forced outages.

Figure 24: Generation availability weighted by capacity, by region



Darwin-Katherine

Due to the larger proportion of generation capacity in the Darwin-Katherine region compared with Alice Springs and Tennant Creek, the Territory result (weighted average) is heavily influenced by the Darwin-Katherine results.

Generation availability in Darwin-Katherine improved in 2021-22 following two years of decline in 2019-20 and 2020-21. The improved availability is due to reductions in planned maintenance in 2019-20, and planned and forced outages in 2020-21. In particular, the Channel Island power station had elevated levels of planned maintenance in 2019-20 and 2020-21, and forced outages in 2020-21. There was also a very high level of forced outages at the Katherine power station in 2020-21. Two major engine replacements at the power station in 2020-21 appear to have had a positive impact on the forced outage rate, and in turn the availability rate at the power station in 2021-22, which returned to a level more consistent with historical performance.

Generation availability in 2021-22 was similar with the median result over the last five years, at around 89%.

While actual generation availability improved in 2021-22 compared with the previous year, the four-year rolling average at the Channel Island power station is showing a steady deterioration. It is important this deterioration is closely monitored by Territory Generation, and more broadly Government and the Commission, noting the Commission has a role in providing advice to Government, such as through this review, given the power station is the largest in the Darwin-Katherine region and is heavily relied upon for maintaining a secure and reliable Darwin-Katherine power system.

The 2020-21 NTPSPR discussed how the generating units at the power station are ageing, with some nearing end-of-life (starting in 2026-27), and therefore the probability of extended outages may increase. Relevantly, the Commission is aware from licensee reporting that a number of constraints apply to the operation of some generators at the Channel Island power station, including constraints on those scheduled for retirement in the medium-term due to generator, or generator component failures or limitations. These constraints limit the system controller's flexibility in dispatching generation to meet customer demand.

The Commission considers that these observations support its view in the 2021 Northern Territory Electricity Outlook Report (NTEOR) that urgent investment in new generation, storage and or demand response is needed, noting the NTEOR assumes these end-of-life generators at the Channel Island power station remain serviceable and available until that date.

Alice Springs

Generation availability deteriorated in Alice Springs in 2021-22 compared with the previous year, however is similar to the median over the last five years.

The availability of generation in the Alice Springs power system has been lower than the Darwin-Katherine and Tennant Creek power systems for four of the last five years, with Tennant Creek recording a slightly lower level of availability in 2020-21.

In 2021-22 the availability of generation in the Alice Springs power system was just over 78%, which compares poorly with 89% and 95% in the Darwin-Katherine and Tennant Creek power systems, respectively. The highest level of availability in the region over the last five years was in 2020-21, with a result of 81%.

Two power stations at opposite ends of their lifecycle are driving the poor availability of generation in the Alice Springs region. The relatively new generation at the Owen Springs power station has had a consistently elevated level of planned maintenance over the four years prior to 2021-22. The end-of-life generation at the Ron Goodin power station has had a very high level of forced outages over the last five years.

The Owen Springs power station recorded its highest level of availability in 2021-22, at around 90%. This was largely driven by a reduction in planned maintenance, which was at its lowest level over the last five years in 2021-22. In contrast, the Ron Goodin power station reached its lowest level of availability over the last five years in 2021-22 of around 51%. The low level of availability is mainly due to a high rate of forced outages, which is not unexpected given the age of the generators.

Despite the low level of availability, the Ron Goodin power station may still be relied on to provide a level of back-up to the region and is likely to continue to do so until the Owen Springs power station and battery energy storage system have proven to operate without constraints. However, the availability of the Ron Goodin power station is likely to continue to diminish over time, noting Territory Generation has advised it will eventually be placed in a standby state. While the power station is being relied on, it will increase generation costs compared with running the newer, more efficient generators at Owen Springs power station. Hence, it is encouraging to see improvements at the Owen Springs power station.

