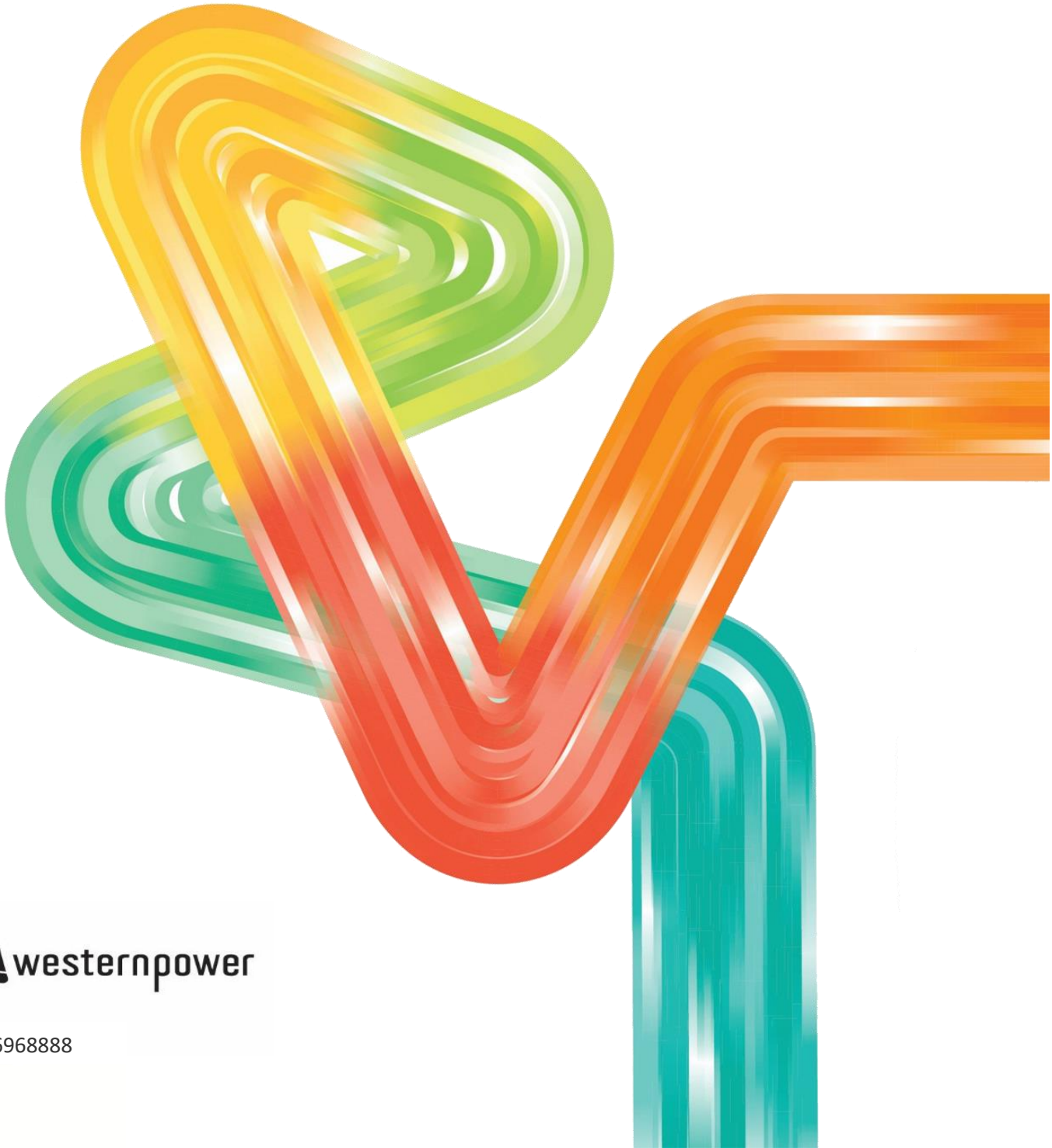
Attachment 5.1

AA4 Capital Expenditure Report

Access Arrangement Information

1 February 2022



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Access Arrangement Information - AA4 Capital Expenditure Report

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Contents

Abbreviations

The following table provides a list of abbreviations and acronyms used throughout this document. Defined terms are identified in this document by capitals.

