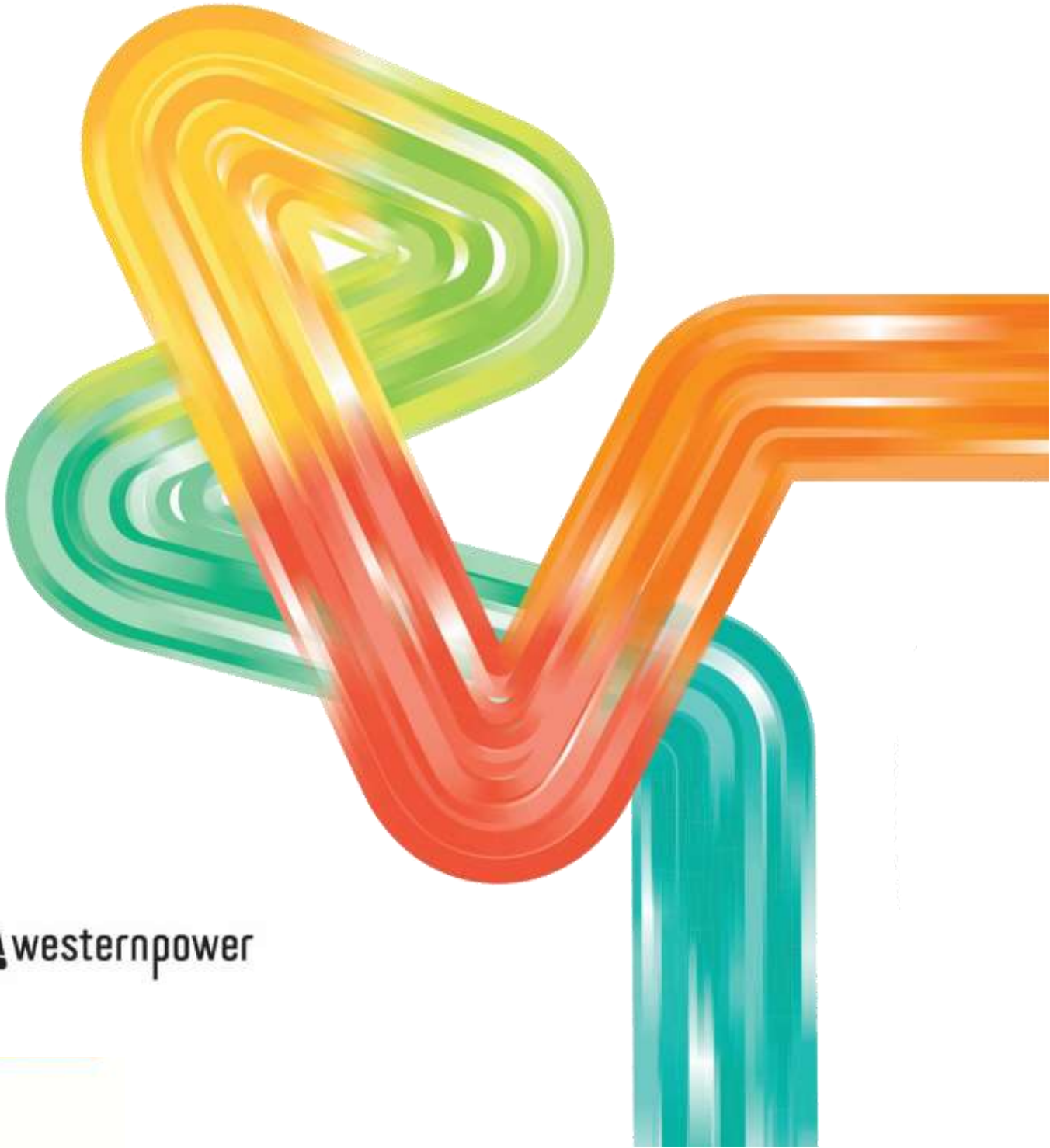
Electricity Networks Access Code 2004

Service Standard Performance Report for the year ended 30 June 2019

27 September 2019



westernpower

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1. Executive Summary

Western Power publishes the Service Standard Performance Report **(Report)** annually to detail its performance against the Service Standard Benchmarks **(SSBs)** defined in Western Power's current approved Access Arrangement **(AA4)**. This report covers the period 1 July 2018 to 30 June 2019 **(2018/19 period)**.

Of the 19 SSBs specified in AA4, 15 SSBs applied for the 2018/19 period and are reported on in this Report. This information is published in accordance with the *Electricity Networks Access Code 2004* **(Access Code).**

1.1 Performance summary

During the 2018/19 period, Western Power's overall performance surpassed the required levels in all 15 SSBs which applied for the period. Reporting on performance for the additional four[1] SSBs will commence from 1 July 2019 and will be reported in the 2019/20 Report.

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 Access Arrangement[2] and in accordance with the required amendments[3] to SSBs which are detailed below.

The Economic Regulation Authority (**ERA**) published its current approved Access Arrangement (AA4) on 28 February 2019 with a commencement date of 1 July 2019. The ERA approved 19 SSBs comprising:

- 15 SSBs from the AA3 list of benchmarks (two benchmarks have been removed from the list of AA3 benchmarks: System Minutes Interrupted - Meshed and Radial)
- Four new benchmarks in AA4: LED replacement, supply abolishment, remote re-energisation and remote de-energisation (to be reported from 1 July 2019 onwards for inclusion in the 2019/20 Report).

In addition to the 19 approved SSBs, 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; and
- LoSEF - meshed, as detailed in section 6.3

Consistent with AA4, Western Power will not receive any Service Standard Adjustment Mechanism **(SSAM)** rewards or penalties in 2018/19. Accordingly, there are no Service Standard Targets applicable in the 2018/19 period. New SSAM targets apply from 1 July 2019 and will be reported in the 2019/20 period.

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1 New SSBs for the following reference services: D1 – Supply Abolishment (whole current metering) Service, D8 – Remote De-energise Service, D9 – Remote Re-energise Service and D10 Streetlight LED Replacement Service.

2 Corrected version 10 May 2019 did not alter the ERA's access arrangement decision (available on the ERA website)

3 ERA Further Final Decision 2 Jan 2019 (available on the ERA website)

1.3 Service standard performance

The minimum levels of service required of Western Power for the 2018/19 period are defined by 15 SSBs covering distribution and transmission reliability and security of supply, call centre performance and street lighting performance.

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 2018/19 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 publish a report annually on SSB performance.

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 service standards 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 2018/19 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 t/a Western Power. For the purposes of this Report and in referencing the Access Code, the Electricity Distribution Licence (EDL1), the Electricity Transmission Licence (ETL2) and AA4, the terms distribution network and transmission network are used throughout this Report.

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 823,000 poles and over 103,000 circuit kilometres of power lines. The distribution network consists of over 820 feeders, connected to the transmission network at 152 terminal and zone substations, providing an electricity supply to over 1,150,000 customers and over 270,000 street lights.

