Electricity Networks Access Code 2004

Service Standard Performance Report for the year ended 30 June 2021

30 September 2021

westernpower

Contents

1. Executive Summary 1

1.1 Performance summary 2

1.2 Introduction 2

1.3 Service Standard performance 3

2. Background 4

3. The structure of this Report 5

4. Reference services 6

4.1 Reference services for entry points 6

4.2 Reference services for exit points 6

4.3 Reference services for bi-directional points 8

4.4 Reference services at connection points (ancillary) 9

4.5 Reference services for Metering services 12

5. Current Service Standard Benchmarks 14

5.1 Distribution network Service Standards 14

5.1.1 SAIDI 14

5.1.2 SAIFI 15

5.1.3 Distribution network feeder classifications 15

5.1.4 Call centre performance 16

5.2 Transmission network Service Standards 16

5.2.1 Circuit Availability 16

5.2.2 LoSEF 17

5.2.3 Average Outage Duration 18

5.3 Street lighting repair time 18

5.3.1 Areas defined 18

5.4 Supply abolishment 19

5.5 Streetlight LED replacement service 19

6. Actual Service Standard performance 20

6.1 Summary of Service Standard performance 20

6.2 Distribution network 21

6.2.1 Distribution network – key strategies and activities 21

6.3 Transmission network 24

6.3.1 Transmission network – key strategies and activities 24

6.3.2 LoSEF for radial and meshed circuits 26
6.4 Street lighting repair time 27
6.5 Supply abolishment 27
6.6 Western Power Network Performance 27
6.7 Emerging Challenges 28
7. Exclusions from SSB performance 30
7.1 Distribution performance – SAIDI, SAIFI 30
7.1.1 Major Event Days (MEDs) 30
7.1.2 Transmission network interruptions 31
7.1.3 Other third-party network interruptions 32
7.1.4 Planned interruptions 32
7.1.5 Force Majeure 33
7.2 Distribution performance – Call centre performance 34
7.2.1 Abandoned calls – four seconds or less 34
7.2.2 Major Event Days 34
7.2.3 Extraordinary events 34
7.3 Transmission performance 34
7.3.1 Force Majeure 35
7.3.2 Planned interruptions - major construction work exceeding 14 days 35
7.4 Street lighting repair time 35
7.4.1 Force Majeure 35
7.4.2 Streetlights for which Western Power is not responsible for maintenance 36
8. $MAIFI_E$ 37
9. Service Standard Adjustment Mechanism 38
9.1 Overview 38
9.2 Actual performance 38
Appendix A Service Standard performance graphs – 2011/12 to 2020/21 39

1. Executive Summary

Western Power has prepared the Service Standard Performance Report (Report) as requested by the Economic Regulation Authority (ERA) under clause 11(3) of the Electricity Networks Access Code 2004 (Access Code). The report details Western Power's performance against the Service Standard Benchmarks (SSBs) defined in Western Power's current approved Access Arrangement (AA4). This report covers the period 1 July 2020 to 30 June 2021 (2020/21 period).

Of the 19 SSBs specified in AA4, 17 SSBs[1] are included in the Report for the 2020/21 period. During the 2020/21 period, Western Power's overall distribution and transmission network performance was above the required levels for 16 of the 17 SSBs, with only CBD, System Average Interruption Frequency Index (SAIFI) being below the required level. This was an improvement from 2019/20 where two SSBs (Urban and Rural Short, System Average Interruption Frequency Index SAIDI) were below the required level.

The improved performance was a result of targeted reliability improvement activities implemented in 2020/21, routine maintenance activities and an overall reduction in the interruptions across the network compared to 2019/20.

Although reliability performance improved on the distribution network in comparison to the 2019/20 period, environmental impacts on our network continue to contribute to the overall performance remaining below the Service Standard Targets (SSTs). Performance against SSTs enable Western Power to earn or incur financial rewards or penalties.

SSB performance is designed to measure the outcomes that customers value and which can be controlled and managed. To do so, events or circumstances that are outside of Western Power's control are excluded, including events such as force majeure. During the 2019/20 period, four events were classified as force majeure consisting of severe bushfire and weather events. In the 2020/21 period the trend in bushfires and severe weather events continued, with two events being classified as force majeure:

- January – March 2021 bushfires. The combined effect of eight concurrent and widespread bushfire events occurring between 2 January to 13 March 2021 caused extensive damage to the distribution network and put a significant strain on Emergency Services.
- Tropical Cyclone Seroja occurred on 11 and 12 April 2021, resulting in damaging winds (wind gusts up to 170km/h recorded near Kalbarri) and significant rain over a large geographic area approximately 700km long and 150km wide causing extensive network damage. The breadth and severity of Tropical Cyclone Seroja impacted supply to around 31,500 customers, with some customers without supply for up to 10 weeks.

Reliability performance was also impacted during Total Fire Ban (TFB) days declared by the Department of Fire and Emergency Services (DFES) which have been at an elevated level since 2019/20[2]. TFB days are declared on days when fires are most likely to threaten lives and property. This means Western Power takes appropriate additional precautions to eliminate or manage potential risks to the public and our people, which can lead to wider and longer power outages.

In parallel with these environmental challenges, the electricity landscape is undergoing unprecedented transformation from historical one-way power flows to two-way power flows, creating additional challenges to deliver the safe and reliable electricity service that the community expects. A growing

[1] The Remote De-energise and Remote Re-energise services were not provided in the 2020/21 period but expected to commence in the third quarter of the 2021/22 period.

[2] Source DFES Website - https://dfes.wa.gov.au/totalfirebans/Documents/TFB-Declarations-2015-2021.pdf

challenge for Western Power is low load and system stability, primarily due to the changing generation mix towards renewable generation and increased penetration of distributed energy resources such as rooftop photovoltaic (PV) systems on the network. System low load events on the South West Interconnected System (SWIS) are increasing in frequency and magnitude which creates a risk of widespread outages.

As such, Western Power continues to collaboratively work with industry stakeholders to manage and seek innovative ways to mitigate the risk of widespread outages that could occur in these challenging conditions.

This includes:

- working with the Australian Energy Market Operator (AEMO) and Energy Policy WA (EPWA) on immediate and longer-term actions to manage low load conditions
- seeking appropriate changes to the service standards in the fifth Access Arrangement (AA5), to remain relevant to represent the value of the service we provide to our consumers

Western Power continues to monitor the impacts from environmental and low load conditions, and the sustained impact on average performance as an input into how we can transform our network and meet the needs of our customers, to provide a service that is affordable, safe and reliable.

1.1 Performance summary

Western Power's overall distribution and transmission network performance was above the required levels for 16 of the 17 SSBs during the 2020/21 period:

Distribution Network - The reliability performance of the distribution network improved in 2020/21, with eight of the nine SSBs being met, compared to seven in 2019/20. Both SAIDI and SAIFI improved for all indicators in the 2020/21 period, apart from SAIFI Rural Long and SAIFI CBD.

A number of factors contributed to the improved performance including reductions in interruptions attributed to:

- emergency outages to remove hazards
- wind borne debris, birds and vegetation
- equipment faults

Transmission Network - All four transmission SSB's were achieved during the period. The performance of the transmission network improved in 2020/21 compared to the previous period for Loss of Supply events but deteriorated for Circuit Availability and Average Outage Duration.

1.2 Introduction

As a regulated business, Western Power is required to comply with a broad range of obligations. This Report presents information on Western Power's reliability performance against the Approved Fourth Access Arrangement (AA4).

In addition to the 19 SSBs specified in AA4, Western Power is required to report on three additional performance measures in this Report for each financial year:

- Momentary Average Interruption Frequency Index events ($MAIFI_E$) by feeder category as detailed in section 8
- Loss of Supply Event Frequency (LoSEF) – radial as detailed in section 6.3

- LoSEF - meshed as detailed in section 6.3

1.3 Service Standard performance

The minimum levels of service required of Western Power for the 2020/21 period are defined by the 17 applicable SSBs, covering distribution and transmission reliability and security of supply, call centre performance, street lighting performance, LED replacements, and supply abolishment.

Reliability of supply reflects the service Western Power provides to its customers and is a direct measure of the performance of its transmission and distribution networks. Western Power's performance against the SSBs applicable to the 2020/21 period is provided in section 6.

Western Power's obligations under its transmission and distribution licences require it to comply with the Access Code and meet the service levels defined by the SSBs and prepare a report annually on SSB performance as requested by the ERA.

2. Background

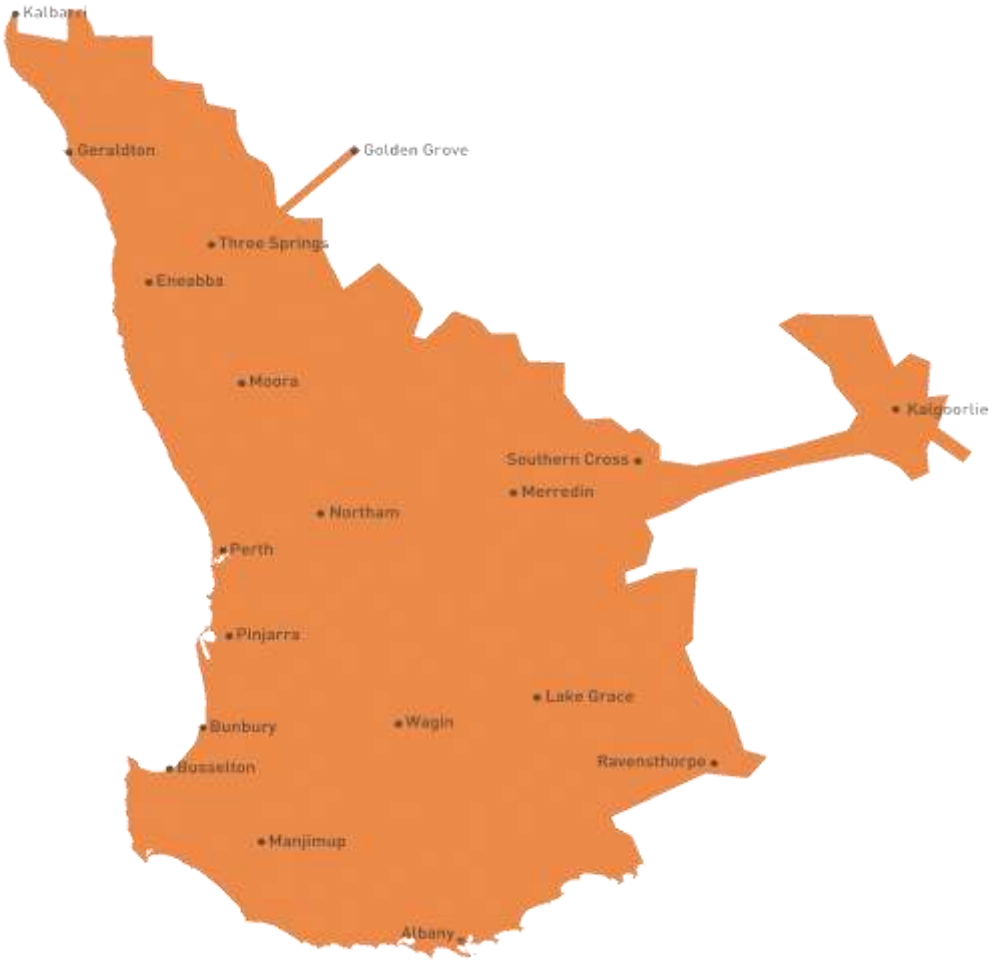
In accordance with section 11.1 of the Access Code, Western Power must provide reference services at a service standard at least equivalent to the SSBs set out in the access arrangement. Section 11.2 of the Access Code requires the ERA to annually publish Western Power's actual performance against the SSBs.

The purpose of this Report is to provide information on the actual Service Standard performance against the SSBs contained in Western Power's AA4, applicable for the 2020/21 period.

The Western Power Network is defined by the Access Code as the portion of the South West Interconnected Network (SWIN) that is owned by the Electricity Network Corporation trading as Western Power. For the purposes of this Report, the terms distribution network and transmission network are used in reference to the Access Code, the Electricity Distribution Licence (EDL1), the Electricity Transmission Licence (ETL2) and AA4.

The Western Power Network covers a geographic area from Kalbarri to Albany, and from Perth to Kalgoorlie (Figure 2.1) of 255,064 square kilometres. It has a diverse asset base which includes more than 825,000 poles and over 103,000 circuit kilometres of power lines. The distribution network consists of over 820 feeders, connected to the transmission network at 154 terminal and zone substations, providing an electricity supply to over 1,160,000 customers and over 276,000 streetlights.

Figure 2.1: Map of the Western Power Network Coverage



3. The structure of this Report

This Report is structured in accordance with the ERA's Report Template:

- Section 4 outlines and describes the reference services provided by Western Power relevant to the Access Code, section 11.1, within the AA4 period
- Section 5 outlines and describes the SSBs relevant for the AA4 period
- Section 6 outlines and describes the actual performance against the applicable AA4 SSBs for the 2020/21 period
- Section 7 outlines and describes the recognised exclusions defined for the AA4 SSBs
- Section 8 outlines and describes the recognised events known as Momentary Interruptions, or $MAIFI_E$
- Section 9 outlines and describes the application of the Service Standard Adjustment Mechanism (SSAM)
- Appendix A provides charts for each of the SSBs, with the trend of historical performance over a ten-year period
- The figures and tables throughout the Report include data for the following access arrangements:

AA4	AA3	AA2
2020/21	2016/17	2011/12
2019/20	2015/16	2010/11
2018/19	2014/15	
2017/18	2013/14	
	2012/13	

4. Reference services

Under AA4 and in accordance with the Access Code sections 5.1 and 11.1, Western Power provides the following reference services:

- Three reference services at entry points for users (entry services)
- 17 reference services at exit points for users (exit services)
- 15 bi-directional reference services at bi-directional points (bi-directional services)
- 10 reference services at connection points (ancillary services)
- 16 standard metering services as reference services

4.1 Reference services for entry points

An entry service is a covered service provided by Western Power at an entry point under which the user may transfer electricity into the network at the entry point.

An entry point is a point on a covered network identified as such in an access contract at which, subject to the access contract, electricity is more likely to be transferred into the network than transferred out of the network. Table 4.1 lists the network entry point reference services.