Term	Definition
AA3	Third access arrangement
AA4	Fourth access arrangement
AA5	Fifth access arrangement
Access Code	Electricity Networks Access Code 2004
AEMO	Australian Energy Market Operator
AECSF	Australian Energy Sector Cyber Security Framework
ALARP	As low as reasonably practicable
AMI	Advanced metering infrastructure
AMS	Asset Management System
APR	Annual Planning Report
Capex	Capital expenditure
CMS	Customer Management System
CNMS	Communications Network Management System
DER	Distributed energy resources
EMS	Energy Management System
ENSMS	Electricity Network Safety Management System
ERA	Economic Regulation Authority
ERAC	Enterprise Risk Assessment Criteria
ERP	Enterprise Resource Planning
GTEng	Enterprise Grid Transformation Engine
HV	High voltage
IAM	Investment adjustment mechanism
ICT	Information and communications technology
IGF	Investment Governance Framework
LV	Low voltage
NFIT	New facilities investment test
NPV	Net present value
NOM	Network Opportunity Map
NRAC	Network Risk Assessment criteria

Term	Definition
NRMS	Network Risk Management Standard
NRMT	Network Risk Management Tool
PV	photovoltaic
RAB	Regulated asset base
SCADA	Supervisory Control and Data Acquisition
SOTI	State of the Infrastructure
SPS	Standalone power system
SUPP	State Underground Power Project
SVC	Static vars compensators
WEM	Wholesale Energy Market

1. Introduction

1. This document provides information to support our actual capital expenditure (**capex**) over the fourth access arrangement (**AA4**) period covering 2017/18 to 2021/22 being rolled into the capital base. This is in accordance with the new facilities investment test (**NFIT**) set out in sections 6.5.1 to 6.5.4 of the Access Code.

2. It includes information on:

   - the actual capex undertaken for the five years of the AA4 period[1]
   - the outcomes associated with these investments over the period
   - the reasons for variances between what was forecast in the last review and the actual expenditure
   - why we believe the capex meets the NFIT requirements of the Access Code.

3. All figures presented in this document are actual for 2017/18 to 31 August 2021 and forecast from 1 September 2021 to 30 June 2022.

1.1 Key Messages

4. During the access arrangement review, the Economic Regulation Authority of Western Australia (**ERA**) accepted Western Power's forecast of the new facilities investment for the AA4 period of $4,221.1 million[2] as being consistent with the Access Code requirements.

5. We propose that $3,106.2 million of our new facilities investment during the AA4 period be added to the capital base. This includes:

   - actual new facilities investment of $4,098.2 million between 2017/18 to 2021/22
   - less capital contributions of $992.0 million.

6. The actual expenditure undertaken during the AA4 period is consistent with the Electricity Networks Access Code 2004 (**Access Code**) requirements as a result of:

   - responding to customer needs, for example investing in grid transformation to optimise future energy generation, and enable the connection of more renewable energy
   - efficiently minimising costs through our works optimisation process and our procurement practices (including the competitive tendering of materials and work delivered by external parties)
   - delivering network management savings through our risk-based approach to asset management which reflects industry best practice
   - optimising investment solutions by considering alternative options instead of 'like-for-like' asset replacement of existing network assets, such as network reconfiguration enabling load transfer
   - continuously improving our governance procedures via several policies, strategies, and frameworks to ensure all investment decisions are prudent and delivered efficiently.

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1 Expenditure is reported as audited full 2017/18 to 2020/21 actuals and 2021/22 actual to 31 August 2021 then forecast to 30 June 22

2 This is the ERA's approved new facilities investment for the AA4 period in $ real at 30 June 2022 and includes costs that will be recovered through capital contributions.

7. Our major augmentation projects and expenditure were subject to additional scrutiny. During the AA4 period, the ERA reviewed and approved the CBD Hay Milligan Supply Reinforcement consistent with section 6.71(b) of the Access Code.

2. AA4 capital expenditure

8. This section compares the capex forecasts supported by the ERA for the AA4 period with the actual capex undertaken in that period.

9. All monetary amounts presented in this document are expressed in real 30 June 2022 dollars, include indirect costs and apply to 1 July to 30 June regulatory years unless otherwise stated. Note, some tables may not add up due to rounding.