The Commission notes that the level of availability in the Alice Springs region is likely to continue to be poor in subsequent years while the Ron Goodin power station is still operating, and in turn, it will continue to drag down the regional result.

Tennant Creek

Generation availability dramatically improved in the Tennant Creek power system during 2021-22 to around 95%, from a low over the last five years of around 80% in 2020-21. The improvement in 2021-22 was driven by a reduction in planned maintenance, which had been steadily increasing over the previous three years. Territory Generation advised in its EIP Code reporting it has utilised the new Jenbacher generators during the reporting period, while it also retired older generators from service.

The Commission notes that forced outages in the power system have been consistently low over the last five years.

Availability in the power system has been inconsistent over the last five years, primarily due to planned maintenance. This is preferable to forced outages, which as discussed earlier in this chapter should be minimised where possible, as high levels of forced outages can increase risks to system reliability and security due to the limited or no notice inherent to forced outages.

4 Previous NTPSPR recommendations

This chapter provides an assessment of the status of the recommendations from previous NTPSPRs, which were either not assessed as complete in the 2020-21 NTPSPR, or were recommended in the 2020-21 NTPSPR for the first time. It is important to note that the recommendations are those of the Commission and where they do not relate to non-compliance, such as with licence conditions or relevant legislation, are not enforceable.

The Commission has grouped the recommendations to highlight related issues or overlapping recommendations, where possible.

Table 8 provides a summary of the Commission's assessment of the status of previous NTPSPR recommendations in terms of whether the recommendations are considered as open or complete.

Table 8: Summary of assessed status of previous NTPSPR recommendations

	NTPSPR				
	2017-18	2018-19	2019-20	2020-21	Total
Open	2	5	4	4	15
Complete	8	1	2	2	13

Katherine region operation

In addition to the two recommendations below, which are related to the operation of the Darwin-Katherine power system in the Katherine region, the Commission made a recommendation in the 2017-18 NTPSPR in relation to Katherine and Pine Creek island management, however this was closed as an overlapping recommendation was made in the 2018-19 NTPSPR (shown below).

Recommendation: Review and improve the operation of the Katherine/ Pine Creek island

NTPSPR: 2018-19 Page: vi

Accurate and reliable islanding identification and clear and robustly implemented protocols are required.

Relevant licensee or stakeholder:	PWC System Control
	PWC Power Services
	Territory Generation
	EDL
Status:	In progress

Recommendation: Katherine island operation

NTPSPR: 2020-21 Pages: v and 22

It is recommended that PWC System Control investigates how generating units in the Katherine region could be normally operated in both voltage and frequency droop modes to assist power system recovery from a separation event.

Relevant licensee or stakeholder: PWC System Control
Territory Generation
EDL

Status: In progress

While the recommendations above, and the one in 2017-18 are specific and technical in nature, they all relate to improving the performance of the power system and customer experience in the Katherine region, which as discussed elsewhere in this review, is poor compared with the other Territory regions.

When requested to provide feedback on the recommendation from the 2018-19 NTPSPR, PWC Power Services advised that an updated standalone Darwin-Katherine transmission line islanding scheme (islanding scheme) is required, which will be delivered in parallel with a Darwin-Katherine transmission line secondary system replacement project, and is forecast for completion in August 2025.

The Commission understands that under the updated islanding scheme it is intended signals will be sent to relevant power stations when a trip on the 132 kV transmission line between Darwin and Katherine occurs. Power stations will be required to take 'control actions' to meet PWC System Control operational requirements. These 'control actions' may include requiring generators to trip off or 'roll back' their output.

In practice, where generators are required to trip off, the Commission understand this may mean there is no attempt to 'catch' the trip of the transmission line, and operate the Katherine region as a separate islanded region from the rest of the power system. While this will likely not reduce the frequency of interruptions experienced by customers in the Katherine region, it may reduce the duration of interruptions to some degree. This is due to avoiding situations where an unsuccessful attempt to 'catch' a trip of the transmission line results in the Katherine region being in an 'unknown' state, and in turn reducing the complexity and time in restoring the transmission line.