Figure 2.1: Map of the Western Power Network

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 2018/19 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 $MAIFI_E$
- 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
2018/19	2016/17	2011/12
2017/18	2015/16	2010/11
	2014/15	2009/10
	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)

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 standard metering service at an entry point on the distribution system.
B2	Transmission Entry Service	An entry service combined with a connection service and a standard metering service at an entry point on the transmission system.
B3	Entry Service Facilitating a Distributed Generation or Other Non-Network Solution *(1 July 2019 commencement)*	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 standard metering service 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 standard metering service 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 standard metering service 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 standard metering service 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 standard metering service 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 standard metering service 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 standard metering service 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 standard metering service 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 at an exit point on the low voltage (415 volts or less) distribution system for the purpose of public street lighting, plus the service of the provision and maintenance of the streetlight.
A10	Un-Metered Supplies Exit Service	An exit service combined with a connection service 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 standard metering service at an exit point on the transmission system.
A12	3 Part Time of Use Energy (Residential) Exit Service *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 standard meter service 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 standard meter service 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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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: Reference services at connection points (ancillary)

Reference Service		Reference Service Description
D1	Supply Abolishment Service *(1 July 2019 commencement)*	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.
D2	Capacity Allocation Swap (Nominator) (Business) Service *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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 *(1 July 2019 commencement)*	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.
D10	Streetlight LED Replacement Service *(1 July 2019 commencement)*	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.

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.

In the 2017/18 period, the SSBs that applied were as published in the previous approved Access Arrangement (AA3). For the 2018/19 period, the SSBs that apply have been updated as per the current Access Arrangement (AA4), approved by the ERA.

The key changes in the SSBs from the 2017/18 Report to this 2018/19 Report are:

- Removal of System Minutes Interrupted for the meshed transmission network and System Minutes Interrupted for the radial transmission network as SSB measures
- Adjustment to the definition of LoSEF to exclude the coincident demand for non-reference service customers from the System Peak MW measurement. As a result, the 2017/18 performance has been updated to reflect the AA4 definition for comparison to 2018/19 in section 6
- Adjustment to the Major Event Day **(MED)** threshold definition that impacts SAIDI, SAIFI and Call centre performance measures. As a result, the 2017/18 performance has been updated to reflect the AA4 definition for comparison to 2018/19 in section 6.

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 and meshed, making clear the classification of the 220kV circuit between Muja Terminal and Merredin Terminal.

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[4] (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

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

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 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
- 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
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 2019 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 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 street lighting repair time:

- Force majeure events
- Street lights 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.

6. Actual service standard performance

6.1 Summary of service standard performance

During the 2018/19 period, Western Power's overall performance surpassed the required levels in all 15 of the SSBs which applied for the period. Reporting of performance for the additional four SSBs commenced on 1 July 2019 and will be reported in the 2019/2020 Report. The service standard performance is detailed in Table 6.1.

Table 6.1: Service Standard performance summary for the 2018/19 period

			SSB 2018/19 onwards	2014/15 actual AA3	2015/16 actual AA3	2016/17 actual AA3	2017/18 actual AA4	2018/19 AA4	
								Actual	SSB met
Distribution	SAIDI	CBD	≤ 33.7	26.2	22.6	13.8	1.3	14.7	✓
		Urban	≤ 130.6	103	91.3	104.4	104.5	108.2	✓
		Rural Short	≤ 215.4	182.6	168.4	175.6	151.9	183	✓
		Rural Long	≤ 848.3	677.5	582.6	626.2	718.1	731.8	✓
	SAIFI	CBD	≤ 0.21	0.17	0.1	0.11	0.04	0.11	✓
		Urban	≤ 1.27	1.09	0.91	1.02	1.03	0.99	✓
		Rural Short	≤ 2.34	1.98	1.75	1.76	1.59	1.83	✓
		Rural Long	≤ 5.70	4.41	3.99	3.95	3.96	4.13	✓
Transmission	Call Centre Performance - %		≥ 86.80	93.70	91.40	91.80	91.70	91.70	✓
	Circuit Availability - %		≥ 97.80	98.53	98.66	98.90	99.10	98.70	✓
	Loss of Supply Events	>0.1 & ≤1.0 SMI	≤ 26	24	15	16	11	13	✓
		>1.0 SMI	≤ 7	0	1	2	6	2	✓
	Average Outage Duration		≤ 1,234	720	1,265	653	560	523	✓
Street Lights	Metropolitan area - business days		≤ 5	1.26	1.55	2.47	3.06	4.82	✓
	Regional area - business days		≤ 9	1.18	0.89	4.59	7.00	8.15	✓
	Service Standard performance reporting applicable from 1 July 2019								
	LED Replacements		Note[5]					N/A	
	Supply Abolishment - business days		≤ 15					N/A	
	Remote de-energise - business day		≤ 1					N/A	
	Remote re-energise - business day		≤ 1					N/A	

[5] 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

6.2 Distribution network

The reliability performance of the distribution network declined in the 2018/19 period compared to the previous period. Both SAIDI and SAIFI declined for all indicators apart from Urban SAIFI which improved by 4%.

Factors primarily contributing to reliability performance included:

- Pole top fires and overhead cable and switchgear failures
- Emergency outages due to hazards
- Underground cable and switchgear failures
- Environmental factors such as lightning, birds, vegetation and wind-borne debris impacting on the network
- Interruptions where the cause of the outage could not be identified.

All distribution measures performed within their prescribed service standard benchmarks.

6.2.1 Distribution network – areas of focus

Key strategies and activities continued to be implemented during the 2018/19 period to maintain or deliver targeted improvements in the reliability of supply.

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.

Improvement in reliability performance can be influenced by reducing the number and duration of faults caused by equipment failure or instances where wildlife and vegetation interact with the Network. Where assets are targeted for zone-based replacement, alternative options may be considered for additional reliability and customer benefit, such as re-routing feeders through areas that have a lower reliability risk.

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 the systemic factors that negatively affect reliability and the suitability of options at that location on the Network. Possible options under this strategy include:

- installing interconnections between parts of the Network to facilitate the transfer of customer connections to different points on the Network (reducing supply interruption duration)
- 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 that 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 and battery energy storage systems.

Table 6.2: Distribution performance and commentary for the AA4 2018/19 period

Service Standard	2018/19		Comments
	SSB	Actual	
CBD SAIDI	33.7	14.7	Performance was better than the AA4 benchmark but worse than the 2017/18 period (1.3 minutes per year). The primary contributor to decline in performance was underground cable and switchgear failures. Note: The CBD SAIDI performance is volatile over short periods of time due to the combined effects of fewer connections and the relatively long repair times for faults in an underground CBD network.
Urban SAIDI	130.6	108.2	Performance was better than the AA4 benchmark but worse than the 2017/18 period (104.5 minutes per year). The main contributor to the decline in performance was emergency outages to remove hazards.
Rural Short SAIDI	215.4	183.0	Performance was better than the AA4 benchmark but worse than the 2017/18 period (151.9 minutes per year). The main contributors to the decline in performance were failures of underground cables and the impact of fauna.
Rural Long SAIDI	848.3	731.8	Performance was better than the AA4 benchmark but worse than the 2017/18 period (718.1 minutes per year). The primary contributors to the decline in performance during the 2018/19 period were increases in unplanned outages where the cause could not be identified and emergency outages to remove hazards.
CBD SAIFI	0.21	0.11	Performance was better than the AA4 benchmark but worse than the 2017/18 period (0.04 interruptions per year). The primary contributor to the decline in performance was underground cable and switchgear failure. Note: The CBD SAIFI performance is volatile over short periods of time due to the combined effects of fewer connections and the relatively long repair times for faults in an underground CBD network.
Urban SAIFI	1.27	0.99	Performance was better than both the AA4 benchmark and the 2017/18 period (1.03 interruptions per year). The primary contributors to the improved performance were reductions in unplanned outages where the cause could not be identified and reductions in equipment failure.
Rural Short SAIFI	2.34	1.83	Performance was better than the AA4 benchmark but worse than the 2017/18 period (1.59 interruptions per year). The decline in performance during the 2018/19 period was predominantly due to increases in fauna related incidents and underground cable failures.
Rural Long SAIFI	5.70	4.13	Performance was better than the AA4 benchmark but worse than the 2017/18 period (3.96 interruptions per year). The primary contributors to the decline in performance were increases to unplanned outages where the cause could not be identified and emergency outages to remove hazards.