10. As required by section 4.5.4 of the ERA's Guidelines for Access Arrangement Information, this section explains the key outcomes of the AA4 capex program and the reasons for variances from what was forecast in the last review.

2.1 Background to the AA4 regulatory period

11. Western Power's AA4 proposal was developed to achieve the following objectives:

- **Safety:** maintain the overall safety of the network in line with jurisdictional obligations (eliminate/reduce risk so far as is reasonably practicable) with actual performance not deteriorating below recent historical trends
- **Service:** maintain current levels of service standard performance for the Western Power Network (reliability of supply and security of supply), as well as call centre and streetlight performance
- **Growth:** meet the forecast growth in the customer base and energy demand, and the changing energy needs of Western Australians
- **Compliance:** satisfy compliance requirements
- **Efficiency:** continue to improve the efficiency of operations.

Safety

12. Customer feedback in the AA4 period found that our customers were satisfied with the current network safety and reliability levels with price being the single most important factor. Consistent with this feedback, our AA4 investment proposal focussed on taking a risk-based approach to asset replacement and renewal whereby we would maintain overall network safety levels as low as reasonably practicable and target expenditure on programs and areas of the network that have the greatest impact.

13. This focus on maintaining safety performance was to continue to monitor and address escalating asset risks and maintain the level of risk from the third access arrangement (**AA3**) period.

14. The greatest risk to public safety posed by the network is the potential for assets to initiate fires or cause electric shock. Accordingly, Western Power identified four key programs expected to have the greatest effect on reducing the likelihood of major public safety incidents:

- pole management
- conductor management
- connection management
- bushfire management.

Service

15. The reliability expenditure program for the AA4 period was designed to maintain service at the levels achieved at the end of the AA3 period. Our AA4 investment proposal focussed on maintaining network reliability levels while targeting programs and expenditure to parts of the network that have poorer than average reliability such as Kalbarri, Perth Hills, Gnowangerup, Ravensthorpe, Perenjori and Morawa.

Growth

16. The AA4 proposal was underpinned by a high growth forecast at the time of submission, evidenced by:

- peak demand increasing on average by 147 MW per year over the prior decade
- record numbers of major load and generator connection applications
- an estimated 130,000 new distribution customers connecting to the Western Power Network.

17. While there was evidence of peak demand growth slowing, some areas in the network were continuing to grow, and forecast investment was targeted to address these growing areas while maintaining reliability and safety across the network.

Compliance

18. Western Power has a range of compliance requirements relating to environmental, power quality, and network security obligations[3]. The compliance expenditure program for the AA4 period was designed for Western Power to meet its compliance obligations, including new national guidelines on the protection of critical infrastructure that were introduced in 2015.[4]

Efficiency

19. Our AA4 proposal built on the efficiency and governance improvements in the AA3 period, and included investment designed to enable us to undertake network operations more efficiently. The investments targeted at improving efficiency included:

- Information and communications technology (**ICT**) investments
- rationalisation and modernisation of depots
- upgrade of Supervisory Control and Data Acquisition (**SCADA**) and communications systems
- investment in Advanced metering infrastructure (**AMI**).

Total approved capex for the AA4 period

20. The ERA accepted our forecast of the new facilities investment for the AA4 regulatory period of $4,221.1 million as being consistent with the Access Code requirements. Of this $717.2 million of forecast capex in the following categories was subject to the Investment adjustment mechanism (**IAM**):

- connecting new generation capacity
- connecting new loads
- augmentation of the Western Power Network to provide additional capacity for the provision of covered services
- augmentation under the State Underground Power Project (**SUPP**).

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3 Note, safety compliance obligations are captured in the 'maintaining safety' capex category

4 *National Guidelines for Protecting Critical Infrastructure from Terrorism*, Australia-New Zealand Counter-Terrorism Committee, 2015.

2.1.1 Changes during the AA4 period

21. Western Power's AA4 proposal was based on proven technology available at the time of submission. As such, the majority of the expenditure forecast related to traditional poles and wires solutions. However, as foreshadowed in our AA4 proposal, new technology rapidly developed over the AA4 period and we have adopted innovative network solutions where there is a clear cost saving or benefit to customers in the longer term.

Asset replacement and renewal (safety & reliability)

22. The AA4 period has seen a continued transformation in the energy market with rapid adoption of new and sustainable technologies by our customers and industry, with more solar and wind power and batteries connected to the network.