Table 4.1: Network entry point reference services

Reference Service		Reference Service Description
B1	Distribution Entry Service	An entry service combined with a connection service and a reference service (metering) on the distribution system.
B2	Transmission Entry Service	An entry service combined with a connection service and a reference service (metering) at an entry point on the transmission system.
B3	Entry Service Facilitating a Distributed Generation or Other Non-Network Solution	An entry service provided on the same basis as entry service B1 in circumstances where this service provides for facilities and equipment connected behind a connection point (including distributed generating plant and other non-network solutions) that results in Western Power's capital-related costs or non-capital costs reducing as a result of the entry point for the distributed generating plant or other non-network solution being located in that particular part of the covered network. Note: a 'thin connection' that involves the export of electricity onto the Western Power Network or the provision of another network support service may be eligible for this reference service.

4.2 Reference services for exit points

An exit service is a covered service provided by Western Power at an exit point under which the user may transfer electricity out of the network at the exit point.

An exit point is a point on a covered network identified as such in an access contract at which, subject to the access contract, electricity is more likely to be transferred out of the network than transferred into the network. Table 4.2 lists the network exit point reference services.

Table 4.2: Network exit point reference services

Reference Service		Reference Service Description
A1	Anytime Energy (Residential) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A2	Anytime Energy (Business) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A3	Time of Use Energy (Residential) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A4	Time of Use Energy (Business) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A5	High Voltage Metered Demand Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the high voltage (6.6 kV or higher) distribution system.
A6	Low Voltage Metered Demand Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A7	High Voltage Contract Maximum Demand Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the high voltage (6.6 kV or higher) distribution system.
A8	Low Voltage Contract Maximum Demand Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A9	Street lighting Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system for the purpose of public streetlighting, plus the service of the provision and maintenance of the streetlighting assets.
A10	Un-Metered Supplies Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A11	Transmission Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the transmission system.
A12	3 Part Time of Use Energy (Residential) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A13	3 Part Time of Use Energy (Business) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A14	3 Part Time of Use Demand (Residential) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.

Reference Service		Reference Service Description
A15	3 Part Time of Use Demand (Business) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A16	Multi Part Time of Use Energy (Residential) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.
A17	Multi Part Time of Use Energy (Business) Exit Service	An exit service combined with a connection service and a reference service (metering) at an exit point on the low voltage (415 volts or less) distribution system.

4.3 Reference services for bi-directional points

A bi-directional service is a covered service provided by Western Power at a bi-directional point under which the user may transfer electricity into and out of the network. A bi-directional point is a point on a covered network identified as such in an access contract at which, subject to the access contract, electricity is both transferred into the network and transferred out of the network. Table 4.3 lists the network bi-directional reference services.

Table 4.3: Network bi-directional reference services

Reference Service		Reference Service Description
C1	Anytime energy (residential) bi-directional service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C2	Anytime energy (business) bi-directional service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C3	Time of Use Energy (Residential) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C4	Time of Use Energy (Business) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C5	High Voltage Metered Demand Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the high voltage (6.6 kV or higher) distribution system.
C6	Low Voltage Metered Demand Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C7	High Voltage Contract Maximum Demand Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the high voltage (6.6 kV or higher) distribution system.

Reference Service		Reference Service Description
C8	Low Voltage Contract Maximum Demand Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C9	3 Part Time of Use Energy (Residential) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C10	3 Part Time of Use Energy (Business) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C11	3 Part Time of Use Demand (Residential) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C12	3 Part Time of Use Demand (Business) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C13	Multi Part Time of Use Demand (Residential) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C14	Multi Part Time of Use Demand (Business) Bi-directional Service	A bi-directional service combined with a connection service and a reference service (metering) at a bi-directional point on the low voltage (415 volts or less) distribution system.
C15	Bi-directional Service Facilitating a Distributed Generation or Other Non-Network Solution	A bi-directional service provided on the same basis as bi-directional services C1 to C14 (selected by the user) in circumstances where this service provides for facilities and equipment connected behind a connection point (including distributed generating plant and other non-network solutions) that results in Western Power's capital-related costs or non-capital costs reducing as a result of the entry point for the distributed generating plant or other non-network solution being located in that particular part of the covered network. {Note: a 'thin connection' that involves the export of electricity onto the Western Power Network or the provision of another network support service may be eligible for this reference service.}

4.4 Reference services at connection points (ancillary)

Western Power offers 10 services at a connection point as a reference service (ancillary). Table 4.4 lists the reference services at connection points (ancillary).

Table 4.4.4: Reference services at connection points (ancillary)

Reference Service		Reference Service Description
D1	Supply Abolishment Service	A service ancillary to an exit service, entry service or bi-directional service to permanently disconnect electricity supply, remove the meter and abolish the connection point.

Reference Service		Reference Service Description
D2	Capacity Allocation Swap (Nominator) (Business) Service	A service ancillary to: • exit services A7, A8 and A11; • entry services B1 and B2; and • bi-directional services C7 and C8 under which a user's contracted capacity is decreased at one or more connection points under its access contract and there is a corresponding increase in contracted capacity at one or more connection points under its own access contracts or connection points under another user's access contract for one or more intraday periods for a clearly specified period of time nominated by the user following which the contracted capacity under the user's access contract is reinstated.
D3	Capacity Allocation Swap (Nominee) (Business) Service	A service ancillary to: • exit services A7, A8 and A11; • entry services B1 and B2; and • bi-directional services C7 and C8 under which a user's contracted capacity is increased at one or more connection points under its access contract and there is a corresponding decrease in contracted capacity at one or more connection points under its own access contracts or connection points under another user's access contract for one or more intraday period for a clearly specified period of time nominated by the user following which the contracted capacity under the user's access contract is reinstated.
D4	Capacity Allocation Same Connection Point (Nominator) (Business) Service	A service ancillary to: • exit services A7, A8 and A11; • entry services B1 and B2; and • bi-directional services C7 and C8 under which a user's contracted capacity at a connection point is decreased under its access contract (expressed as a percentage of that contracted capacity (DSOC or CMD)) for a clearly specified period of time and there is a corresponding increase in contracted capacity to another user at the same connection point under its access contract. The allocated capacity is not further transferable or otherwise delegable. At the end of the specified period the contracted capacity under the user's access contract is reinstated.

Reference Service		Reference Service Description
D5	Capacity Allocation Same Connection Point (Nominee) (Business) Service	A service ancillary to: • exit services A7, A8 and A11; • entry services B1 and B2; and • bi-directional services C7 and C8 under which a user's contracted capacity is increased at a connection point under its access contract (expressed as the percentage of contracted capacity (DSOC or CMD) nominated pursuant to reference service D4) for a clearly specified period of time and there is a corresponding decrease in contracted capacity to the nominator user at the same connection point under its access contract. The allocated contracted capacity is not further transferable or otherwise delegable. At the end of the specified period the contracted capacity under the user's access contract is reinstated.
D6	Remote Direct Load Control Service	A service ancillary to: • exit services A1 to A8 and A12 to A17; and • bi-directional services C1 to C15 to send a command to an activated device for the control of a load at a connection point from a remote locality. The service does not include any site visits by Western Power.
D7	Remote Load Limitation Service	A service ancillary to: • exit services A1 to A8 and A12 to A17; and • bi-directional services C1 to C15 to remotely limit the load at a connection point through a Western Power meter. The service does not include any site visits by Western Power.
D8	Remote De-energise Service *(Expected to commence in 3rd quarter of 2021/22)*	A service ancillary to: • exit services A1 to A8 and A12 to A17; • entry service B1; and • bi-directional services C1 to C15 to de-energise a meter by removing supply voltage from all outgoing circuits on a non-permanent basis by a command sent to a meter from a remote locality. The service does not include any site visits by Western Power.
D9	Remote Re-energise Service *(Expected to commence in 3rd quarter of 2021/22)*	A service ancillary to: • exit services A1 to A8 and A12 to A17; • entry service B1; and • bi-directional services C1 to C15 to re-arm a previously de-energised meter by a command sent to a meter from a remote locality. The service does not include any site visits by Western Power.

Reference Service		Reference Service Description
D10	Streetlight LED Replacement Service	A service ancillary to: • Reference Service A9 – Streetlighting Exit Service to replace an existing streetlight luminaire with one of the LED luminaires specified in the price list.

4.5 Reference services for Metering services

Western Power offers 16 metering services as reference services. Table 4.5 provides a list of these metering services.

Table 4.5: Reference services at connection points (ancillary)

Reference Service		Reference Service Description
M1	Unidirectional, accumulation, bi-monthly, manual	Provision of accumulated energy data from an accumulation meter (uni-directional) or interval meter derived by way of a manual read on a bi-monthly basis.
M2	Unidirectional, accumulation (TOU), bi-monthly, manual	Provision of accumulated energy data for the time bands of the reference tariff for the underlying exit service from an accumulation meter (uni-directional) or interval meter derived by way of a manual read on a bi-monthly basis.
M3	Unidirectional, interval, bi-monthly, manual	Provision of interval energy data from an interval meter (uni-directional) derived by way of a manual read on a bi-monthly basis.
M4	Unidirectional, interval, monthly, manual	Provision of interval energy data from an interval meter (uni-directional) derived by way of a manual read on a monthly basis.
M5	Unidirectional, interval, bi-monthly, remote	Provision of interval energy data from an interval meter (uni-directional) derived via a communications network on a bi-monthly basis.
M6	Unidirectional, interval, monthly, remote	Provision of interval energy data from an interval meter (uni-directional) derived following the collection of the interval energy data via a communications network on a monthly basis.
M7	Unidirectional, interval, daily, remote	Provision of interval energy data from an interval meter (uni-directional) derived following the collection of the interval energy data via a communications network on a daily basis.
M8	Bidirectional, accumulation, bi-monthly, manual	Provision of accumulated energy data from an accumulation meter (bi-directional) or interval meter (bi-directional) derived by way of a manual read on a bi-monthly basis.
M9	Bidirectional, accumulation (TOU), bi-monthly, manual	Provision of accumulated energy data for the time bands of the reference tariff for the underlying bi-directional service from an accumulation meter (bi-directional) or interval meter (bi-directional) derived by way of a manual read on a bi-monthly basis.
M10	Bidirectional, interval, bi-monthly, manual	Provision of interval energy data from an interval meter (bi-directional) derived by way of a manual read on a bi-monthly basis.
M11	Bidirectional, interval, monthly, manual	Provision of interval energy data from an interval meter (bi-directional) derived by way of a manual read on a monthly basis.

Reference Service		Reference Service Description
M12	Bidirectional interval, bi-monthly, remote	Provision of interval energy data from an interval meter (bi-directional) derived following the collection of the interval energy data via a communications network on a bi-monthly basis.
M13	Bidirectional, interval, monthly, remote	Provision of interval energy data from an interval meter (bi-directional) derived following the collection of the interval energy data via a communications network on a monthly basis.
M14	Bidirectional, interval, daily, remote	Provision of interval energy data from an interval meter (bi-directional) derived following the collection of the interval energy data via a communications network on a daily basis.
M15	Unmetered supply, accumulation, bi-monthly, manual	Provision of the metering services set out in the Metering Code for a type 7 connection point.
M16	One off manual interval read	Provision upon request of interval energy data collected as a manual read from an accumulation meter.

5. Current Service Standard Benchmarks

In Western Power's approved Access Arrangement and in accordance with the Access Code section 11.2, Western Power has SSBs which it is required to monitor and meet each financial year. Of the 19 SSBs specified in AA4, 17 SSBs applied for the 2020/21 period and are reported on in this Report. This information is published in accordance with the Electricity Networks Access Code 2004 (Access Code).

In addition, Western Power is required to report on three additional performance measures in this Report:

- $MAIFI_E$ by feeder category
- LoSEF disaggregated by radial
- LoSEF disaggregated by meshed

5.1 Distribution network Service Standards

For the reference services A1 to A10, A12 to A17, B1 and B3, C1 to C15 and any applicable ancillary reference service D2 to D7, the SSBs are expressed in terms of:

- System Average Interruption Duration Index (SAIDI)
- System Average Interruption Frequency Index (SAIFI)
- Call centre performance – percentage of fault calls responded to in 30 seconds or less (after exclusions).

The SAIDI and SAIFI metrics are defined in accordance with the National Regulatory Reporting Requirements[3] (NRRR) and can be described as:

- SAIDI – Total number of minutes, on average, that a customer on a distribution network is without electricity in a year
- SAIFI – The average number of times a customer's electricity supply is interrupted per year.

5.1.1 SAIDI

SAIDI, measured over a 12-month period, by NRRR definition is the sum of the duration of each customer interruption (customer minutes interrupted) - lasting more than one minute, attributable solely to the distribution network (after exclusions), divided by the average of the total number of connected customers at the beginning and the end of the reporting period.

The unit of measure is minutes per year and the lower the minutes per year, the higher the level of service performance.

The following exclusions apply to SAIDI:

- A Major Event Day (MED) in accordance with the AA4 description
- Interruptions shown to be caused by a fault or other event on the transmission network or a third-party system (for instance, without limitation interruptions caused by an inter-trip signal, generator unavailability or a customer installation)
- Planned interruptions

[3] National Regulatory Reporting for electricity distribution and retail businesses, Utility Regulators Forum discussion paper, March 2002 © Commonwealth of Australia

- Force majeure events affecting the distribution system.

The SSBs expressed in terms of SAIDI for each year of the AA4 period are shown in Table 5.1.

Table 5.1: SAIDI SSBs for each year ending 30 June

SAIDI	Minutes per year
	SSB
CBD	33.7
Urban	130.6
Rural Short	215.4
Rural Long	848.3

5.1.2 SAIFI

SAIFI, measured over a 12-month period, by NRRR definition is the total number of customer interruptions, lasting more than one minute, attributable solely to the distribution network (after exclusions), divided by the average of the total number of connected customers at the beginning and the end of the reporting period.

The unit of measure is interruptions per year and the lower the number of interruptions per year, the higher the level of service performance. The exclusions for SAIDI discussed in section 5.1.1, also apply to SAIFI. The SSBs expressed in terms of SAIFI for each year of the AA4 period are shown in Table 5.2.

Table 5.2: SAIFI SSBs for each year ending 30 June

SAIFI	Interruptions per year
	SSB
CBD	0.21
Urban	1.27
Rural Short	2.34
Rural Long	5.70

5.1.3 Distribution network feeder classifications

The feeder classification, consistent with the NRRR, applied to Western Power's distribution network and used to report Service Standards performance in accordance with AA4, include: CBD, Urban, Rural Short and Rural Long. Definitions are provided in Table 5.3.