Service Standard	2018/19		Comments
	SSB	Actual	
Call centre performance	86.8%	91.7%	The 2018/19 performance of 91.7% of fault calls answered within 30 seconds was better than the AA4 benchmark, and the same as 2017/18. Performance was maintained during a transition period that involved the "go-live" of a new Customer Management System in February 2019 – a core Call Centre platform.

6.3 Transmission network

The performance of the transmission network improved in the 2018/19 period compared to the previous period for LoSEF >1.0 System Minutes Interrupted and Average Outage Duration but declined for Circuit Availability and LoSEF >0.1 and ≤1.0 System Minutes Interrupted.

Factors primarily contributing to performance are detailed in Table 6.3. All transmission measures performed within their prescribed service standard benchmarks.

6.3.1 Transmission network – areas of focus

Key strategies and activities continued to be implemented during the 2018/19 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 worked 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 2018/19 period

Service Standard	2018/19		Comments
	SSB	Actual	
Circuit Availability	97.8%	98.7%	Performance was better than the AA4 benchmark but lower than the 99.1% for the 2017/18 period. Western Power has worked to improve maintenance planning and coordination across planned outages. However, during 2018/19 there were several instances of having to extend planned outages due to inclement weather and in one instance, a major forced outage. The major forced outage involved a terminal transformer being unavailable for 319 days. The performance excludes any extended planned interruptions for major construction work greater than 14 circuit unavailability days (refer to section 7.3.2 for further details).
LoSEF >0.1 and ≤1.0 System Minutes Interrupted	26	13	Performance was better than the AA4 benchmark but lower than the 2017/18 period (11 LoSEF >=0.1SMI <1.0SMI). The restoration of customers via the distribution system helped to maintain performance within the benchmark.
LoSEF >1.0 System Minutes Interrupted	7	2	Performance was better than both the AA4 benchmark and the 2017/18 period (6 LoSEF >1.0 SMI events).
Average Outage Duration	1,234	523	Performance was better than both the AA4 benchmark and the 2017/18 period (560 outage minutes). The improved performance was achieved through priority being placed on the maintenance, inspection and fault management on the regulated circuits. In addition, proactive measures such as on-call network switching resources and/or additional resources were employed to expedite restoration of faulted regulated circuits.

The significant events under the LoSEF for the 2018/19 period are detailed in Table 6.4 and 6.5.

Table 6.4: LoSEF >1.0 SMI for the 2018/19 period

Events	Date	Load Area	Network Configuration	System Minutes	Connected Load MW	Contributing Factor
1	11/03/2019	EC/EGF	Radial	3.5	85.0	Bushfire
2	15/03/2019	EGF	Radial	2.4	10.5	Lightning/Thunderstorm
EC=East Country, EGF=Eastern Goldfields, GSR=Great Southern Region, NC=North Country, PIC=Picton, CT=Cannington, SF=South Fremantle, NT=Northern Terminal						

Table 6.5: LoSEF >0.1 & ≤1.0 SMI for the 2018/19 period

Events	Date	Load Area	Network Configuration	System Minutes	Connected Load MW	Contributing Factor
1	19/08/2018	NT	Meshed	0.21	5.7	TX equipment failure
2	05/10/2018	EGF	Meshed	0.24	79.8	Lightning/Thunderstorm
3	07/10/2018	GSR	Meshed	0.11	5.7	Bird/Animal
4	12/11/2018	GSR	Meshed	0.21	6.8	Unknown
5	22/01/2019	PIC	Radial	0.24	8.1	Pole top fire
6	27/01/2019	CT	Meshed	0.24	6.7	DX equipment failure
7	14/03/2019	EGF	Radial	0.58	86.7	Contact with plant
8	18/03/2019	NC	Meshed	0.24	4.7	Lightning/Thunderstorm
9	21/03/2019	EC	Radial	0.37	8.1	Lightning/Thunderstorm
10	03/04/2019	CT	Meshed	0.62	41.6	Contact with plant
11	03/04/2019	EC	Radial	0.15	1.6	Lightning/Thunderstorm
12	08/04/2019	GSR	Meshed	0.24	5.6	Bird/Animal
13	04/06/2019	SF	Meshed	0.10	16.6	Bird/Animal
EC=East Country, EGF=Eastern Goldfields, GSR=Great Southern Region, NC=North Country, PIC=Picton, CT=Cannington, SF=South Fremantle, NT=Northern Terminal						

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, the two events for LoSEF >1.0 SMI were in the radial transmission network. Also illustrated in Table 6.5, for LoSEF >0.1 SMI and ≤1.0 SMI in the 2018/19 period, nine were in the meshed transmission network and four were in the radial 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 2018/19 period

Service Standard	2018/19		Comments
	SSB	Actual	
Metropolitan area	≤ 5 business days	4.82	Performance in the metropolitan area was worse than the 2017/18 period (3.06 average business days), and still within the SSB target of 5 business days.
Regional area	≤ 9 business days	8.15	Performance in regional areas was worse than the 2017/18 period (7.00 average business days), and still within the SSB target of 9 business days.

6.5 Western Power Network Performance

Western Power does not have an SSB measure for the total network. As shown in Table 6.7 and Figures 6.1 and 6.2, the reliability performance of the Western Power distribution network for the 2018/19 period was lower compared to the previous year, with the duration of outages and the frequency of interruptions increasing.