The Commission was previously advised that PWC Power Services was considering a staged solution, which included interim and final islanding schemes, however it was determined by PWC Power Services that the same scope of work was required for both schemes, and therefore a staged approach did not offer any benefits.

In relation to the second recommendation above (from the 2020-21 NTPSPR), Territory Generation advised that generating units at the Katherine power station commonly do not operate due to the units' position in merit order (order of priority for dispatch), and when they are operating, the generating units are not big enough to capture all the load demand on the separation event. That is, when a trip of the 132 kV transmission line occurs, generation in the Katherine region is either not online or does not have enough capacity to 'catch' the trip and establish a secure and reliable separate island from the rest of the power system.

Relevantly, the Commission is aware of other attempts to improve performance in the Katherine region over recent years, including in relation to synchronisation in Pine Creek and constraints to operate generation in the Katherine region during periods of heightened risk of the transmission line tripping. However, current performance in the region does not demonstrate to the Commission that issues related to the operation of the power system in the Katherine region have been addressed sufficiently, and therefore the recommendations are considered to still be in progress.

The Commission notes that while EDL was provided an opportunity to comment on the implementation progress of the recommendations, it did not provide a response.

Generation asset management

Recommendation: Balance pro-active and reactive system improvement strategies

NTPSPR: 2018-19	Pages: v and 15

Good electricity industry practices, such as in relation to condition monitoring and preventative maintenance, and visibility and knowledge of plant limits, should be adopted by generators, with more formal auditing.

Part A – Improved condition monitoring and preventative maintenance practices.

Part B – Better visibility and knowledge of plant limits, in particular where these plant limits vary.

Relevant licensee or stakeholder:	Territory Generation (part A and B)
	EDL (part A and B)
	PWC System Control (part B)
Status:	In progress

In relation to part A of the recommendation, Territory Generation advised that it has a new incident reporting process, and dedicated frontline staff now undertake regular condition monitoring. Further, reporting of reliability statistics has commenced and a condition monitoring dashboard has been created to assist with oversight.

As shown in the Generation chapter of this review, generation availability improved in 2021-22, and this may be influenced by Territory Generation's changes. However, the Commission would like to observe an improvement over a longer term to consider part A of the recommendation as complete.

In relation to part B of the recommendation, Territory Generation noted the recommendation was in relation to ambient conditions, and it now has better knowledge and visibility of plant limits through its generator control system, which employs an automatic load reduction capability based on plant temperatures. Further, all generators are monitored, with any significant variations in temperature reported to PWC System Control through Territory Generation's operators.

PWC System Control advised that it has improved knowledge of plant limits, with most operational data streamed in real time through the SCADA system, and some irregular information communicated through operational staff, however it is reliant on information provided by generators.

It appears from licensee's responses that Territory Generation's visibility of plant limits has improved, and both Territory Generation and PWC System Control have better knowledge of plant limits. Further, while the visibility of plant limits by PWC System Control is subject to the adequacy of communication with generators, there appears to be systems and processes in place.

Noting part B was directed mainly at Territory Generation and PWC System Control, the Commission considers part B is complete.

The Commission notes that while EDL was provided an opportunity to comment on the implementation progress of the recommendation, it did not provide a response.

Recommendation: Ensure learnings from the Owen Springs Jenbacher project are embedded in the Tennant Creek Jenbacher project

NTPSPR: 2018-19 Page: vi

The system black in Alice Springs on 13 October 2019 demonstrated the level of knowledge Territory Generation has of the original equipment manufacturer's controls of the Jenbacher generators is insufficient to ensure correct operation while operating near or at the generators' expected capacity.

Relevant licensee or stakeholder: Territory Generation

Status: Complete

Territory Generation advised that learnings from the Owen Springs Jenbacher project have been implemented at the Tennant Creek power station. Further, Territory Generation advised that a long-term maintenance agreement is in place for the generators.