Table 5.3: Feeder classifications

Feeder Category	Description
CBD	A feeder supplying predominantly commercial, high-rise buildings, supplied by a predominantly underground distribution network containing significant interconnection and redundancy when compared to urban areas

Feeder Category	Description
Urban	A feeder, which is not a CBD feeder, with actual maximum demand over the reporting period per total feeder route length greater than 0.3 MVA/km
Rural Short	A feeder which is not a CBD or urban feeder with a total feeder route length less than 200 km
Rural Long	A feeder which is not a CBD or urban feeder with a total feeder route length greater than 200 km

5.1.4 Call centre performance

Call centre performance, measured over a 12-month period, is the number of fault calls responded to in 30 seconds or less (after exclusions), divided by the total number of fault calls.

The unit of measure is percentage of calls per year and the higher the percentage of calls per year, the higher the level of service performance.

The following exclusions apply to call centre performance:

- Calls abandoned by a caller in four seconds or less of their postcode being automatically determined or when a valid postcode is entered by the caller
- Calls abandoned by a caller in 30 seconds or less of the call being placed in the queue to be responded to by a human operator
- All telephone calls received on a MED which is excluded from SAIDI and SAIFI
- A fact or circumstance beyond the control of Western Power affecting the ability to receive calls to the extent that Western Power could not contract on reasonable terms to provide for the continuity of service.

The SSB expressed in terms of call centre performance for each year of the AA4 period is shown in Table 5.4.

Table 5.4: Call centre performance SSB for each year ending 30 June

Call centre performance	Percentage of calls per year
	SSB
	86.8%

5.2 Transmission network Service Standards

In respect of the reference services A11 and B2 available to users directly connected to the transmission network, the SSBs are described below.

5.2.1 Circuit Availability

Circuit Availability is the availability of the transmission network and is measured by the actual number of hours the transmission network circuits are available, divided by the total possible hours available (after exclusions).

The unit of measure is percentage of hours per year and the higher the percentage of hours per year, the higher the level of service performance.

The following exclusions apply to circuit availability:

- Interruptions affecting the transmission system shown to be caused by a fault or other event on a third-party system (for instance, without limitation interruptions caused by an inter-trip signal, generator unavailability or a customer installation)
- Force majeure events affecting the transmission system
- Duration of planned interruptions for major construction work, including periods where availability is temporarily restored, is to be capped at 14 days in calculating transmission line availability.

The SSB expressed in terms of Circuit Availability for each year of the AA4 period is shown in Table 5.5.

Table 5.5: Circuit Availability SSB for each year ending 30 June

Circuit Availability	Percentage of hours per year
	SSB
	97.8%

5.2.2 LoSEF

LoSEF is the frequency of unplanned customer interruption events where the loss of supply:

- exceeds 0.1 but less or equal to 1.0 System Minutes Interrupted
- exceeds 1.0 System Minutes Interrupted.

The unit of measure is the number of events per year and the lower the number of events per year, the higher the level of service performance.

When calculating LoSEF for the financial year ending 30 June 2020 and each financial year thereafter, "System Peak MW" is the maximum peak demand recorded for the South West Interconnected System for the previous year, excluding the coincident demand for those customers receiving a non-reference service, where the impact of an Unplanned Customer outage event is excluded for the purpose of this measure.

The following exclusions apply to System Minutes Interrupted:

- Planned interruptions
- Momentary interruptions (less than one minute)
- Unregulated transmission assets
- Interruptions affecting the transmission system shown to be caused by a fault or other event on a third-party system (for instance, without limitation interruptions caused by an inter-trip signal, generator unavailability or a consumer installation)
- Force majeure events affecting the transmission system.

The SSBs expressed in terms of LoSEF for each year of the AA4 period are shown in Table 5.6.

Table 5.6: LoSEF SSBs for each year ending 30 June

LoSEF	Number of events per year
	SSB
>0.1 & ≤1.0 System Minutes Interrupted	26
> 1.0 System Minutes Interrupted	7

5.2.3 Average Outage Duration

Average Outage Duration is the total number of minutes duration of all unplanned interruptions on the transmission network divided by the number of unplanned interruption events (after exclusions). The unit of measure is minutes per year and the lower the minutes per year, the higher the level of service performance.

The exclusions that apply to LoSEF also apply to Average Outage Duration. In addition, the exclusion applies for reactive compensation plant, and any event contributing to Average Outage Duration is capped at 14 days.

The SSB expressed in terms of Average Outage Duration for each year of the AA4 period is shown in Table 5.7.

Table 5.7: Average Outage Duration SSB for each year ending 30 June

Average Outage Duration	Minutes per year
	SSB
	1,234

5.3 Street lighting repair time

For the reference service A9, the SSBs are expressed in terms of street lighting repair time.

Street lighting repair time is the average number of business days to repair a faulty streetlight. The unit of measure is the average number of business days. The lower the average number of business days, the higher the level of service performance.

The following exclusions apply to street lighting repair time:

- Force majeure events
- Streetlights for which Western Power is not responsible for maintenance.

The SSBs expressed in terms of street lighting repair time for each year of the AA4 period are shown in Table 5.8.

Table 5.8: Street lighting repair time SSBs for each year ending 30 June

Street lighting repair time	SSB – average number of business days
Metropolitan area	5
Regional area	9

5.3.1 Areas defined

The areas for street lighting repair times are defined as follows:

Metropolitan area

Areas of the State defined in the *Code of Conduct for the Supply of Electricity to Small Use Customers 2018*.

Regional area

All areas in the Western Power Network other than the metropolitan area.

5.4 Supply abolishment

For the reference service D1, the SSB is expressed in terms of response time.

Supply abolishment response time is the average number of business days to abolish supply. The unit of measure is average number of business days and the lower the average number of business days, the higher the level of service performance.

The following exclusions apply to supply abolishment response time:

- Supply abolishment requests that:
  - are cancelled or are requested to be deferred;
  - relate to non-whole current meters or non-standard technical configurations, site access issues or safety issues;
  - require external approvals or actions beyond the control of Western Power as a *reasonable and prudent person*; or
- A fact or circumstance beyond the control of Western Power as a *reasonable and prudent person* affecting the ability to abolish supply.
- Force majeure events affecting the ability to abolish supply.

The SSB expressed in terms of supply abolishment response time for each year of the AA4 period is shown in Table 5.9.

Table 5.9: Supply abolishment response time SSB for each year ending 30 June

Supply abolishment response time	SSB – average number of business days
Supply abolishment response time	15

5.5 Streetlight LED replacement service

For the reference service D10 the SSB is the LED replacement, requested by the user, will be completed as soon as reasonably practicable in accordance with good electricity industry practice.

Similar to 2019/20, Western Power was not requested to perform this service during the 2020/21 period. However, Western Power has held discussions with several Local Government Authorities (LGAs) seeking streetlight LED replacement services and due to rising level of interest shown by the LGAs, this service will continue to be offered in 2021/22.

6. Actual Service Standard performance

6.1 Summary of Service Standard performance

The Service Standard performance is detailed in Table 6.1.

Table 6.1: Service Standard performance summary for the 2020/21 period

			SSB 2018/19 onwards	2016/17 actual AA3	2017/18 actual AA3	2018/19 actual AA4	2019/20 actual AA4	2020/21 AA4	
								Actual	SSB met
Distribution	SAIDI	CBD	≤ 33.7	13.8	1.3	14.7	22.8	14.1	✓
		Urban	≤ 130.6	104.4	104.5	106.1	134.3	118.0	✓
		Rural Short	≤ 215.4	175.6	151.9	179.3	218.3	210.2	✓
		Rural Long	≤ 848.3	626.2	718.1	712.3	737.7	713.5	✓
	SAIFI	CBD	≤ 0.21	0.11	0.04	0.11	0.20	0.26	×
		Urban	≤ 1.27	1.02	1.03	0.97	1.14	1.13	✓
		Rural Short	≤ 2.34	1.76	1.59	1.79	2.11	1.94	✓
		Rural Long	≤ 5.70	3.95	3.96	4.02	3.77	4.25	✓
	Call Centre Performance - %		≥ 86.8	91.8	91.7	91.7	92.6	91.9	✓
Transmission	Circuit Availability - %		≥ 97.8	98.9	99.1	98.7	98.8	98.5	✓
	Loss of Supply Events	>0.1 & ≤1.0 SMI	≤ 26	16	11	13	15	13	✓
		>1.0 SMI	≤ 7	2	6	2	3	2	✓
	Average Outage Duration		≤ 1,234	653	560	523	751	1,027	✓
Streetlights	Metropolitan area - business days		≤ 5	2.47	3.06	4.82	4.53	4.83	✓
	Regional area - business days		≤ 9	4.59	7.00	8.15	6.77	7.33	✓
	LED Replacements		Note[4]			N/A	N/A	N/A	
	Supply Abolishment - business days		≤ 15			N/A	3.36	2.54	✓
	Remote de-energise - business day		≤ 1			N/A	N/A	N/A	
	Remote re-energise - business day		≤ 1			N/A	N/A	N/A	

[4] For the reference service D10 the Service Standard Benchmark is the LED replacement, requested by the user, will be completed as soon as reasonably practicable in accordance with good electricity industry practice. During the 2020/21 period, Western Power was not requested to perform this service.

Two SSBs were not reported on in 2020/21, metering remote de-energise and remote re-energise. Western Power is currently unable to provide these services and is working on having an IT solution implemented and the services are expected to be available in the third quarter of the 2021/22 period.

6.2 Distribution network

During the 2020/21 period, Western Power's overall distribution performance was above the required levels for eight of the nine distribution SSBs. The measure below the required level was SAIFI CBD. CBD average performance is highly volatile over time due to the combined effects of lower number of outages, fewer connections, and the relatively long repair time for faults in an underground CBD network. CBD SAIFI performance is expected to be better than the required level in future years but there remains an ongoing risk that CBD performance may go below the required level in some years.

The reliability performance of the distribution network improved in 2020/21 compared to the previous period, with both SAIDI and SAIFI improving for all indicators apart from SAIFI Rural Long and SAIFI CBD.

There have been a number of factors that influenced the overall improved performance in 2020/21 including reductions in interruptions attributed to:

- emergency outages to remove hazards
- wind borne debris, birds and vegetation, and
- equipment faults

6.2.1 Distribution network – key strategies and activities

Key strategies and routine activities continued to be implemented during the 2020/21 period to maintain network reliability of supply.

Routine maintenance

This activity involves Western Power's routine and targeted asset inspection, maintenance programs, and monitoring of assets. This is done in conjunction with vegetation management plans, as well as the replacement of deteriorating assets and defective assets, such as poles, conductors and switching equipment. The objective of routine and targeted maintenance is to reduce public safety risk and to maintain reliability performance.

Grid augmentation

This activity involves additional capital work such as network modification or installation of new assets. Specific areas may be targeted based on their long-term reliability performance and underlying reliability risk factors. The nature of augmentation will depend on systemic factors that negatively affect reliability and the suitability of options at that location on the network. Possible options under this strategy include:

- installing new interconnections between parts of the network to facilitate the transfer of customer connections to different points on the network (reducing supply interruption duration), and extensive automation of existing interconnections to allow nearly instantaneous transfer
- replacing overhead power lines with covered conductor or underground cables (to reduce the risk of a live electrical conductor contacting a foreign body and causing a supply interruption)

- augmenting or upgrading the distribution feeders, to ensure there is sufficient load carrying capacity, and that the assets are in an adequate (serviceable) condition to meet customer needs
- investigating and utilizing new technology that is expected to improve the customer experience, such as microgrids, automation, standalone power systems, portable generation connecting transformers (injection units), battery energy storage systems, fast communication links and protection devices.

Targeted activities

Several targeted reliability activities were undertaken during the 2020/21 period:

- Targeted equipment repairs were brought forward to increase the speed and operability of automated fault restoration systems.
- Network reconfiguration was implemented and performance improvements were realised towards the end of 2020/21 and will remain in place for the first half of the 2021/22 period.
- Transmission planned outages process has been advanced to reduce the impact on distribution network flexibility.
- Engagement continued with Western Power customers to improve the process of updating keys and contacts of commercial tenants of CBD buildings which contain Western Power equipment. This will allow Western Power staff to readily access equipment in fault situations and expedite response and restoration times.
- Continued with the deployment of Fuse Saver technology to reduce sustained outages on radial spurs.
- Temporary deployment of generators for selected reliability hot spots. In the 2020/21 period, temporary islanded networks were created for some periods of time in the towns of Kalbarri and Mullewa, and portable generators were deployed to Margaret River to support the network supply.

A significant number of network reconfiguration and optimisation projects for Rural Short feeders have been investigated and are scheduled for implementation during the 2021/22 period. It is expected that network performance benefits from these projects will be realised from 2022/23 onwards.

Strategies for the management of distribution underground cables were reviewed in the 2020/21 period. The revised strategy deployment activities including data acquisition and building up capability to carry out targeted testing will be a focus for the 2021/22 period.

Table 6.2: Distribution performance and commentary for the AA4 2020/21 period

Service Standard	SSB	2019/20	2020/21	Comments
		Actual	Actual	
CBD SAIDI	33.7	22.8	14.1	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. The primary contributors to improved performance were fewer interruptions attributed to unknown causes and equipment failure. Note: The CBD SAIDI performance is volatile over a short period of time due to the combined effects of fewer connections and the relatively long repair time for fault in an underground CBD network.

Service Standard	SSB	2019/20	2020/21	Comments
		Actual	Actual	
				To limit this volatility and to meet the expected high performance of the CBD network, customers have been engaged to improve Western Power access to equipment in private buildings. Targeted equipment repairs have been executed in the 2020/21 period and further automation of equipment is underway to enhance automated restoration of customers (to be continued throughout the AA4 period).
Urban SAIDI	130.6	134.3	118.0	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. A change in equipment repair processes took place in the second half of the 2019/20 period to increase the speed and operability of automated fault restoration systems. This contributed to the improved performance during the 2020/21 period.
Rural Short SAIDI	215.4	218.3	210.2	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. The primary contributor to the improvement in performance was the reduction in emergency outages to remove hazards. The root causes of emergency outages to remove hazards includes (but not limited to) vegetation, equipment failure and third-party impact on the network. Network reconfigurations were actioned in the second half of the 2020/21 period to minimise the impact of outages on customers. Further network reconfiguration and augmentation projects have been initiated in the 2021/22 period, and their benefits will be realised in the 2022/23 period. A change in equipment repair processes took place in the second half of the 2019/20 period to increase the speed and operability of automated fault restoration systems. This contributed to the improved performance during the 2020/21 period.
Rural Long SAIDI	848.3	737.7	713.5	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. The primary contributor to the improvement in performance was the reduction in outages due to unknown causes, and emergency outages to remove hazards.
CBD SAIFI	0.21	0.20	0.26	Performance was below the AA4 benchmark and declined compared to the 2019/20 period. There has been a rise in the number of interruptions from Feeder circuit breaker trips, resulting in the number of customers interrupted per fault increasing. - The rise in the actual feeder trips is attributed to underground cable failures (directly and indirectly), human error and impacts from tools and machinery (e.g., digging into cables).