Table 6.7: Overall reliability performance of the network

		2017/18	2018/19
Distribution	SAIDI	168.30	175.70
	SAIFI	1.43	1.44

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

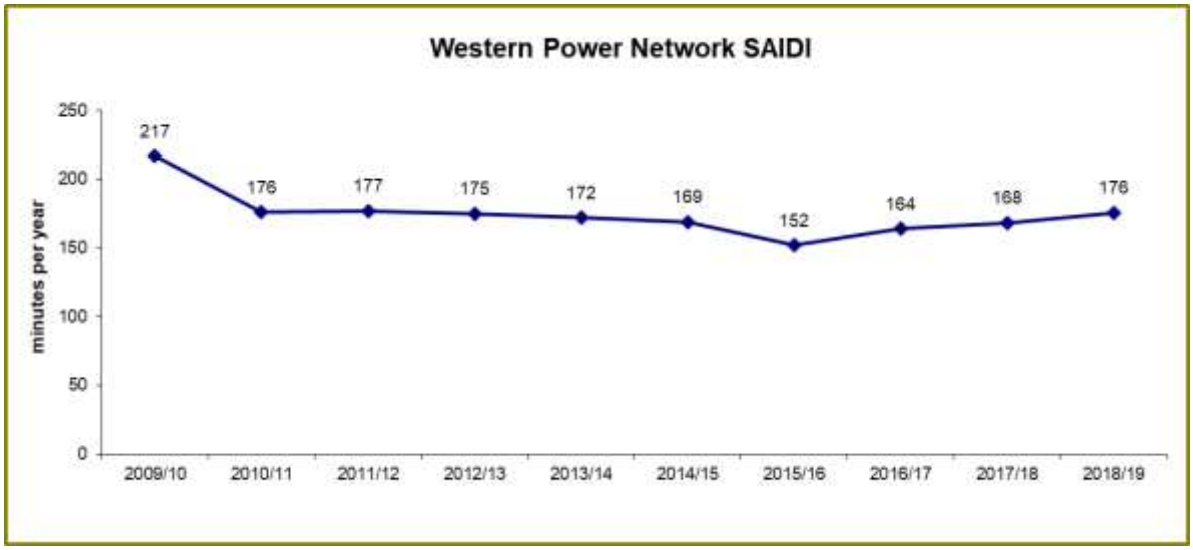
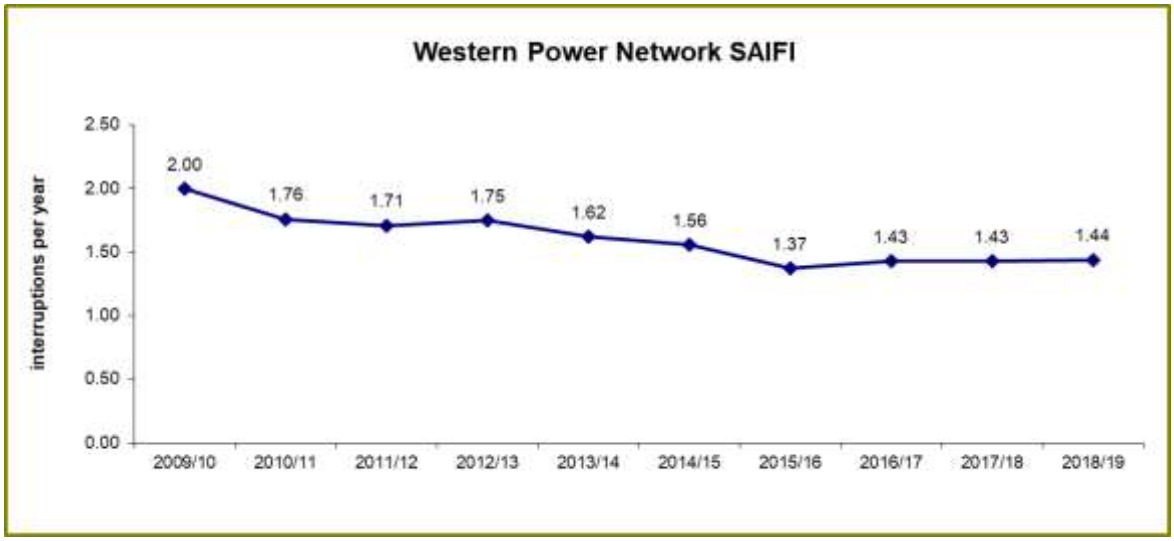


Figure 6.2: Distribution network SAIFI (10-year history)



7. Exclusions from SSB performance

As outlined in section 5, the service standards provide for certain events to be excluded from the distribution and transmission reference service performance.

7.1 Distribution performance – SAIDI, SAIFI

Based on the exclusions described in section 5.1.1, for the 2018/19 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).

There were three days during the 2018/19 period that exceeded the daily MED threshold of 5.82 minutes.

Table 7.1 illustrates:

- SAIDI (minutes per year) and SAIFI (interruptions per year), which have been excluded from the 2018/19 period due to these three MEDs
- Call centre performance (percentage 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 three MEDs.

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

		2014/15	2015/16	2016/17	2017/18	2018/19
SAIDI	CBD	0	6	0	0	0
	Urban	39	39	35	52	11
	Rural Short	44	175	30	157	29
	Rural Long	220	152	133	330	132
SAIFI	CBD	0	0	0	0	0
	Urban	0.22	0.17	0.13	0.08	0.07
	Rural Short	0.31	0.40	0.12	0.40	0.12
	Rural Long	0.78	0.61	0.23	0.61	0.37
Call centre performance		92.9%	90.0%	91.8%	96.1%	92.1%

January 20, 2019

(SAIDI = 6.36 minutes, SAIFI = 0.027 interruptions, call centre performance = 95.6%)

Over 28,000 customers were interrupted for an average of nearly four hours across the Western Power Network (most of the affected customers were in the Perth Metropolitan and Peel regions). There were fire restrictions in force across areas of the network.

January 23, 2019

(SAIDI = 12.9 minutes, SAIFI = 0.050 interruptions, call centre performance = 90.9%)

Over 54,000 customers were interrupted for an average of over four hours across the Western Power Network (most of the affected customers were in the Perth Metropolitan and South West regions).

There was inclement weather in the form of strong winds.

April 19, 2019

(SAIDI = 5.93 minutes, SAIFI = 0.029 interruptions, call centre performance = 90.3%)

Over 26,000 customers were interrupted for an average of around three hours and 30 minutes across the Western Power Network (most of the affected customers were in the Perth Metropolitan, Wheatbelt and Mid-West regions).

There was inclement weather in the form of strong winds.

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

		2014/15	2015/16	2016/17	2017/18	2018/19
SAIDI	CBD	0	0	0	0	0
	Urban	17	8	18	8	3
	Rural Short	17	24	17	50	9
	Rural Long	31	40	70	74	32
SAIFI	CBD	0	0	0	0	0
	Urban	0.25	0.13	0.27	0.18	0.11
	Rural Short	0.22	0.29	0.32	0.33	0.14
	Rural Long	0.34	0.75	0.57	0.29	0.44

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 generator unavailability or customer equipment are outlined in Table 7.3.

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

		2014/15	2015/16	2016/17	2017/18	2018/19
SAIDI	CBD	3	2	1	0	2
	Urban	4	3	5	4	1
	Rural Short	7	2	5	2	1
	Rural Long	5	4	5	7	5
SAIFI	CBD	0.01	0.02	0	0	0.01
	Urban	0.04	0.02	0.13	0.02	0.01
	Rural Short	0.04	0.02	0.13	0.01	0.01
	Rural Long	0.09	0.06	0.09	0.03	0.01

There were 2,441 faults attributed to customer installations or other third-party equipment. There were no 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

		2014/15	2015/16	2016/17	2017/18	2018/19
SAIDI	CBD	4	21	9	10	3
	Urban	55	44	79	97	48
	Rural Short	151	148	186	126	65
	Rural Long	413	448	253	376	157
SAIFI	CBD	0.02	0.06	0.02	0.03	0.01
	Urban	0.17	0.14	0.24	0.30	0.16
	Rural Short	0.45	0.41	0.50	0.38	0.21
	Rural Long	1.20	1.26	0.94	1.08	0.47

7.2 Distribution performance – Call centre performance

Based on the exclusions described in section 5.1.4, for the 2018/19 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 currently 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 2018/19 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 were no events on the transmission network that were classified as force majeure.

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 7.5 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 7.5: Planned interruptions for major construction work exceeding 14 days

	2014/15	2015/16	2016/17	2017/18	2018/19
Number of planned interruptions	10	19	24	14	17

8. $MAIFI_E$

During the 2018/19 period, there were approximately 3,400 momentary interruptions recorded on the network. Most of these interruptions occurred on the Rural Long network.

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
CBD	0.37	0.12
Urban	0.74	0.65
Rural Short	2.23	2.19
Rural Long	6.03	6.80

Appendix A

- Service standard performance graphs

- 2009/10 to 2018/19

A.1 Service standard performance graphs – 2009/10 to 2018/19

The following graphs illustrate the actual performance of the service standards for the 10 financial years up to the 2018/19 period. The data for 2017/18, which was the first year of AA4, has been updated to reflect AA4 methodology.