While some issues remain in the Tennant Creek power system, which include the response of the Jenbacher generators to disturbances in the system, these issues are not what was envisaged by this recommendation. Therefore, based on the advice of Territory Generation, the Commission considers this recommendation is complete.

Recommendation: More thorough investigation of single unit trips

NTPSPR: 2019-20 Pages: v and 14

It is important for generation licensees to understand why their generation units trip. Single generator trips will continue to occur (and seemingly at greater frequency) unless more thorough investigation of the cause of single unit trips occurs and identified issues are addressed.

Relevant licensee or stakeholder: Territory Generation

EDL

Status: In progress

Territory Generation advised that it now has an incident reporting and investigation process, and associated database, and is also utilising fault codes. Further, Territory Generation has created two new Senior Control System Technician positions, one to manage the northern regions and one to manage the southern regions of it operations, with one of the focuses of these positions the investigation and reporting (to PWC System Control) of all unit trips.

The Commission considers that while Territory Generation appears to have strengthened its investigation and reporting of unit trips, it has not yet seen sufficient evidence to demonstrate the steps are reducing single unit trips, and accordingly the recommendation is assessed as in progress.

The Commission notes that while EDL was provided an opportunity to comment on the implementation progress of the recommendation, it did not provide a response.

Reporting

Recommendation: Reporting of causes for single unit trips

NTPSPR: 2017-18 Page: 9

The cause of single unit trips should also be reported to enable better scrutiny of the plant performance.

Relevant licensee or stakeholder: PWC System Control
Territory Generation
EDL

Status: Complete

As discussed above under the previous recommendation, Territory Generation appears to have strengthened its investigation and reporting of unit trips, with PWC System Control confirming it receives the reporting from Territory Generation. This has allowed PWC System Control to report on the causes behind single unit trips to a greater degree, such as in its half-yearly reporting to the Commission.

The Commission confirms that the level of detail regarding single unit trips has improved in PWC System Control's half-yearly reporting to the Commission, and has allowed for a greater level of scrutiny.

The Commission notes that while EDL was provided an opportunity to comment on the implementation progress of the recommendation, it did not provide a response. The Commission understands EDL provides information to PWC System Control as part of normal forced outage or return to service requests. However, separate or specific reporting, such as what Territory Generation is now doing, is not provided.

Given Territory Generation currently has the majority of generation in the Territory, and its level of single generator trip reporting and scrutiny of plant performance has increased, the Commission considers this recommendation complete.

Recommendation: Incident reporting – incident recovery

NTPSPR: 2020-21 Pages: vi and 49

It is recommended that more focus on the recovery phase after major incidents be included in PWC System Control's major incident reports.

Relevant licensee or stakeholder: PWC System Control

Status: In progress

PWC System Control advised that this recommendation has been partially implemented through an updated final incident report template.

The Commission has seen evidence of a more detailed final incident report in terms of the recovery phase in the most recent reports, however considers that more sustained evidence is required before the recommendation can be assessed as complete.

Recommendation: Incident reporting – clarity on generation SAIFI and SAIDI apportioning in incident reports

NTPSPR: 2020-21 Pages: vi and 29

It is recommended that PWC System Control clearly identify and apportion the customer impact for a particular event between the relevant licensees in each major incident report, noting the EIP Code requires generators to report on their SAIFI and SAIDI performance.

Relevant licensee or stakeholder: PWC System Control

Status: In progress

PWC System Control advised that it considers there is enough information in its current incident reports, which are provided to all relevant licensees, including licensed generators, in order to apportion SAIFI and SAIDI. However, System Control has indicated that it will consider whether this can be made clearer as part of its biannual reporting obligations under the System Control Technical Code.

Noting this is an interim solution until the Commission has amended the EIP Code to address the issue, the Commission considers the recommendation is in progress, as PWC System Control incident reports (or biannual reporting) do not yet explicitly identify and apportion SAIFI and SAIDI between licensees.