Service Standard	SSB	2019/20	2020/21	Comments
		Actual	Actual	
				- The rise in the number of interrupted customers per fault is attributed to planned outages, inoperability of switching equipment and equipment defects, which diminished the network switching flexibility. Note: The CBD SAIFI performance is volatile over a short period of time due to the combined effects of fewer connections and the relatively long repair time for fault in an underground CBD network. Strategies for the management of distribution underground cables were reviewed in the 2020/21 period, and the revised strategy deployment activities, along with asset failure monitoring, will be a focus for the 2021/22 period.
Urban SAIFI	1.27	1.14	1.13	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. The primary contributor to improved performance was the reduction of interruptions attributed to equipment failure.
Rural Short SAIFI	2.34	2.11	1.94	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. The primary contributor to the improvement in performance was a reduced number of emergency outages to remove hazards.
Rural Long SAIFI	5.70	3.77	4.25	Performance exceeded the AA4 benchmark but declined compared to the 2019/20 period. The primary contributors to the reduced performance were increases in the customer impact of interruptions attributed to lightning activity and equipment failure.
Call centre performance	86.8%	92.6%	91.9%	The 2020/21 performance exceeded the AA4 benchmark but declined compared to the 2019/20 period. The decline in performance was due to an isolated technical issue related to an IT upgrade of the automated systems that are used to keep customers informed during power outages. The issue was quickly resolved.

6.3 Transmission network

All transmission SSBs were achieved in the 2020/21 period. Factors primarily contributing to performance are detailed in Table 6.3.

6.3.1 Transmission network – key strategies and activities

Key strategies and routine activities continued to be undertaken during the 2020/21 period to maintain or deliver targeted improvements in the performance of the transmission network.

Routine and targeted maintenance

This activity involves Western Power's routine and targeted asset inspection, maintenance programs, and monitoring of assets. This is done in conjunction with vegetation management plans, as well as the replacement of deteriorating assets and defective assets, such as poles and conductors. The objective of routine and targeted maintenance is to positively influence reliability performance and reduce public safety risk.

Western Power has continued to improve maintenance planning and coordination across planned outages to reduce adverse impacts on transmission circuit availability.

Operational response

Western Power expedites the restoration of faulted regulated circuits by employing proactive measures such as on-call network switching resources and/or additional resources.

The restoration of customers via the distribution system, where available, helps to maintain performance within the relevant benchmarks.

Table 6.3: Transmission performance and commentary for the 2020/21 period

Service Standard	SSB	2019/20	2020/21	Comments
		Actual	Actual	
Circuit Availability	97.8%	98.8%	98.5%	Performance exceeded the AA4 benchmark but declined compared to the 2019/20 period.
LoSEF >0.1 and ≤1.0 System Minutes Interrupted	<26	15	13	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period. The restoration of customers via the distribution system helped to maintain performance within the benchmark.
LoSEF >1.0 System Minutes Interrupted	<7	3	2	Performance exceeded the AA4 benchmark and was an improvement on the 2019/20 period.
Average Outage Duration	1,234	751	1,027	Performance exceeded the AA4 benchmark but declined compared to the 2019/20 period. A number of reasons contributed to the decline in performance, including: • unavailability of spares and specialized resources due to the impact of Covid-19 • storm activity affecting a number of transmission lines • environmental clean-up of a transformer oil leak at Southern Terminal • additional work identified to safely operate the network due to equipment condition.

The significant events under the LoSEF for the 2020/21 period are detailed in Tables 6.4 and 6.5.

Table 6.4: LoSEF >1.0 SMI for the 2020/21 period

Events	Date	Load Area	Network Configuration	System Minutes	Connected Load MW	Contributing Factor
1	30/12/2020	PIC	Mesh	1.004	26.99	Bushfire
2	18/01/2021	NC	Mesh	1.583	15.25	Unknown
EC=East Country, EGF=Eastern Goldfields, GSR=Great Southern Region, NC=North Country, PIC=Picton, CT=Cannington, SF=South Fremantle, NT=Northern Terminal, WT=Western Terminal						

Table 6.5: LoSEF >0.1 & ≤1.0 SMI for the 2020/21 period

Events	Date	Load Area	Network Configuration	System Minutes	Connected Load MW	Contributing Factor
1	16/08/2020	MH	Mesh	0.275	13.36	Distribution Equipment
2	17/09/2020	CBD	Mesh	0.176	5.02	Distribution Equipment
3	9/11/2020	NT	Mesh	0.539	12.27	CB:Failure
4	8/01/2021	PIC	Mesh	0.365	23.24	TX: Oil/Gas/Pressure
5	11/01/2021	PIC	Mesh	0.168	16.62	TX: Oil/Gas/Pressure
6	6/02/2021	GSR	Mesh	0.308	5.62	Protection Failure
7	3/03/2021	SF	Mesh	0.141	6.65	Protection Failure
8	4/03/2021	EGF	Mesh	0.984	94.18	Lightning/Thunderstorms
9	19/03/2021	CT	Mesh	0.173	6.65	Bird/Animal/Insect
10	23/03/2021	MH	Mesh	0.127	6.13	Distribution Equipment
11	22/05/2021	GSR	Mesh	0.331	6.13	Distribution Equipment
12	10/06/2021	PIC	Mesh	0.245	4.84	Unknown
13	26/06/2021	NT	Mesh	0.233	6.78	CB: Overload (Thermal/Current)
EC=East Country, EGF=Eastern Goldfields, GSR=Great Southern Region, NC=North Country, PIC=Picton, CT=Cannington, SF=South Fremantle, NT=Northern Terminal, WT=Western Terminal, MH = Mandurah						

6.3.2 LoSEF for radial and meshed circuits

Western Power does not have SSB measures for LoSEF for radial and meshed circuits.

As shown in Table 6.4, two (2) events for LoSEF >1.0 SMI were in the meshed transmission networks, with none in the radial transmission network. Also, as illustrated in Table 6.5, for LoSEF >0.1 SMI and ≤1.0 SMI in the 2020/21 period, all 13 events were in the meshed transmission network.

In the classification of radial and meshed transmission networks for the purposes of this Report, the 220kV circuit between Muja Terminal and Merredin Terminal is classified as a radial transmission network circuit due to the protection scheme installed which results in a trip to the whole 220kV line in the event of any fault on the Muja to Merredin lines.

6.4 Street lighting repair time

Table 6.6: Street lighting repair time performance and commentary for the 2020/21 period

Service Standard	2020/21		Comments
	SSB	Actual	
Metropolitan area	≤ 5 business days	4.83	Performance was within the AA4 Benchmark of 5 busines days but declined compared to the 2019/20 period (4.53 average business days). Performance was impacted due to reallocation of resources to aid with bushfire remediation work.
Regional area	≤ 9 business days	7.33	Performance was within the AA4 Benchmark of 9 business days but declined compared to the 2019/20 period (6.77 average business days). Performance was impacted due to reallocation of resources to aid with bushfire remediation work and with recovery from storm damage.

6.5 Supply abolishment

Table 6.7: Supply abolishment response time performance and commentary for the 2020/21 period

Service Standard	2020/21		Comments
	SSB	Actual	
All areas	≤ 15 business days	2.54	The average performance exceeded the AA4 Benchmark of 15 business days and was an improvement from the 2019/20 actual of 3.36 days

6.6 Western Power Network Performance

Western Power does not have an SSB measure for the total network. As shown in Table 6.8 and Figures 6.1 and 6.2, the reliability performance of the distribution network for the 2020/21 period improved compared to the previous year, with both the duration of outages and the frequency of interruptions having reduced.

The improved performance was a result of an overall reduction in the interruptions across the network, and the various routine activities and targeted strategies identified in section 6.2.1.

Table 6.8: Overall reliability performance of the network

		2019/20	2020/21
Distribution	SAIDI	208.8	193.8
	SAIFI	1.63	1.62

Figure 6.1: Distribution network SAIDI (10-year history)

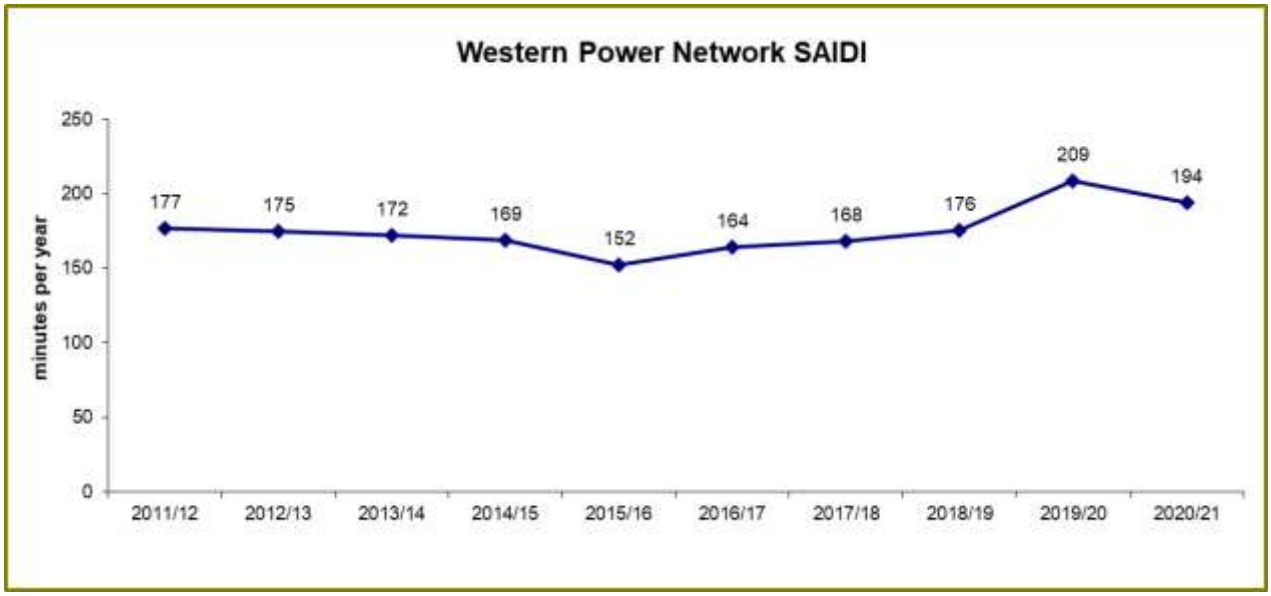
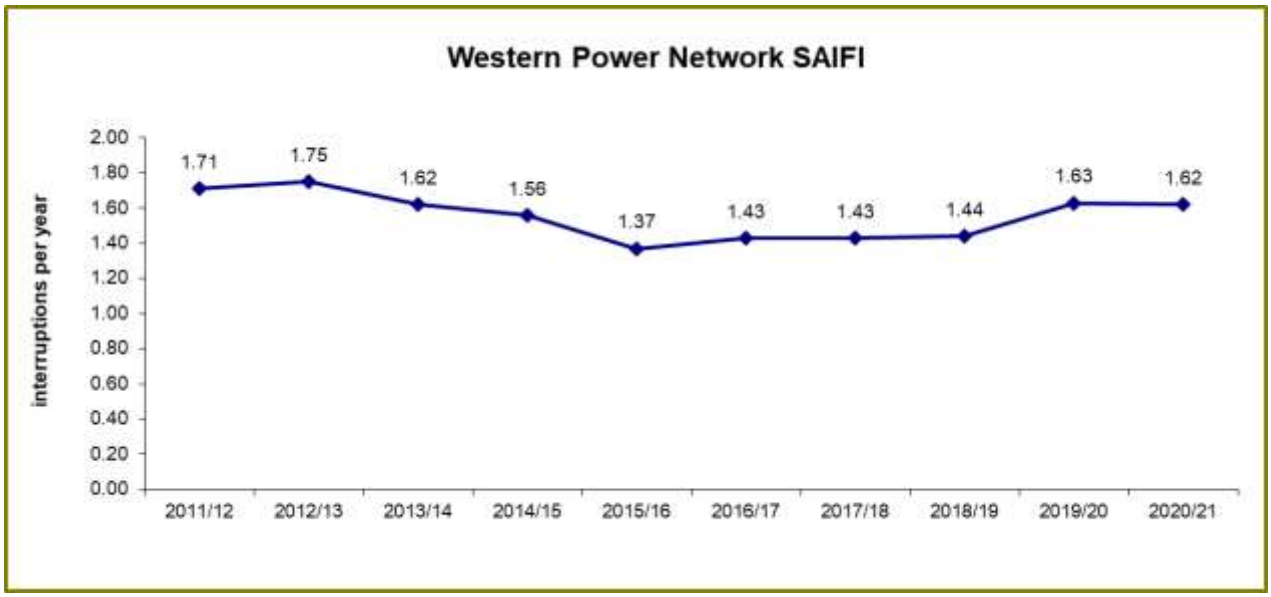


Figure 6.2: Distribution network SAIFI (10-year history)



6.7 Emerging Challenges

The 2019/20 period was impacted by a high bushfire season and an increased number of severe weather events, including four events being classified as force majeure. In the 2020/21 period the trend in bushfires and severe weather events continued, with a series of concurrent bushfire events occurring between January – March 2021, Tropical Cyclone Seroja in April 2021 and storm activity in June 2021 affecting the Great Southern region. These events caused extensive damage to the Western Power overhead network and resulted in a loss of supply to thousands of customers across the network.

Reliability performance was also impacted during Total Fire Ban (TFB) days declared by the Department of Fire and Emergency Services (DFES) which continued to be at an elevated level since 2019/20. TFB days are declared on days when fires are most likely to threaten lives and property. This means Western Power takes appropriate additional precautions to eliminate or manage potential risks to the public and our people, which can lead to wider and longer power outages.