A.1.1 Distribution performance

- 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

Figure A.1: CBD SAIDI

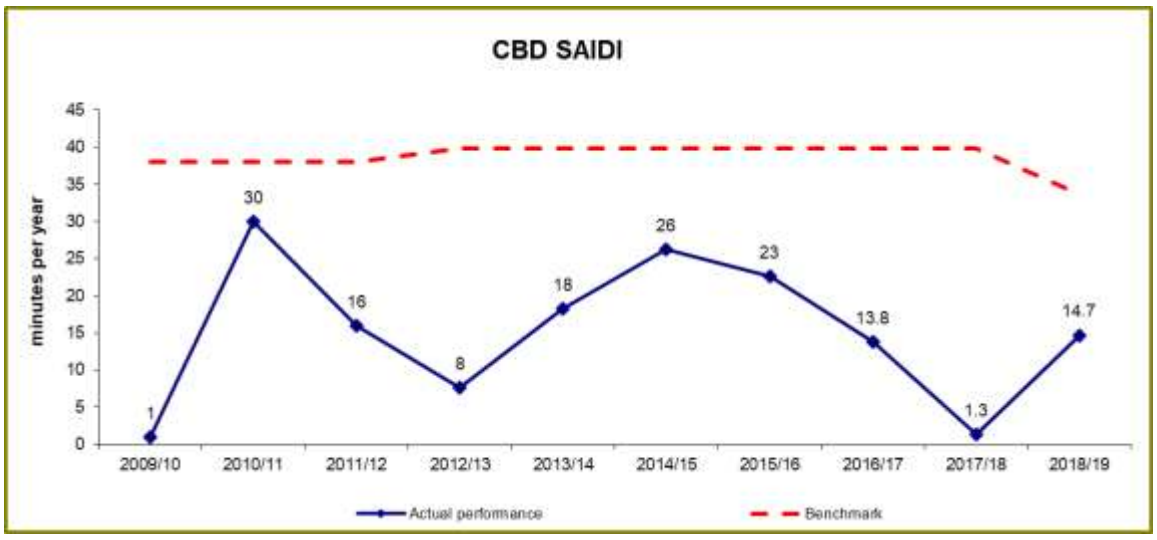


Figure A.2: CBD SAIFI

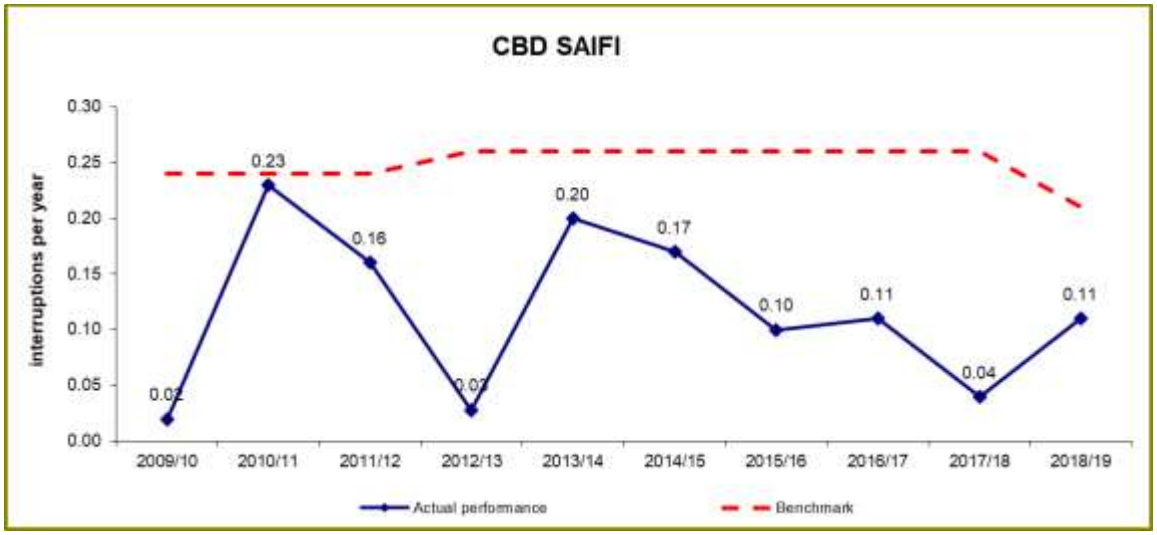


Figure A.3: Urban SAIDI

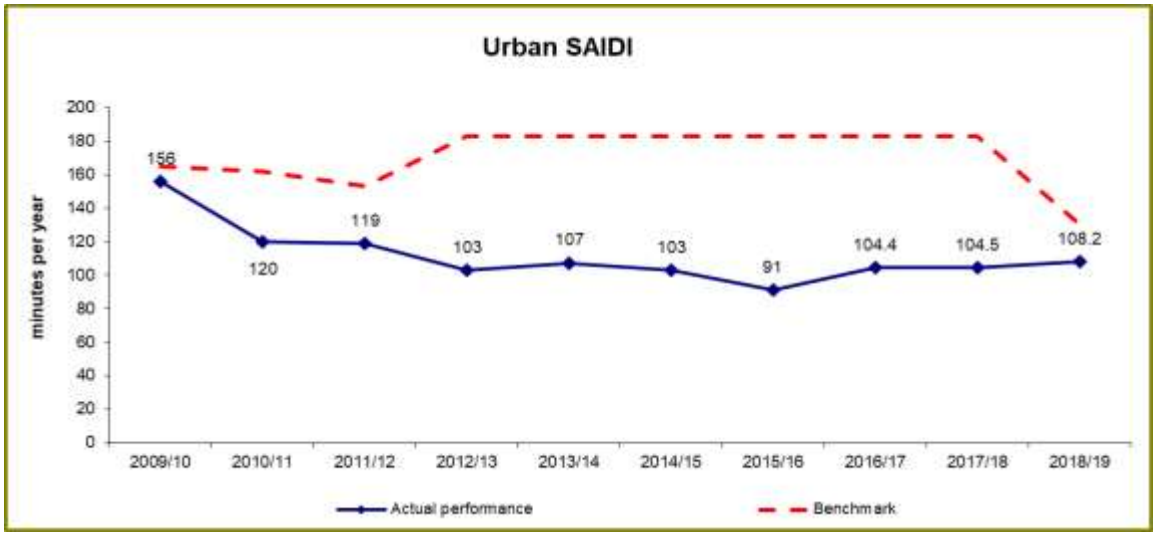


Figure A.4: Urban SAIFI