Planning and coordination

The following recommendations relate to the lack of or inadequate frameworks and structures in the Territory's electricity supply industry, or overall explicit responsibility, accountability and authority for coordination in the Territory.

Recommendation: Planning and modelling

NTPSPR: 2017-18 Page: vi

Better planning, including modelling of system changes and associated operations, by PWC Power Services in consultation with PWC System Control and licensees.

Relevant licensee or stakeholder: PWC System Control
PWC Power Services
Territory Generation

Status: In progress

Recommendation: Ensure generation and demand changes are planned for with a view to efficiency and robustness

NTPSPR: 2018-19 Pages: v and 35

Detailed planning work is required to understand the operability of the three power systems with increased variable renewable energy penetration. This should include consideration of frequency and voltage control and regulation.

Relevant licensee or stakeholder: PWC System Control
PWC Power Services
Northern Territory Government

Status: In progress

The Commission considers that there is some overlap between the two recommendations above from the 2017-18 and 2018-19 NTPSPRs, and has therefore grouped them together. Further, the recommendations highlight the lack of or inadequate frameworks and structures, or overall explicit responsibility, accountability and authority for coordination, and are relevant across the three power systems in the Territory.

In terms of the recommendations above, the Commission considers relevant stakeholders have made some progress since the recommendations were made, albeit slow and incomplete. The Commission notes work is ongoing, and accordingly, the recommendations are assessed as in progress.

The following recommendations under the 'planning and coordination' heading relate to specific power systems or regions in power systems, rather than all three power systems.

Recommendation: Managing Ron Goodin power station retirement

NTPSPR: 2017-18 Pages: iv and 43

Care should be taken to ensure a robust set of operating protocols is developed to allow for safe and secure operation of the Alice Springs network without the support the Ron Goodin power station.

Relevant licensee or stakeholder: Territory Generation
PWC System Control

Status: In progress

Territory Generation advised that once the Owen Springs power station and Ron Goodin battery energy storage system have proven to operate without system constraints, the Ron Goodin power station will be placed into a standby state.

PWC System Control advised that work completed on the Jenbacher generators at the Owen Springs power station has allowed restrictions on those generators and reliance on the Ron Goodin power station to be lowered. Once all issues with the battery energy storage system have been addressed, the reliance on generators at the Ron Goodin power system should be removed altogether.

The Commission considers it positive that reliance on the end-of-life generation at the Ron Goodin power station is diminishing, especially given the poor reliability of that generation (discussed elsewhere in this review). However, the Ron Goodin power station is still in operation, and the retirement process has not commenced. Accordingly, the Commission considers this recommendation is still in progress.

Recommendation: Investigate alternatives to the Weddell power station constraint

NTPSPR: 2019-20 Pages: v and 23

A constraint imposed on the operation of the Weddell power station under certain load conditions due to thermal capacity limits in the network to allow for secure operation.

Relevant licensee or stakeholder: PWC System Control
PWC Power Services
Territory Generation

Status: In progress

The Commission understands that there are three transmission lines that export electricity from the Weddell power station, with two going to the Archer zone substation and one to the Strangways zone substation. The transmission line to the Strangways zone substation has a design thermal rating of 64 MVA, which is much lower than the 90 MVA rating of each of the two transmission lines to the Archer zone substation.

PWC Power Services has advised that work has been completed to improve the thermal rating of the transmission line to the Strangways zone substation, and final modelling has confirmed an improved rating of 82 MVA.

PWC System Control advised that it has been notified by PWC Power Services of the improved thermal rating and a review of the Weddell power station constraint will commence in May 2023.

As work is still ongoing, and the constraint has not yet been reviewed, the Commission considers this recommendation is still in progress.