In addition to these environmental changes, the need for two-way power flows, compared to historical one-way flows, creates additional challenges to deliver the safe and reliability electricity service that our community expects. A growing challenge for Western Power is low load and system stability, primarily due to the changing generation mix towards renewable generation and increased penetration of distributed energy resources such as rooftop photovoltaic (PV) systems on the network. System low load events on the South West Interconnected System (SWIS) are increasing in frequency and magnitude which creates a risk of widespread outages.

Western Power is working with Energy Policy WA and AEMO on immediate to longer-term actions. This includes determining the implications of increasingly lower SWIS demand events and understanding when significant system risks may be expected to occur, to inform the development and implementation of efficient responses. Some key actions have already been implemented to mitigate the pressing issues (such as new WP reactors, AEMO control room tools, new load on the power system), and a number of shorter-term mitigations have been put forward and will continue to be enhanced (such as further investment in reactors, revised inverter standards, Generator Performance Standard Framework, and DER Register).

Further to the environmental and low load conditions above, energy market reforms[5] are currently underway to address the broader challenges impacting the Western Australian energy landscape. On 9 August 2021, the ERA published its final decision on the framework and approach for Western Power's fifth access arrangement (AA5). This included some decisions relating to the methodology for setting SSBs in AA5 and the Service Standard Adjustment Mechanism (SSAM), which is the financial incentive scheme in which Western Power earns or incurs financial rewards or penalties based on its performance against SSTs. Some of the key decisions impacting SSBs included:

- New exclusion (in the relevant SSBs) of load interruptions caused or extended by TFBs or direction from a local, state or federal government bodies, where a fault or operation of the network did not cause, in whole or part, the event giving rise to the direction
- Removal of the *Force Majeure* exclusion from SAIDI and SAIFI service standards as it is will be covered by Major Event Day and new exclusion mentioned above
- Removal of exclusion for transmission unplanned interruptions affecting reliability of the distribution system
- Removal of Transmission Circuit Availability as an SSB as it does not measure the actual service provided to customers

Western Power will seek for the AA5 SSBs and SSAM to remain relevant to represent the value of the service we provide to our customers.

[5] Energy Transformation Strategy is the Western Australian Government's strategy to ensure the delivery of secure, reliable, sustainable and affordable electricity to Western Australian for years to come, to respond to the energy transformation underway and to plan for the future of our power system. https://www.wa.gov.au/organisation/energy-policy-wa/energy-transformation-strategy

7. Exclusions from SSB performance

As outlined in section 5, the Service Standards provide for certain events to be excluded from the distribution, transmission, street lighting, supply abolishment and remote de-energise and remote re-energise reference service performance.

7.1 Distribution performance – SAIDI, SAIFI

Based on the exclusions described in section 5.1.1, for the 2020/21 period, the distribution performance Service Standards in terms of SAIDI and SAIFI excluded the interruptions described below.

7.1.1 Major Event Days (MEDs)

The MEDs excluded are classified in accordance with the description provided in the Approved Access Arrangement (AA4).

The Box-Cox transformation method has been applied to the daily unplanned SAIDI data set to determine the major event day threshold for each financial year of AA4 to date (2017/18 to 2020/21). The test of whether the logarithms of the data set are not normally distributed was completed as part of the AA4 submission, with the Box- Cox transformation lambda value determined as -0.06. This Box-Cox transformation with a lambda of -0.06 is consistently applied to determine the major event day threshold throughout the AA4 period, using the previous 5 financial years of daily unplanned distribution SAIDIs.

There were four days during the 2020/21 period that exceeded the daily MED threshold of 6.48 minutes.

Table 7.1 illustrates:

- SAIDI (minutes per year) and SAIFI (interruptions per year), which have been excluded from the 2020/21 period due to these four MEDs.
- Call centre performance (percentage of calls per year), which is the percentage number of fault calls responded to in 30 seconds or less against the total number of fault calls during these four MEDs.

Table 7.1: SAIDI, SAIFI and call centre performance exclusions due to MEDs

		2016/17	2017/18	2018/19	2019/20	2020/21
SAIDI	CBD	0	0	0	2.25[6]	0
	Urban	35	52	11	117	29
	Rural Short	30	157	28	192	224
	Rural Long	133	330	130	629	1,655
SAIFI	CBD	0	0	0	0	0
	Urban	0.13	0.08	0.07	0.44	0.03
	Rural Short	0.12	0.40	0.12	0.49	0.08
	Rural Long	0.23	0.61	0.36	1.53	0.23

[6] The comparative number for 2019/20 has been adjusted to account for a small number of feeders not included in the reporting for the period. The previous number was incorrectly shown as 0 but should have been 2.25.

Call centre performance	91.8%	96.1%	92.1%	89.9%	94.3%

February 1, 2021

(SAIDI = 13.1 minutes, SAIFI = 0.006 interruptions, call centre performance = 95.5%)

Around 7,300 customers were interrupted for an average of nearly one day and 11 hours across the Western Power network (most of the affected customers were in the Perth Metropolitan, South West, Wheatbelt and Mid-West regions). The biggest contributor to the customer SAIDI impact was Bush fire activity in the Wooroloo area.

April 11, 2021

(SAIDI = 55 minutes, SAIFI = 0.015 interruptions, call centre performance = 98.5%)

Around 28,000 customers were interrupted for an average of over four days across the Western Power network (most of the affected customers were in the Mid-West, South West, Perth Metropolitan and Wheatbelt regions). The main cause of customer interruptions was network damage from Cyclone Seroja.

April 12, 2021

(SAIDI = 7.1 minutes, SAIFI = 0.004 interruptions, call centre performance = 93.5%)

Around 4,100 customers were interrupted for an average of nearly 1 day across the Western Power network (most of the affected customers were in the Wheatbelt region). The main cause of customer interruptions was network damage from Cyclone Seroja.

June 20, 2021

(SAIDI 11 minutes, SAIFI = 0.018 interruptions, call centre performance = 91.6%)

Around 25,000 customers were interrupted for an average of around seven hours across the Western Power network (most of the affected customers were in the Perth Metropolitan, Great Southern and Goldfields-Esperance regions). The main cause of customer interruptions was storm activity.

7.1.2 Transmission network interruptions

The SAIDI (minutes per year) and SAIFI (interruptions per year) that were excluded due to supply interruptions caused by the transmission network are outlined in Table 7.2.

Table 7.2: SAIDI and SAIFI exclusions due to transmission network interruptions

		2016/17	2017/18	2018/19	2019/20	2020/21
SAIDI	CBD	0	0	0	2	0
	Urban	18	8	3	20	18
	Rural Short	17	50	9	44	143
	Rural Long	70	74	32	236	213
SAIFI	CBD	0	0	0	0.10	0
	Urban	0.27	0.18	0.11	0.24	0.13

		2016/17	2017/18	2018/19	2019/20	2020/21
	Rural Short	0.32	0.33	0.13	0.18	0.29
	Rural Long	0.57	0.29	0.43	0.63	0.31

7.1.3 Other third-party network interruptions

The SAIDI (minutes per year) and SAIFI (interruptions per year) that were excluded due to supply interruptions caused by unavailability of generators or customer equipment are outlined in Table 7.3.

Table 7.3: SAIDI and SAIFI exclusions due to other third-party network interruptions

		2016/17	2017/18	2018/19	2019/20	2020/21
SAIDI	CBD	1	0	2	1	3
	Urban	5	4	1	10	2
	Rural Short	5	2	1	6	21
	Rural Long	5	7	5	8	30
SAIFI	CBD	0	0	0.01	0	0.03
	Urban	0.13	0.02	0.01	0.12	0.01
	Rural Short	0.13	0.01	0.01	0.07	0.05
	Rural Long	0.09	0.03	0.01	0.04	0.01

There were 2,370 faults attributed to customer installations or other third-party equipment. There were 19 faults attributed to generator failure.

7.1.4 Planned interruptions

The SAIDI (minutes per year) and SAIFI (interruptions per year) that were excluded due to planned supply interruptions required to undertake safe work activities on the distribution network and mitigate the risk of unplanned interruptions, are outlined in Table 7.4.

Table 7.4: SAIDI and SAIFI exclusions due to planned interruptions

		2016/17	2017/18	2018/19	2019/20	2020/21
SAIDI	CBD	9	10	3	27	61
	Urban	79	97	49	71	60
	Rural Short	186	126	64	87	81
	Rural Long	253	376	156	277	202
SAIFI	CBD	0.02	0.03	0.01	0.05	0.13
	Urban	0.24	0.30	0.16	0.25	0.18
	Rural Short	0.50	0.38	0.21	0.28	0.25

		2016/17	2017/18	2018/19	2019/20	2020/21
	Rural Long	0.94	1.08	0.48	0.90	0.61

7.1.5 Force Majeure

A force majeure event is a common exclusion across the Service Standard Benchmarks and is defined under the Access Code, under Appendix 3 – Model standard access contract. Force majeure events are events or circumstances which Western Power is not able to reasonably and prudently prevent or overcome.

There were two force majeure events which impacted the distribution network during the 2020/21 period:

- **January-March Bushfires** – The combined effect of a series of eight bushfire events that impacted the distribution network from 2 January to 13 March 2021 has been classified as Force Majeure.

  Unfavourable weather patterns from November 2020 to January 2021 resulted in a high number of widespread bushfires in the Perth Hills in January and February 2021. Four of the January bushfires burned concurrently, and during the Wooroloo fire, another fire at the Cockburn Cement facility placed additional strain on Emergency Services.

  External site access restrictions by the Department of Fire and Emergency Services (DFES), Department of Parks & Wildlife (DPAW) and the Department of Biodiversity, Conservation & Attractions (DBCA), and in one case, by gas pipeline owners the Dampier to Bunbury Natural Gas Pipeline (DBNGP) & APA Group, hindered Western Power's ability to respond, prohibiting Western Power access to its network assets. Repairs could not occur until it was safe to do so under the direction and within the constraints of the operation of the above agencies.

- **Tropical Cyclone Seroja** – The impact of Tropical Cyclone Seroja on the distribution network on 11 to 12 April 2021 has been classified as force majeure. The cyclone resulted in heavy rain and strong winds (gust of 170km/h recorded near Kalbarri) and resulted in widespread damage over a large geographical area of approximately 700km long and 150km wide. The event significantly affected Western Power's distribution networks across the Mid-West region, with some customers without supply for up to 10 weeks.

Table 7.5: Distribution network force majeure events (figures exclude reliability impact on Major Event Days)

Force Majeure Event	Incident Date	Customers Interrupted	SAIDI Impact (Minutes)	SAIFI Impact (Interrupt)	Distribution Area
Wundowie Bushfire	2 – 19 January 2021	830	3.31	0.001	Rural Short
		1,731	9.05	0.031	Rural Long
Red Gully Bushfire	2 - 8 January 2021	2,372	24.14	0.041	Rural Long
Gosnells Bushfire	3 - 4 January 2021	2,374	2.43	0.011	Rural Short
Kwinana Fire	3 - 5 January 2021	435	0.23	0.001	Urban
York Bushfire	15 - 16 January 2021	71	0.96	0.001	Rural Long
Oakford bushfire	16 - 18 January 2021	3,479	3.06	0.021	Rural Short

Force Majeure Event	Incident Date	Customers Interrupted	SAIDI Impact (Minutes)	SAIFI Impact (Interrupt)	Distribution Area
Wooroloo Bushfire	2 Feb-13 March 2021	1,552	1.21	0.005	Rural Short
Cockburn Cement	4 – 5 February 2021	2,512	0.30	0.011	Rural Short
Cyclone Seroja	11 April (excluding 11 & 12 April - which were MEDs)	134	0.38	0.0002	Urban
		1,562	2.52	0.005	Rural Short
		1,621	28.1	0.012	Rural Long

Table 7.6: SAIDI and SAIFI exclusions due to force majeure

		2016/17	2017/18	2018/19	2019/20	2020/21
SAIDI	CBD	0	0	0	0	0
	Urban	0	0	0	0	1
	Rural Short	0	0	0	9	13
	Rural Long	0	0	0	57	62
SAIFI	CBD	0.00	0.00	0.00	0.00	0.00
	Urban	0.00	0.00	0.00	0.00	0.001
	Rural Short	0.00	0.00	0.00	0.03	0.04
	Rural Long	0.00	0.00	0.00	0.25	0.08

7.2 Distribution performance – Call centre performance

Based on the exclusions described in section 5.1.4, for the 2020/21 period, the distribution performance Service Standards in terms of call centre performance exclude the fault call non-compliances as indicated below:

7.2.1 Abandoned calls – four seconds or less

These calls are not captured or recorded within Western Power's systems.

7.2.2 Major Event Days

See section 7.1.1 for the details of the MEDs for the 2020/21 period.

7.2.3 Extraordinary events

There were no extraordinary events on the distribution network affecting the call centre performance.

7.3 Transmission performance

Based on the exclusions described in section 5.2, the transmission performance for the AA4 period excludes the interruptions described below.

7.3.1 Force Majeure

There was one event on the transmission network that was classified as force majeure:

Tropical Cyclone Seroja – The impact of Tropical Cyclone Seroja on the transmission network on 11 to 12th April 2021 has been classified as force majeure. The cyclone resulted in heavy rain and strong winds and in widespread damage over a large area of the Western Power network. Three substations in the Geraldton area were significantly affected and were completely blacked out for a period of time. The Bureau of Meteorology noted that it is very unusual for a tropical cyclone to maintain category 3 (severe) this far south[7].

Table 7.7: Transmission network force majeure events

Force Majeure Event	Incident Date	Circuit Availability	LoSEF >0.1 and ≤1.0 SMI	LoSEF >1.0 SMI	Average Outage Duration
Tropical Cyclone Seroja	11 April 2021	0.0135%	-1	-1	405

7.3.2 Planned interruptions - major construction work exceeding 14 days

In calculating circuit availability, planned interruptions for major construction work is capped at 14 days. Table 7.8 shows the number of planned interruptions for major construction works that exceeded the 14-day cap in each of the last five financial years.

Table 7.8: Planned interruptions for major construction work exceeding 14 days

	2016/17	2017/18	2018/19	2019/20	2020/21
Number of planned interruptions	24	14	17	21	11

7.4 Street lighting repair time

Based on the exclusions described in section 5.3, for the 2020/21 period, the street lighting repair time performance excluded the interruptions described below.