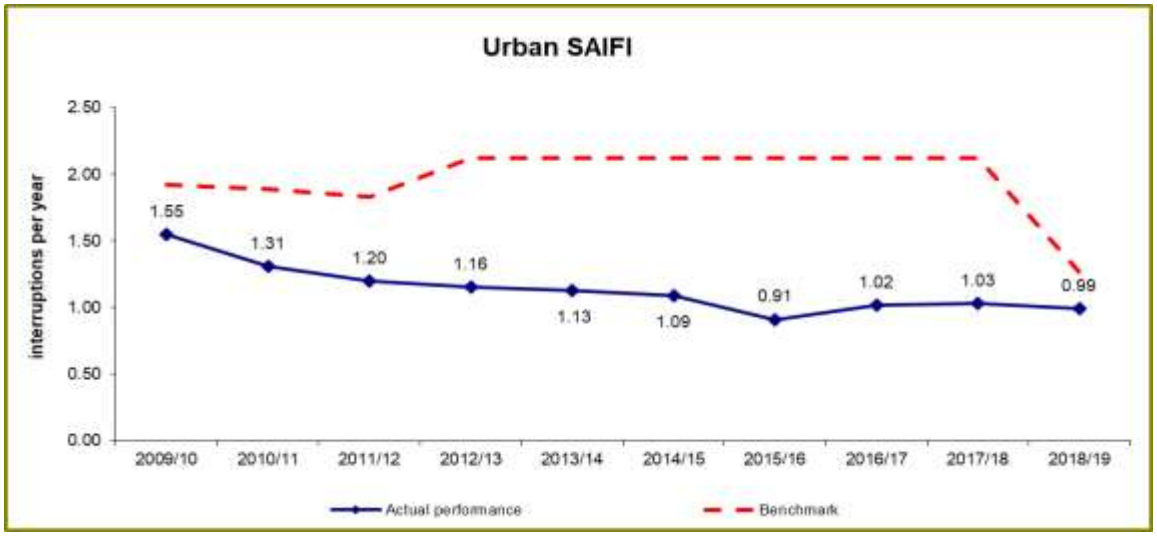


Figure A.5: Rural Short SAIDI

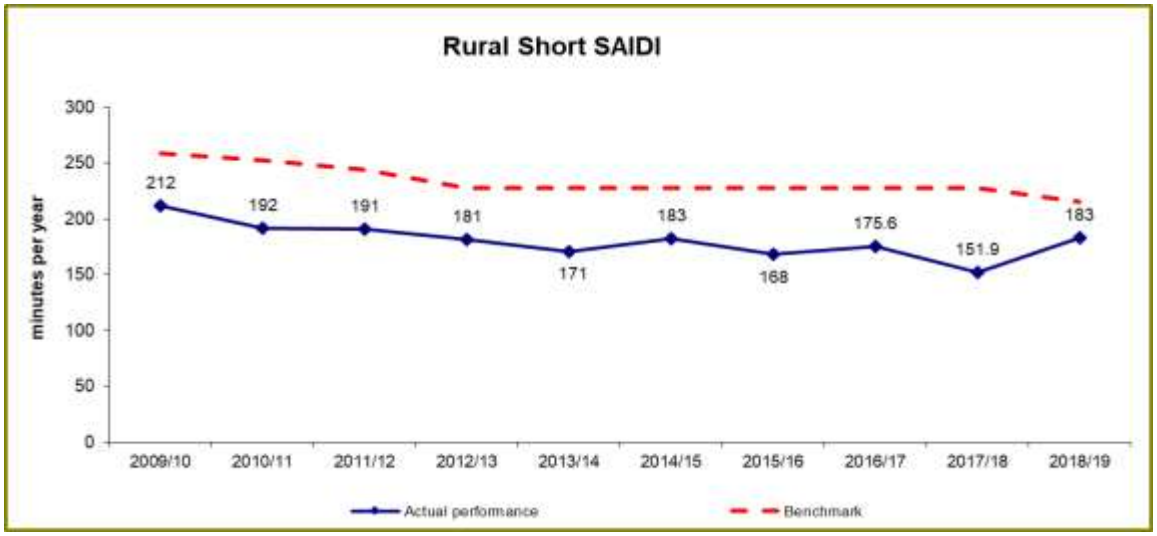


Figure A.6: Rural Short SAIFI

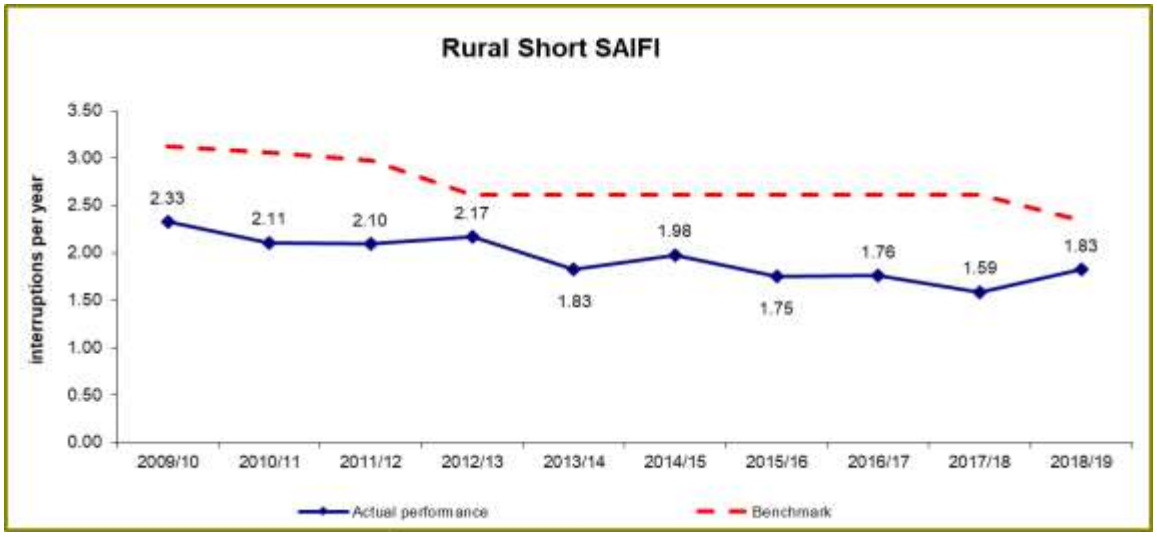


Figure A.7: Rural Long SAIDI

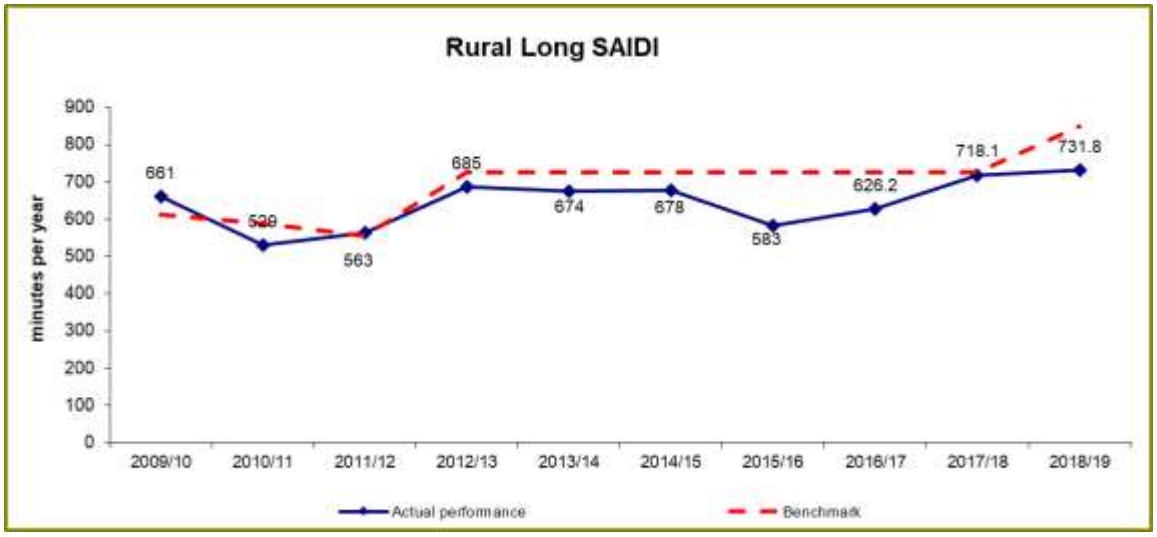


Figure A.8: Rural Long SAIFI

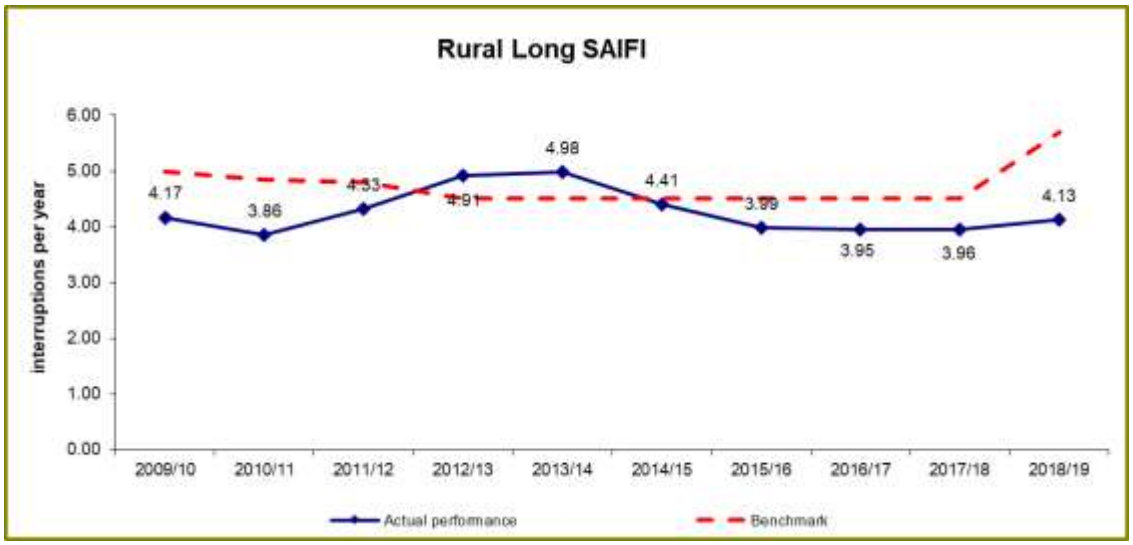