Recommendation: Coordination of generation protection and network requirements

NTPSPR: 2019-20 Pages: vi and 48

The setting of protection limits for over and under voltage and frequency on generating units should always represent the capability of the generation units themselves rather than the power system limits. This recommendation relates mainly to Tennant Creek.

Relevant licensee or stakeholder:	PWC System Control
	PWC Power Services
	Territory Generation
Status:	In progress

This recommendation relates to the Tennant Creek power system. In terms of generation protection, Territory Generation has completed an audit of its generation protection at the Tennant Creek power station. The audit identified protection settings that require changes, with changes to be implemented following review and acceptance by PWC System Control.

In terms of network protection, PWC Power Services advised that it has completed a review of and implemented sensitive [earth] settings in the Tennant Creek network. Further, PWC Power Services has implemented a scheme on two network feeders to reduce the impact of network restoration post auto re-close on generators.

Both licensees have advised that despite the work, challenges in the Tennant Creek power system remain.

Given Territory Generation's audit identified protection setting changes are required, and these are still to be implemented, the Commission has assessed this recommendation as in progress.

Recommendation: Unusual system conditions – islanding investigation

NTPSPR: 2020-21 Pages: v and 22

It is recommended that PWC System Control, in consultation with PWC Power Services and relevant licensees, investigates the possible island or weakened areas of the network that can form in the aftermath of a contingency event and uses a risk-based approach to determine which of these scenarios require planning actions. Planning actions may take the form of constraints, network investment or localised ancillary service requirements, among others.

Relevant licensee or stakeholder: PWC System Control

Status: In progress

PWC System Control advised that work to address this recommendation is associated with a review of the Katherine islanding scheme, which is yet to be completed. Accordingly, the Commission considers this recommendation is yet to be completed.

Network low voltage supply

Recommendation: Management of low voltage supply voltages in Darwin-Katherine network

NTPSPR: 2018-19 Pages: vi and 28

The voltage quality statistics for the Darwin-Katherine network, and more specifically in the Katherine region, show supply voltages are trending towards the high end of the allowable spectrum.

Relevant licensee or stakeholder: PWC Power Services

Status: In progress

PWC Power Services advised that a project has been approved to install inductive compensation in the Katherine region to lower voltage on the Katherine zone substation busbar by absorbing reactive power, with the construction stage of the project expected to be completed by June 2024.

Given projects to address the management of low voltage supply voltages in the Darwin-Katherine power systems are underway, the Commission considers this recommendation to be in progress.

Recommendation: Management of voltage in Alice Springs

NTPSPR: 2019-20 Pages: vi and 42

A need for investigation of, and potential investment in, managing supply voltages in the low voltage parts of the distribution network in the Alice Springs power system.

Relevant licensee or stakeholder: PWC Power Services

Status: In progress

PWC Power Services advised that a project has been approved to construct a connection to the Lovegrove zone substation (expected to be completed by October 2023), which would allow the connection of a hired reactive power load bank to address unstable voltage conditions in low load periods.

Given steps to address the management of voltage in the Alice Springs power system have not been completed, the Commission considers this recommendation to be in progress.

Process

Recommendation: Manage testing and abnormal plant conditions

NTPSPR: 2018-19 Page: vi

Outage protocols including switching sheets, isolations and workspace delineation need greater focus from plant owners to ensure the number of inadvertent trips and faults are minimised.

Relevant licensee or stakeholder: Territory Generation

PWC Power Services

Status: In progress

Territory Generation advised all switching now requires a switching schedule, and it has increased the number of supervisory positions to concentrate on ensuring compliance.

Noting that PWC System Control carries out some network operator functions on behalf of PWC Power Services under a service level agreement, PWC Power Services advised that PWC System Control has developed an operating protocol for outage management.

Despite these actions, inadvertent switching of equipment both in terms of generation and networks, in some instances leading to interruptions of supply to customers, continued in 2021-22. On this basis, the Commission considers that the steps taken by relevant licensees to date are yet to address the issue sufficiently, and therefore the recommendation is assessed as in progress.