7.4.1 Force Majeure

There was one Force Majeure event which impacted the street lighting repair time in the metropolitan area during the 2020/21 period. The force majeure event occurred during the CEPU Industrial Action between 11 May and 9 June 2021, which caused a reduction in available working hours in the metropolitan area to complete street light fault repairs. The industrial action resulted in increased backlog of work orders and an increase in average days to complete street light repairs during the recovery work period in June 2021. The recovery work to reduce the backlog continued into the 2021/22 period.

This event has been classified as "beyond the control of Western Power and was not able to be reasonably prevented" and so meets the definition of a Force Majeure exclusion.

7 http://www.bom.gov.au/cyclone/history/seroja.shtml

This classification has resulted in the amendment of the average number of days to complete metropolitan street light faults for the 2020/21 period from 5.20 days to 4.83 days. The CEPU Industrial Action is yet be resolved.

7.4.2 Streetlights for which Western Power is not responsible for maintenance

There were no exclusions under this category affecting the streetlight repair time performance.

8. $MAIFI_E$

During the 2020/21 period, there were approximately 3,100 momentary interruptions recorded on the network. Most of these interruptions occurred on the Rural Long network.

Momentary interruptions are usually transient faults which are cleared through auto-reclose operations. They can occur due to several reasons, a more common one being vegetation that may have blown onto a line that has subsequently blown off.

Table 8.1 shows the $MAIFI_E$ for the AA4 period for each of the distribution feeder classifications. This data is inclusive of all momentary interruptions on the distribution network.

Table 8.1: $MAIFI_E$ during the AA4 period

	2017/18	2018/19	2019/20	2020/21
CBD	0.37	0.12	0.12	0.18
Urban	0.74	0.64	0.73	0.72
Rural Short	2.23	2.15	2.19	2.18
Rural Long	6.03	6.61	5.48	6.16

9. Service Standard Adjustment Mechanism

9.1 Overview

Western Power's Access Arrangement includes a Service Standard Adjustment Mechanism (SSAM). This is a scheme that ensures that Western Power has an incentive (through financial rewards and penalties) to maintain service standards and improve service standards only where the improvement is of value to customers. This is the second year the SSAM has applied for AA4.

The SSAM applies to 13 SSBs for SAIDI, SAIFI, circuit availability, call centre performance, loss of supply event frequency and average outage duration. A reward or penalty is calculated based on the difference between the actual performance and the Service Standard Target (SST) which is capped, as outlined in AA4.

9.2 Actual performance

Western Power has met or exceeded the expected level of performance for the SSAM target for five out of the 13 SSB measures which are subject to this financial incentive scheme. Table 9.1 shows the results of the SSAM performance for the 2020/21 period. All values are expressed in real dollars as at 30 June 2017.

Table 9.1: Service Standard Adjustment Mechanism results for the 2020/21 period

Service Standard			Incentive Rate			SST	SSB	SSA	SSD	SSAM Reward | Penalty ($M)
			$ Unit Rate	Reward	Penalty					
Distribution	SAIDI	CBD	per SAIDI minute	$30,215	$30,215	17.7	33.7	14.1	3.60	108,774
		Urban		$446,660	$446,660	106.8	130.6	118.0	-11.20	-5,002,592
		Rural Short		$143,118	$143,118	188.6	215.4	210.2	-21.60	-3,091,349
		Rural Long		$52,503	$52,503	677.7	848.3	713.5	-35.80	-1,879,607
	SAIFI	CBD	per 0.01 SAIFI event	$29,224	$29,224	0.12	0.21	0.26	-0.09	-263,016
		Urban		$290,697	$290,697	1.09	1.27	1.13	-0.04	-1,162,788
		Rural Short		$91,819	$91,819	1.96	2.34	1.94	0.02	183,638
		Rural Long		$55,341	$55,341	4.29	5.70	4.25	0.04	221,364
	Call Centre Performance		% calls per year	$38,059	$12,442	92.0	86.8	91.9	-0.1	-12,442
Total Distribution Penalty / Reward (capped at 2.5% for Penalties, and 1% for Rewards)										-10,898,018
Transmission	Circuit Availability		% hours per year	$449,344	$256,768	98.5	97.8	98.5	0.0	0.00
	Loss of Supply Event Frequency	0.1 < System Minute <=1	number of events per year	$89,869	$59,912	17.0	26.0	13	4	359,476
		System Minute > 1		$179,737	$134,803	3.0	7.0	2	1	179,737
	Average Outage Duration		minutes per year	$5,661	$1,598	784	1,234	1027	-243	-388,314
Total Transmission Penalty / Reward (capped at 1% for Penalties, and 1% for Rewards)										150,899
Total SSAM Penalty / Reward										-10,747,119

Note: **SSA** means Service Standard Actual and **SSD** means Service Standard Difference.

The total SSAM penalty has decreased by over 30% compared to 2019/20 due to targeted reliability improvement activities identified in section 6 and a reduction in number of interruptions across the network relative to 2019/20.

Appendix A

Service Standard performance graphs – 2011/12 to 2020/21

A.1 Service Standard performance graphs – 2011/12 to 2020/21

The following graphs illustrate the actual performance of the Service Standards for the 10 financial years up to the 2020/21 period. The Service Standard Target (SST) applied for AA3 from 2012/13 to 2016/17. As the AA4 commencement was delayed to 1 July 2019, the SSTs did not apply for 2017/18 and 2018/19, but will apply for 2019/20 to 2021/22.

- Figure A.1 to Figure A.8 show the SAIDI and SAIFI of the CBD, Urban, Rural Short and Rural Long networks.
- Figure A.9 illustrates Call Centre performance