23. The uptake of these technologies in the small-scale distributed sector has grown rapidly during the AA4 period. This has resulted in a shift from historical one-way power flows to two-way power flows and significant changes in the patterns of high and low demand on the network. This, in turn, has given rise to growing challenges for Western Power and its industry stakeholders to transform the way we deliver a service that meets the needs of our customers to be safe, reliable, and affordable.

24. In light of this, Western Power has initiated a shift in approach to asset replacement and renewal in the AA4 period. We managed the uncertainties caused by the changing energy landscape by trialling and establishing alternate solutions to those we had planned in the AA4 proposal or were only planned to a limited extent.

25. In making investment decisions we have sought to balance the management of asset safety risks and customer reliability with postponing the need for investment where possible to leave open network opportunities created by new technologies and designs that address asset risk, customer demand and network design transformation.

26. Alternative solutions that became available were implemented where we were able to demonstrate that these solutions were more cost effective or offered a greater longer-term benefit than the traditional like-for-like replacement. For example, during the AA4 period we implemented solutions such as standalone power systems (**SPS**) in low density parts of the Western Power Network, as the most cost effective solution to improve reliability for our customers on the more remote parts of the Western Power Network. This approach was consistent with customer feedback provided during the AA4 review, which indicated that customers believed Western Power *should use emerging technologies to deliver improved customer outcomes*.[5]

27. While we have adopted new technologies where these alternative solutions were more cost effective than the traditional like-for-like replacement, we continue to focus on the core of maintaining safety and reliability of our existing assets. Our existing network assets – largely built prior to 1965 – are ageing, with a high proportion in the second half, or approaching the end of their expected service life. As such, capital investment during the AA4 period reflects the asset ageing risk requiring increasing prioritisation compared to the AA3 period.

Transformation of the energy landscape and associated regulatory reforms

28. Regulatory reforms implemented during the AA4 period have enabled Western Power to adopt new technology solutions to manage the Western Power Network. During the AA4 period, Western Power:

[5] Deloitte, *Western Power customer insights feedback report*, Customer insight #5, August 2016.

- started the installation of AMI across the Western Power Network (with approximately 490,000 advanced meters expected on our network by 2022) which will improve the ability to detect faults remotely
- installed a total of 197 SPS units across the Western Power Network with 52 SPS units in 2020/21 and a further 145 planned for 2021/22.

Advanced Metering Infrastructure

29. The Access Code was amended in September 2020[6] to enable cost recovery of AMI expenditure relating to communications and ICT during the AA4 period. The amendments allow recovery of AMI expenditure through a separate building block, similar to how deferred revenue is recovered.

30. As part of recent revisions to the *Electricity Industry (Metering) Code 2012*, from 1 January 2022, all new meters must include a communication link. This effectively mandates that Type 4 AMI meters as the default meter.

31. For the AA4 period, we proposed to introduce AMI as part of the standard meter replacement program. This changed the default replacement meter from a basic meter to AMI (advanced meter and associated communications infrastructure) for:

- meters that are forecast for replacement
- new connections to the Western Power Network
- retailer requested replacements (e.g., where a customer installs a solar photovoltaic (**PV**) system and requires a bi-directional service)
- customer requests – customers whose meters are not scheduled for replacement during the AA4 period have the option to request an advanced meter if they wish, with a fee applicable.[7]

32. The ERA approved capex associated with the installation of AMI meters, and capex associated with the communication infrastructure will be recovered in the AA5 period through the new building block.

SPS

33. The implementation of SPS has been enabled by the following key regulatory changes:

- the *Electricity Industry Amendment Bill 2020* that was passed by State Parliament on 2 April 2020. This amendment was a significant milestone as it means that Western Power can now provide regional customers with new energy solutions, including SPS and storage devices
- on 18 September 2020, the Energy Transformation Taskforce announced the gazettal of the second set of Access Code amendments. This enables Western Power to recover expenditure spent on the SPS program
- the *Electricity Corporations (Electricity Generation and Retail Corporation Area of Operation) Amendment Regulations 2021* that was published in the Government Gazette on 13 January 2021. This enables Western Power to provide SPS under its distribution licence area without requiring a physical connection to the SWIS.