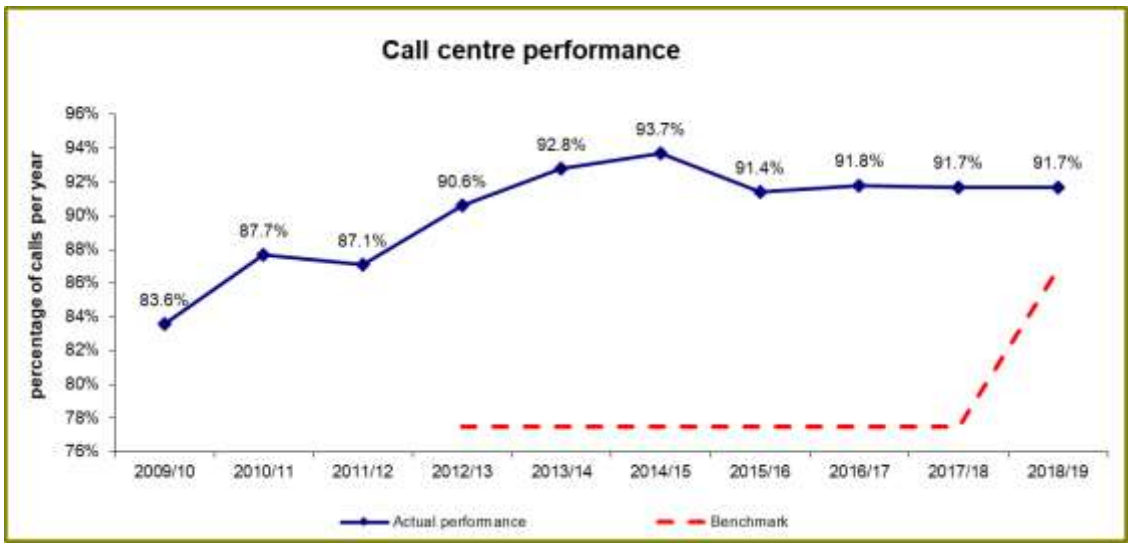


Figure A.9: Call centre Performance



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 interruption duration

Figure A.10: Circuit availability

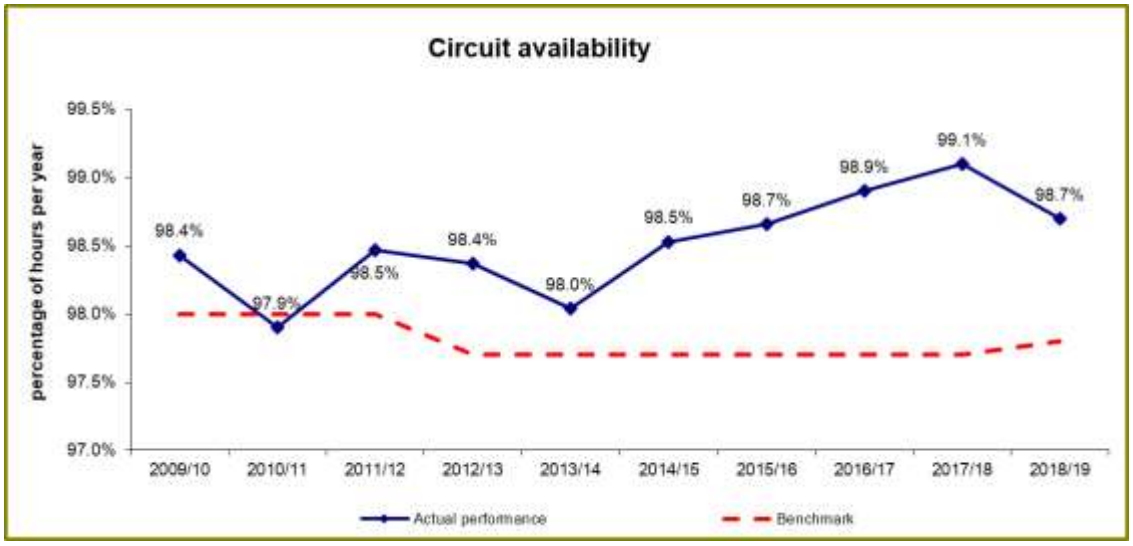


Figure A.11: Loss of supply event frequency > 0. 1 & ≤ 1.0 System Minutes Interrupted