A.1.1 Distribution performance

Figure A.1: CBD SAIDI

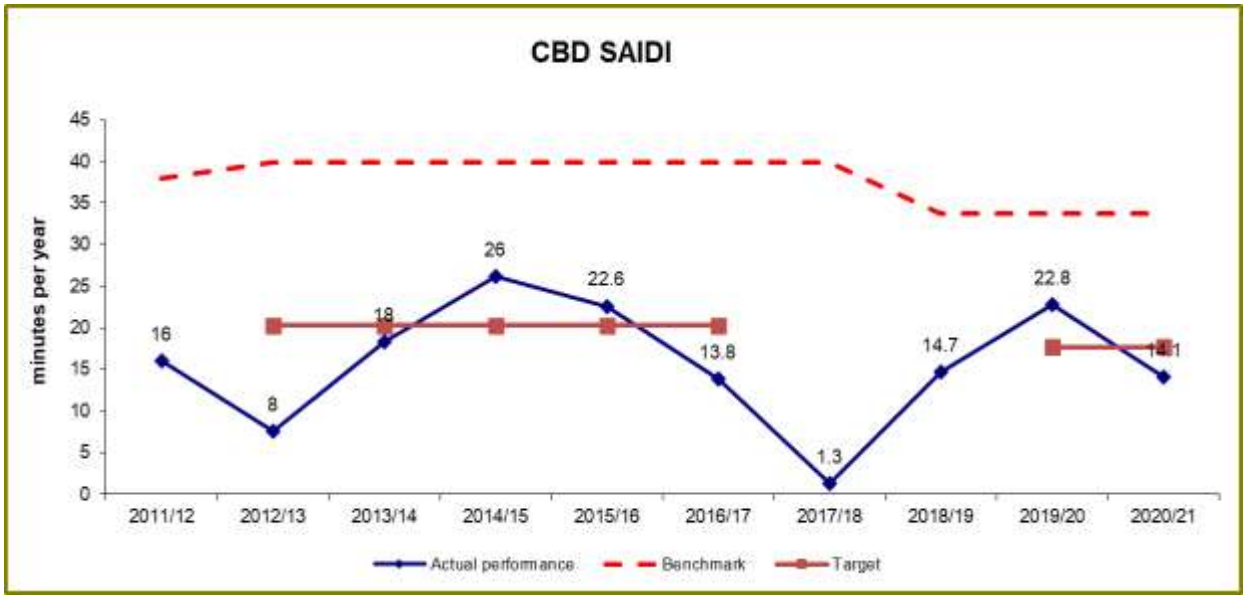


Figure A.2: CBD SAIFI

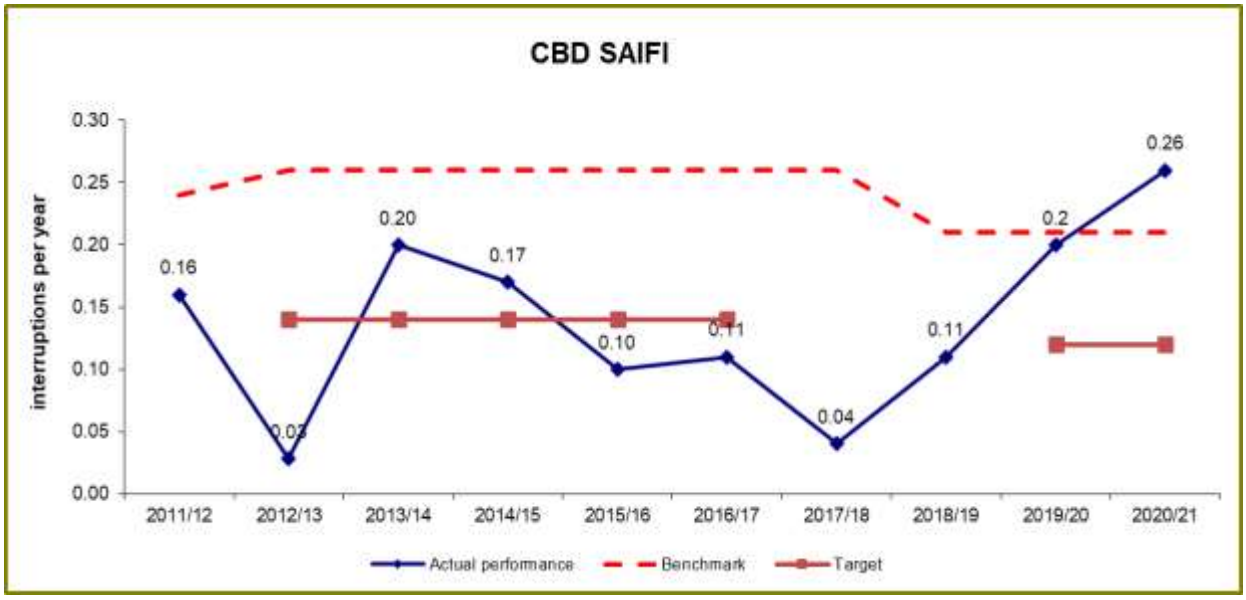


Figure A.3: Urban SAIDI

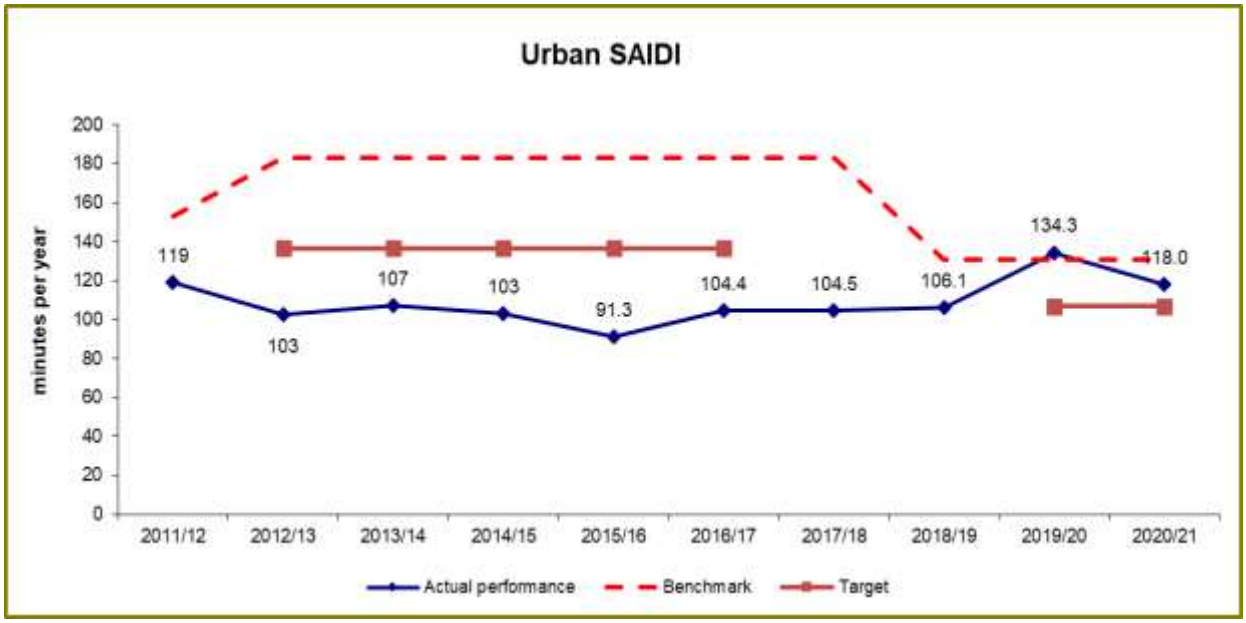


Figure A.4: Urban SAIFI

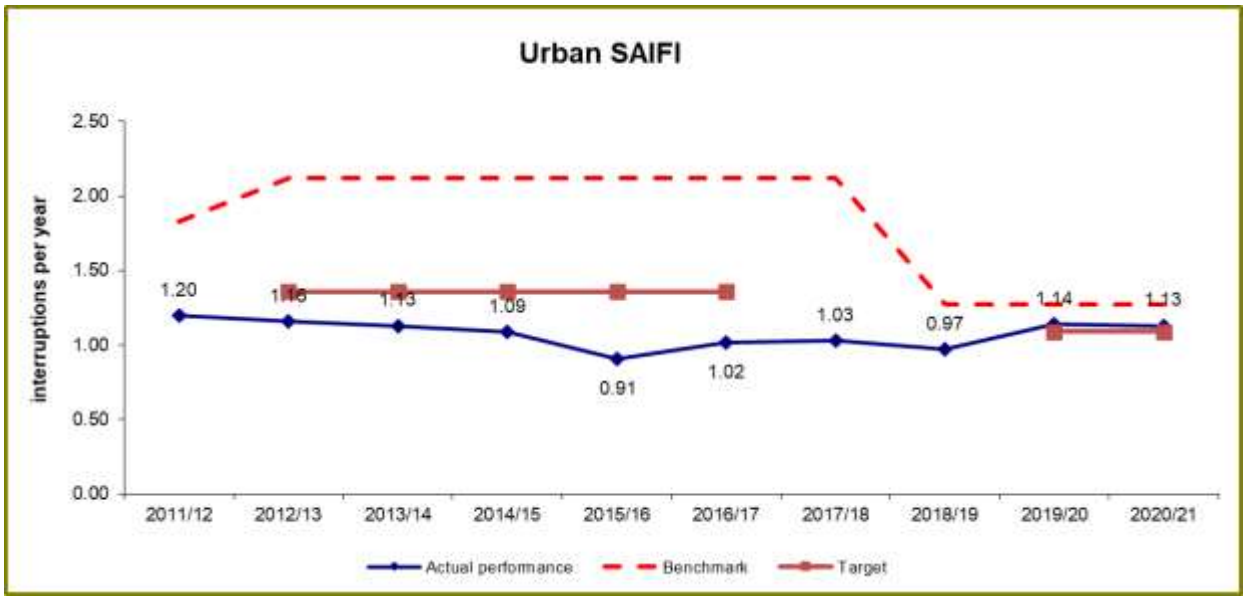


Figure A.5: Rural Short SAIDI

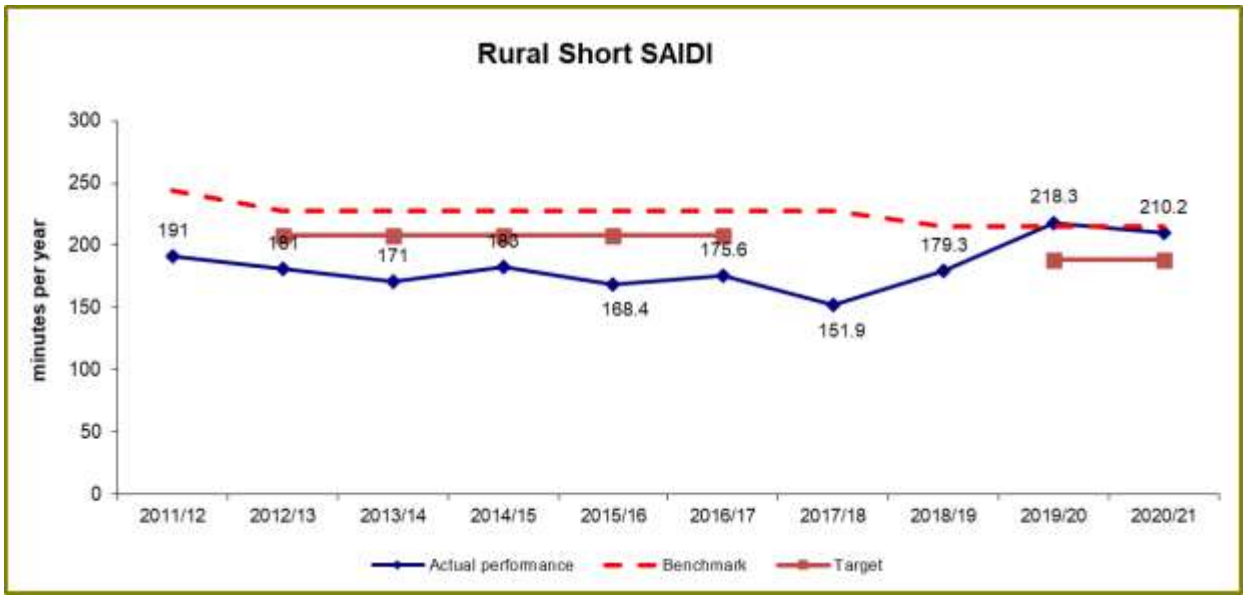


Figure A.6: Rural Short SAIFI

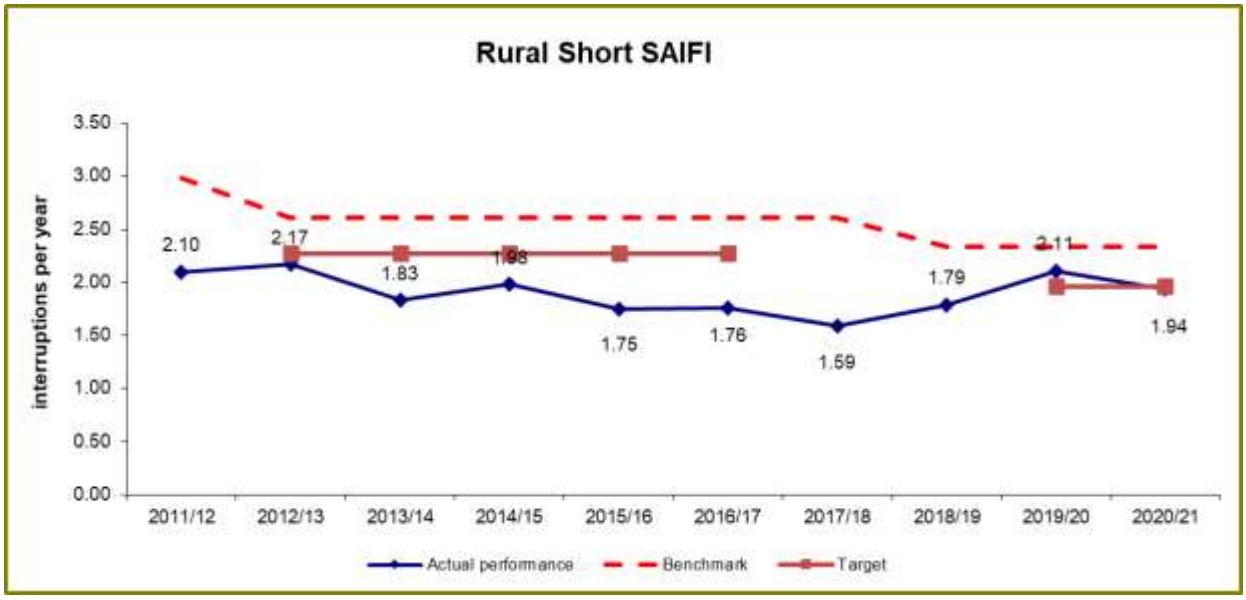


Figure A.7: Rural Long SAIDI

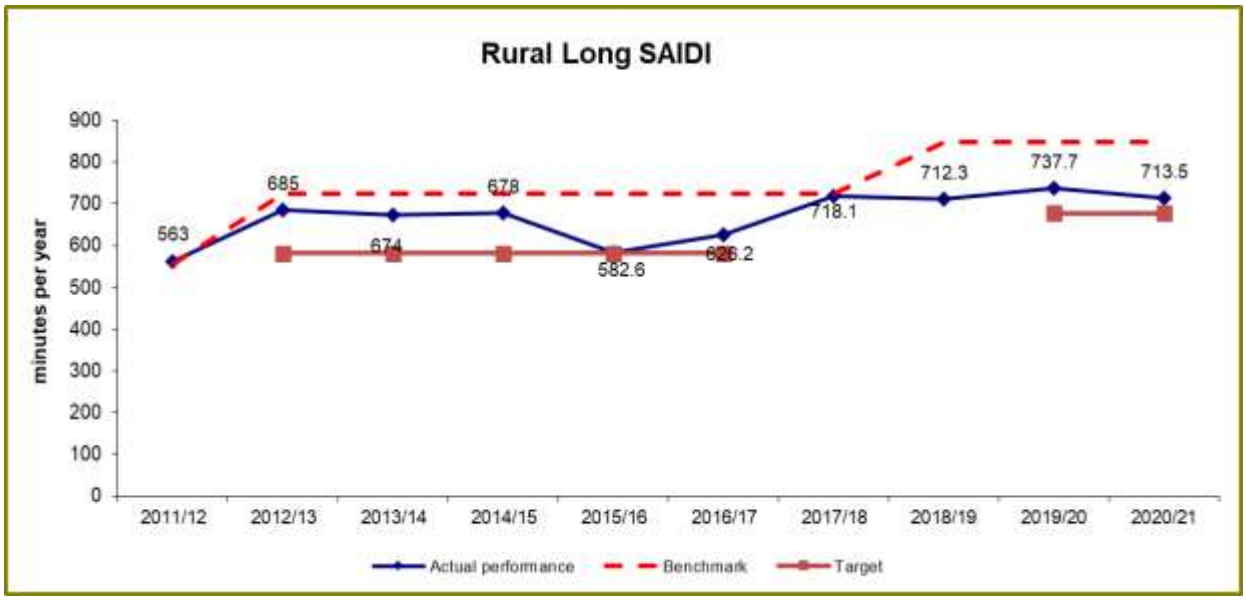


Figure A.8: Rural Long SAIFI

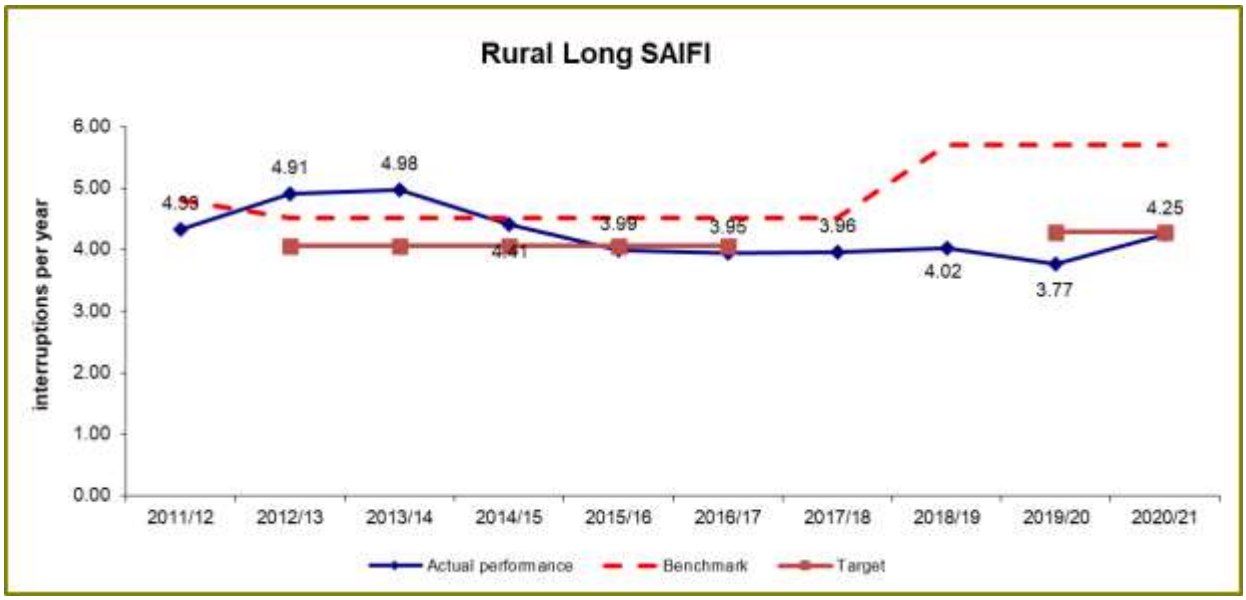
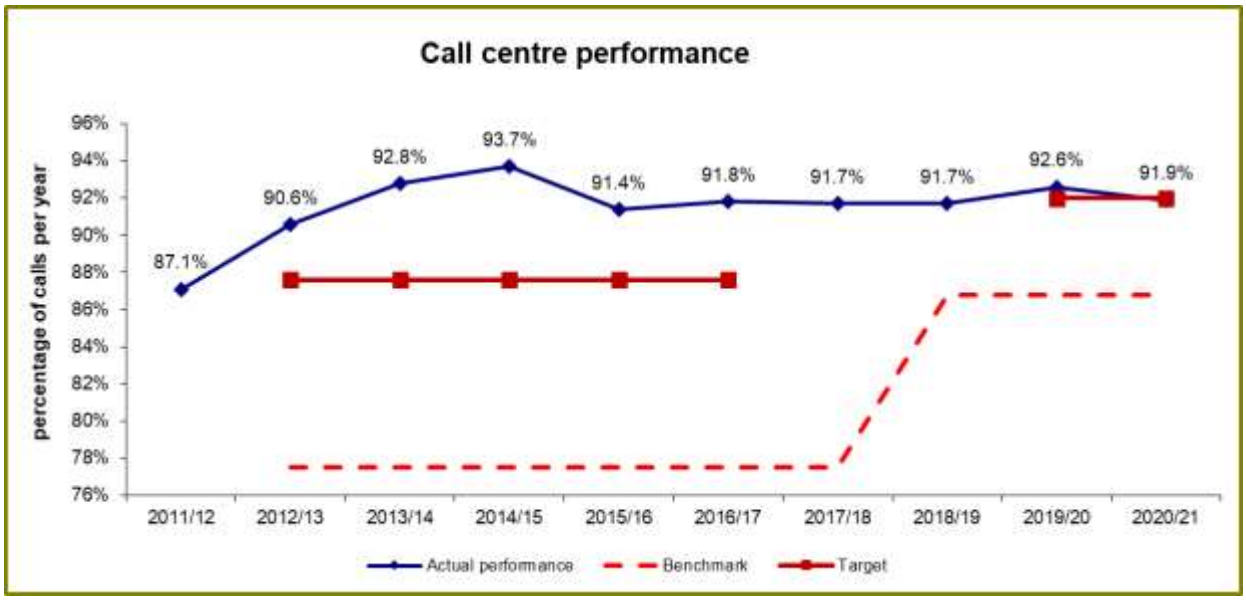


Figure A.9: Call Centre performance



A.1.2 Transmission performance

- Figure A.10 shows the circuit availability
- Figure A.11 and Figure A.12 show the LoSEF for > 0.1 & ≤1.0 and > 1.0 System Minutes
- Figure A.13 shows the average outage duration