Recommendation: Unusual system conditions – focus on recovery phase

NTPSPR: 2020-21 Pages: vi and 53

It is recommended that the processes and procedures used for reconnection and incident recovery be reviewed. This review should include an assessment of the usefulness of each generating unit type for restart services under different conditions, the order of switching and communication, and coordination between PWC System Control, generators and field crews.

Relevant licensee or stakeholder: PWC System Control

Status: Complete

PWC System Control advised that reviews of the relevant documents are undertaken periodically as part of its document compliance system, with Black System Restart Procedures for Darwin-Katherine, Alice Springs and Tennant Creek power systems last reviewed in November 2022, which follows the Commission's recommendation. Further, PWC System Control advised that if processes or procedures are 'flagged' as a contributing factor (in an incident or event), they are reviewed out of cycle to ensure issues are addressed.

In terms of the review addressing the scope envisaged by the recommendation, PWC System Control advised:

> *System black events have a wide ranging set of causes, and restoration for each event can vary based on available plant at the time of event. The items listed here [in the recommendation] form part of the group of information that is noted as needing to be established on the day. At a high more generalised level each of those points are listed as technical issues to be managed during an event. Communication and Coordination factors are specified and have a dedicated section within the procedures.*

The Commission considers that as the Black System Restart Procedures for Darwin-Katherine, Alice Springs and Tennant Creek power systems have been reviewed following its recommendation, and communication and coordination-related matters are explicitly dealt with in the procedures, the recommendation is assessed as complete. However, while accepting that every event is different and all eventualities cannot be planned for, the Commission notes that the consideration of likely events and, to some extent unlikely events, ahead of an event occurring, can be valuable at reducing confusion, uncertainty and mistakes during an event, and ultimately help lower the impact of any such event on customers.

Customer service

Recommendation: Responsiveness to calls

NTPSPR: 2020-21 Pages: vi and 81

Following a decline in phone answering performance in 2020-21, including in relation to the average time taken to answer incoming calls and abandonment rate, it is recommended that PWC Power Services reviews its practices relating to call answering.

Relevant licensee or stakeholder: PWC Power Services

Status: Complete

Following the Commission making this recommendation in the 2020-21 NTPSPR, PWC revised its reporting in relation to its phone answering performance to account for inconsistencies and an improved methodology as part of its 2021-22 reporting. Specifically, the level of calls abandoned before being answered in 2020-21 was revised down from 35% of calls to 12% of calls. The average call waiting time of 55 seconds, which was a large jump from the previous year remains unchanged, but PWC Power Services has advised that this relates to the wide spread outage that occurred in the Darwin-Katherine power system due to a gas supply-related issue at the Channel Island power station (discussed elsewhere in this review).

While 12% of calls abandoned before being answered is a poor result in relation to 2020-21, performance improved in 2021-22, with the level of calls being abandoned reducing to 9% and the average call wait times reducing to 4 seconds, which is the lowest average call wait times over the last five years.

Given the revised result, and the additional context regarding the large increase in average call wait times in 2020-21, the Commission considers the recommendation is no longer warranted, and therefore is assessed as complete.

Appendix: Glossary

AER	Australian Energy Regulator
CSO	community service obligation
Customer minutes without supply	Number of minutes customers are without supply, calculated by multiplying the number of customers impacted by the duration of the incident
DNSP	distribution network service provider
EDL	EDL NGD (NT) Pty Ltd
EIP Code	Electricity Industry Performance Code
GSL	guaranteed service level
GWh	gigawatt hours
kV	kilovolt, 1 kV = 1 thousand volts
MVA	megavolt ampere
MW	megawatt, 1MW = 1 million watts
NEM	National Electricity Market
NTEOR	Northern Territory Electricity Outlook Report
NTPSPR	Northern Territory Power System Performance Review – this review
PWC	Power and Water Corporation
SAIDI	system average interruption duration index
SAIFI	system average interruption frequency index