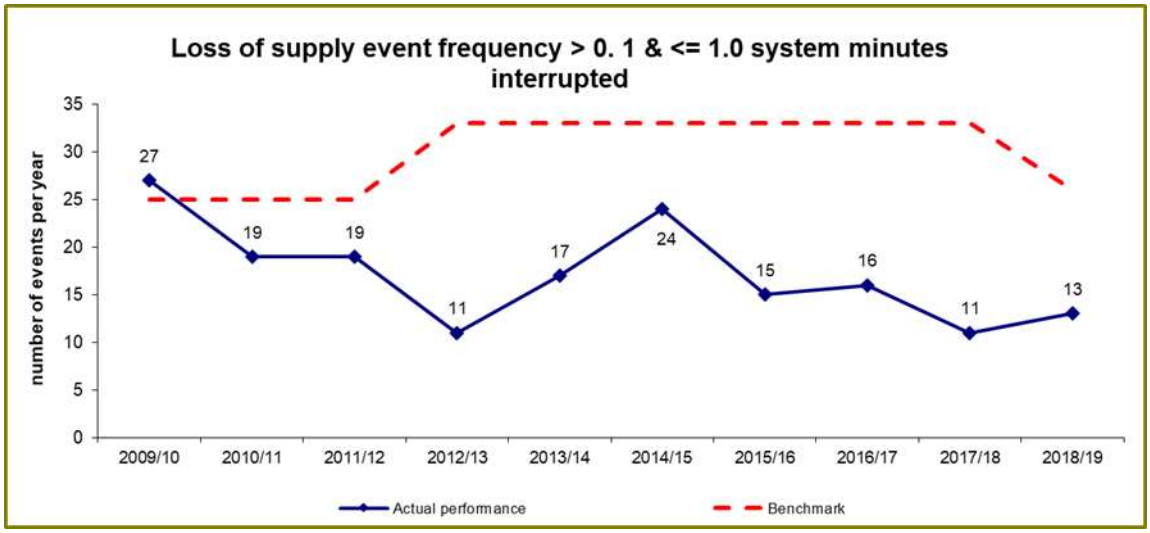


Figure A.12: Loss of supply event frequency > 1 System Minutes Interrupted

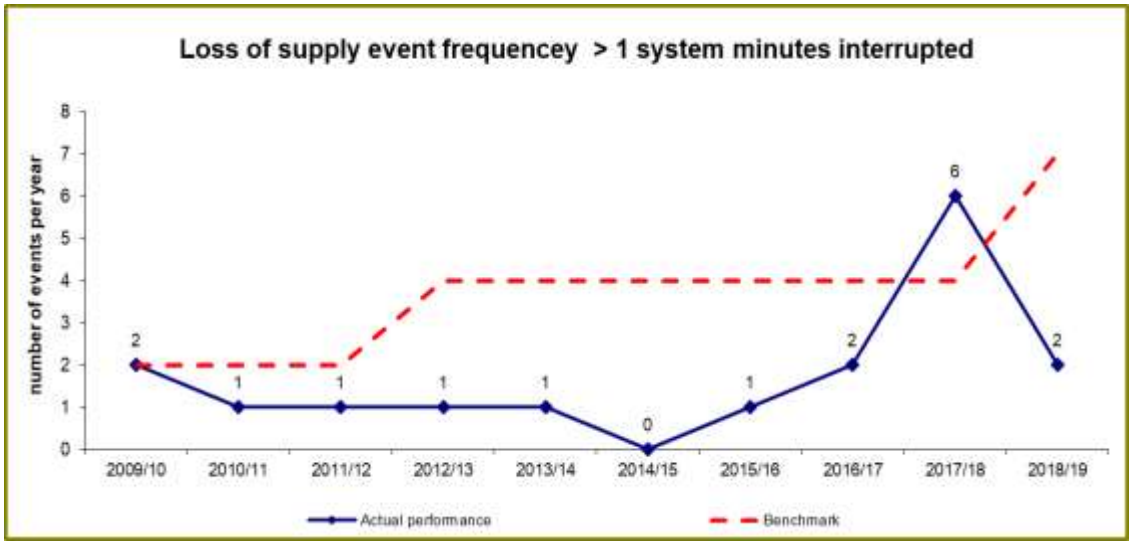
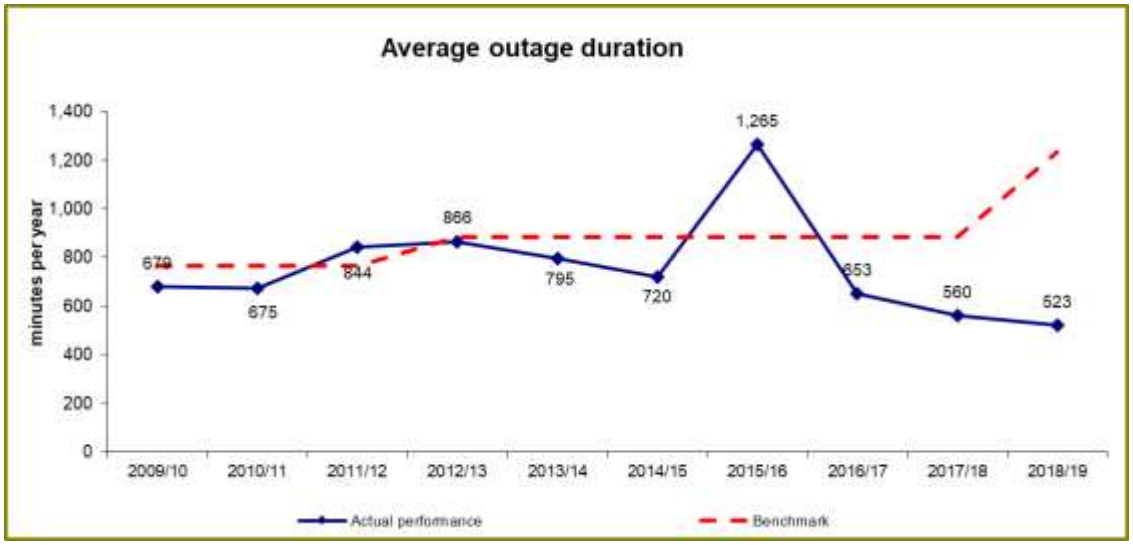


Figure A.13: Average outage duration



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

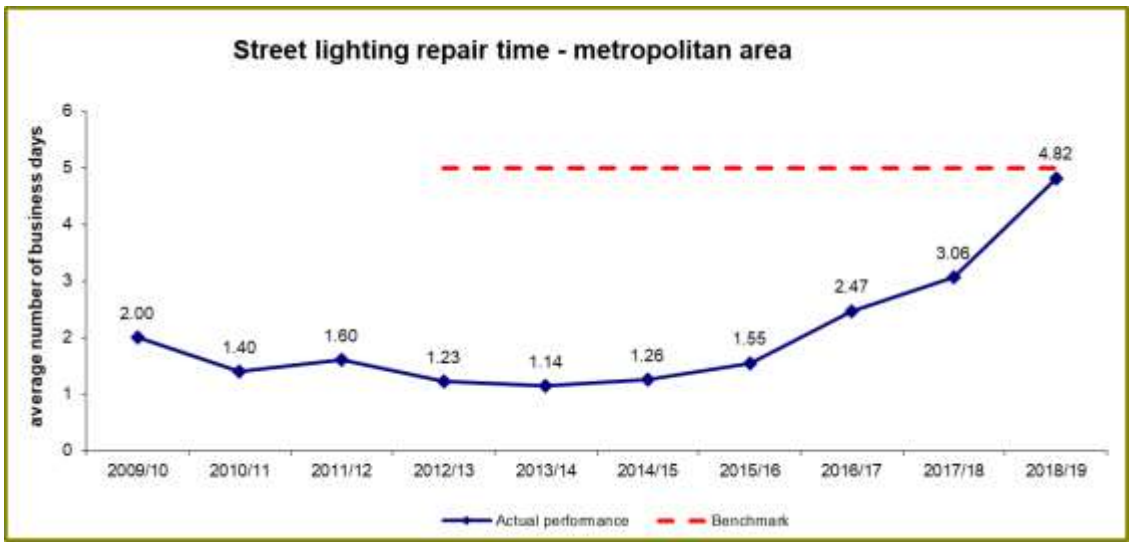


Figure A.15: Street lighting repair time – Regional area