Figure A.10: Circuit availability

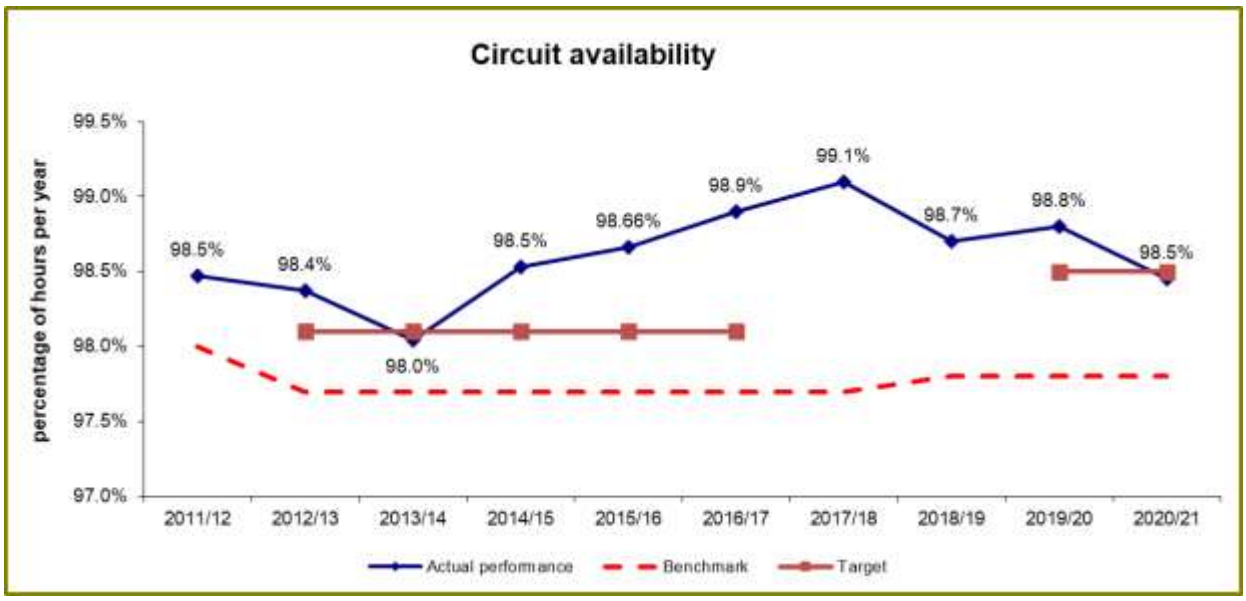


Figure A.11: Loss of supply event frequency > 0. 1 & ≤ 1.0 System Minutes Interrupted

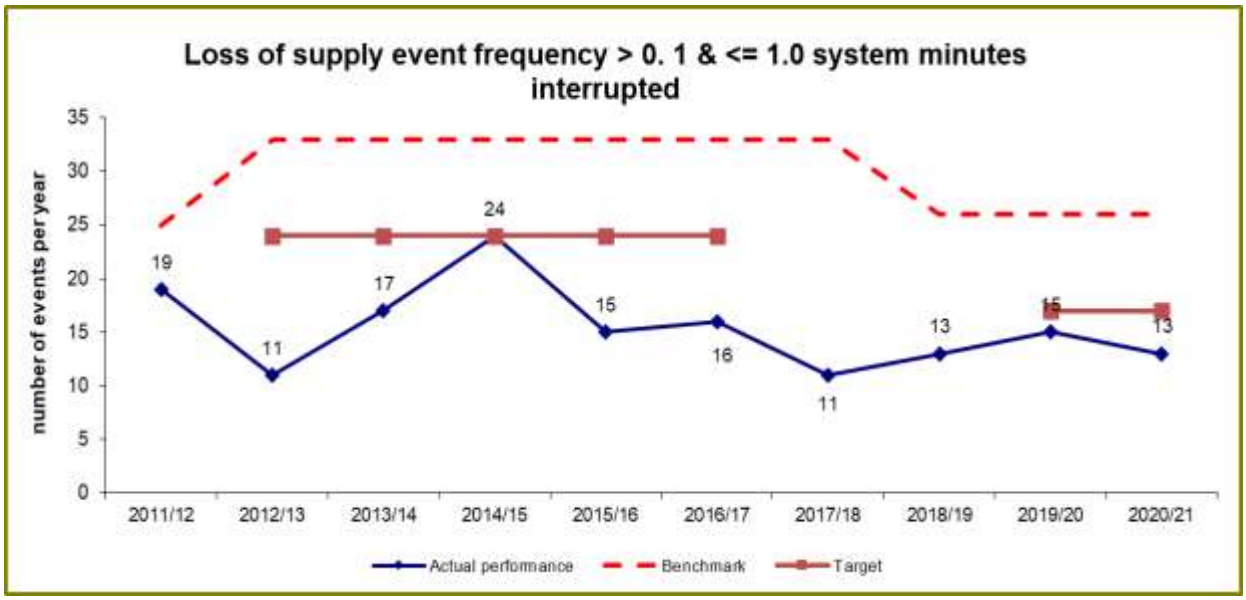


Figure A.12: Loss of supply event frequency > 1 System Minutes Interrupted

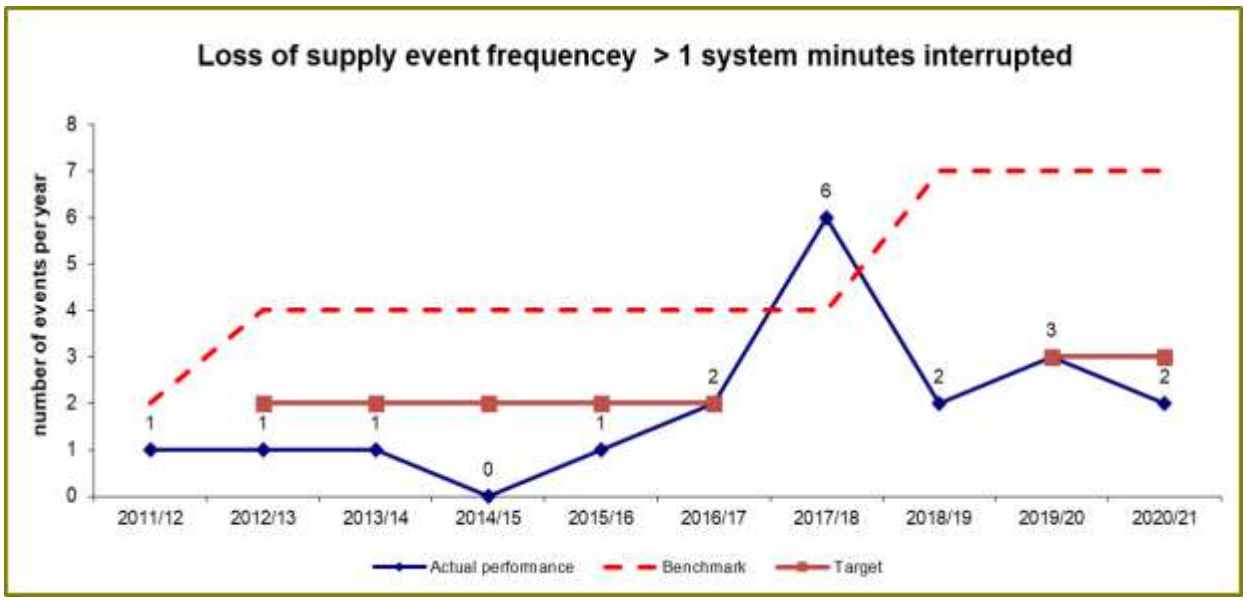
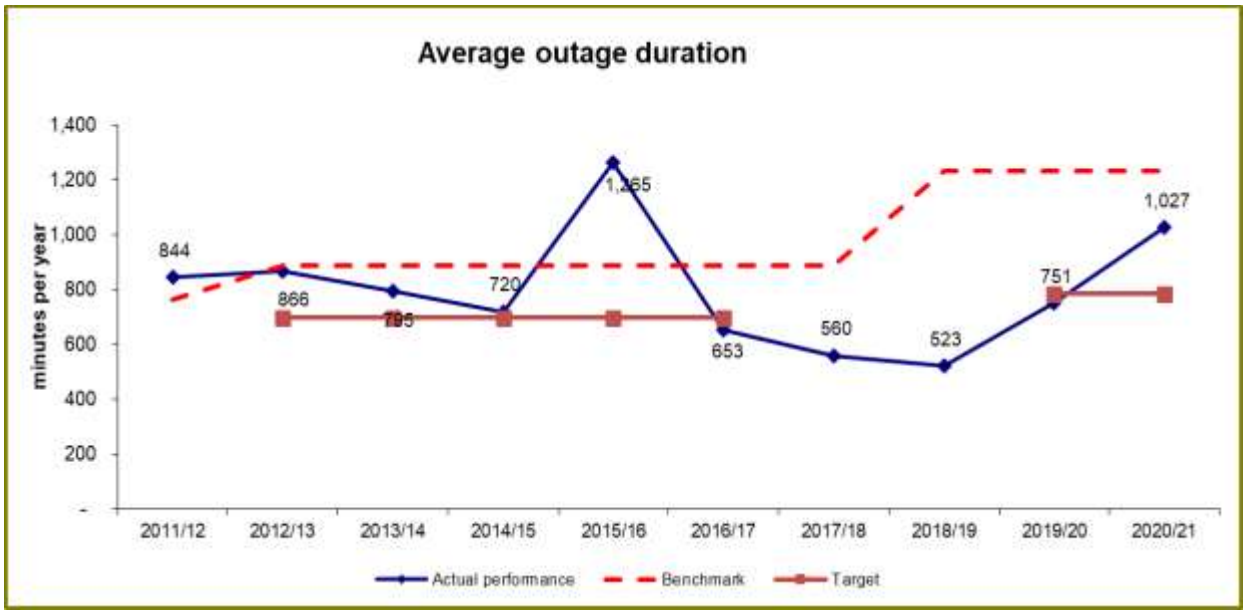


Figure A.13: Average outage duration



A.1.3 Street lighting repair time

Figure A.14 and Figure A.15 show the street lighting repair time for the metropolitan and regional areas

Figure A.14: Street lighting repair time – Metropolitan area

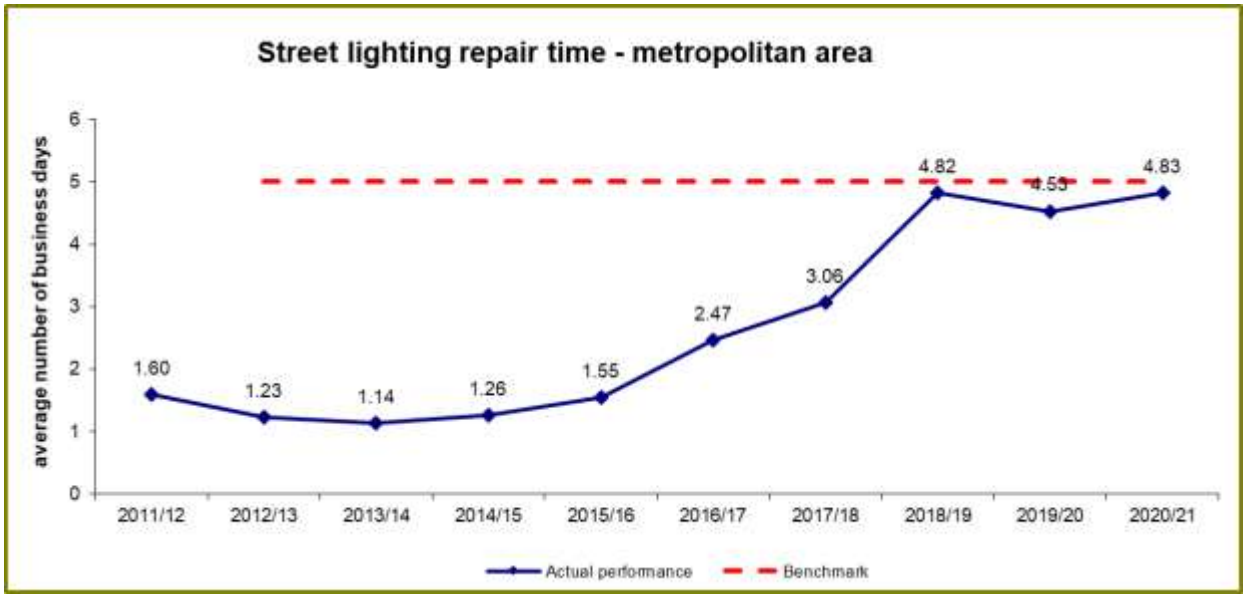
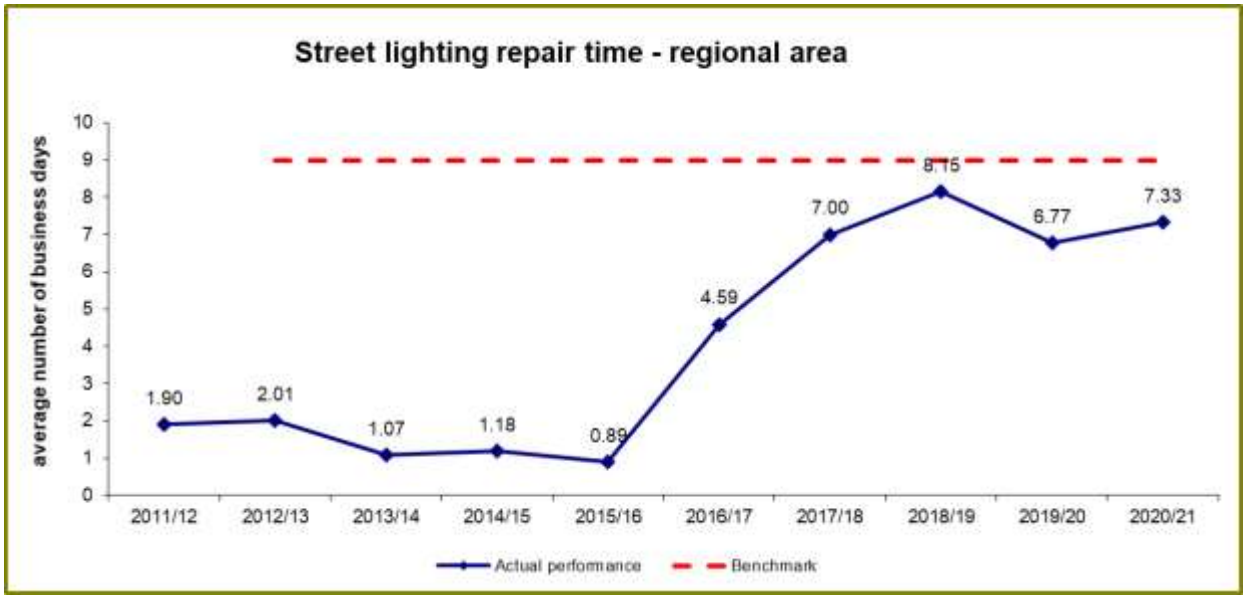


Figure A.15: Street lighting repair time – Regional area



A.1.4 Supply abolishment

Figure A.16: Supply abolishment