34. Western Power has included capex for SPS projects commissioned from 1 October 2020[8] only, after gazettal of the changes to the Access Code:

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6 https://www.wa.gov.au/government/electricity-networks-access-code-tranche-1-amendments

7 Western Power, Access Arrangement Information, October 2017

8 The 30 September 2020/1 October 2020 dates have been applied (i.e. rather than the Access Code update date of 18 September 2020) to align to Western Power's month-end reporting dates.

- expenditure for SPS commissioned from 1 October 2020 onwards will be treated as regulated expenditure, with depreciation calculated from the appropriate commissioning date for the asset. The assets will be recorded against the RAB provided these costs satisfy the NFIT under sections 6.52(a) and 6.52(b) of the Access Code.
- the written down value of for SPS commissioned prior to 30 September 2020 was transferred from unregulated to regulated as at 1 October 2020.

Unforeseen events – COVID, and natural events

35. Unforeseen events during the AA4 period impacted the delivery of our planned investments:

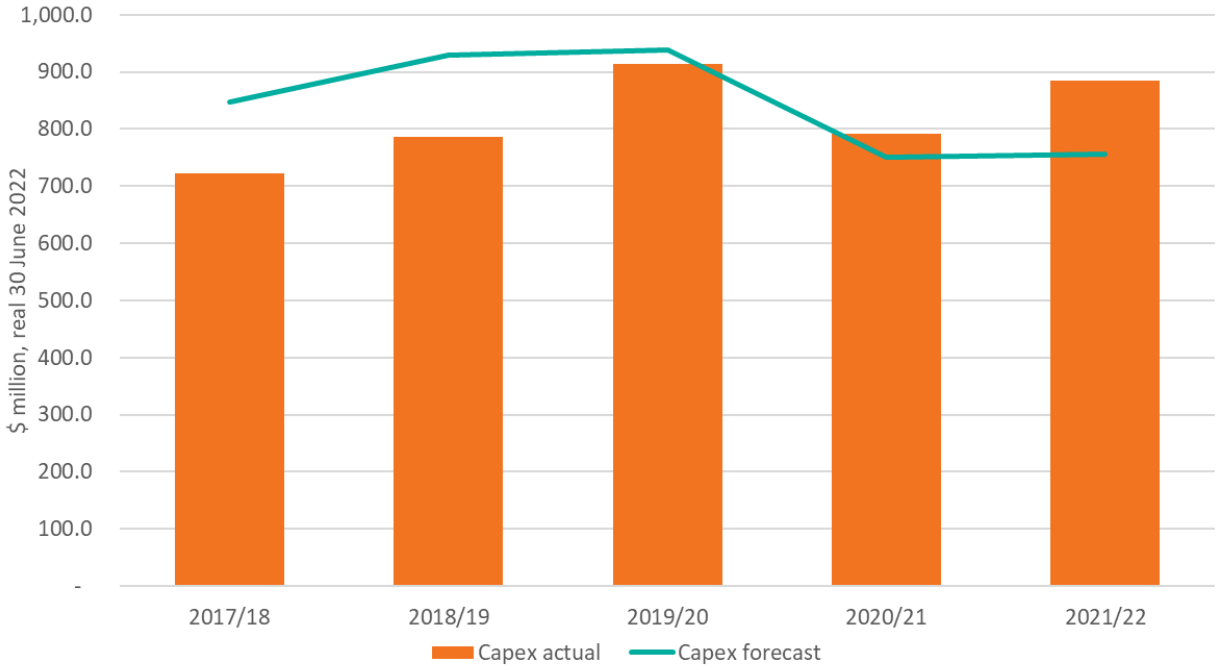
- extreme weather and fire events, such as the Wooroloo bushfire and tropical cyclone Seroja, significantly damaged extensive parts of our network infrastructure.
- the COVID-19 pandemic had immense health, social and economic impacts for Western Australians. We took quick and decisive action to ensure the Western Power Network was able to maintain reliable and safe supply to our customers and keep the lights on.

36. Further delays or deferrals of work may occur during 2021/22 due to competition for resources and supply chain issues caused by global responses to the COVID-19 pandemic. There will also be decisions to make in relation to pricing increases that are occurring due to the competition of resources. This will mean that some work that was planned for the AA4 period will be deferred into the AA5 period. Western Power is trying to mitigate and plan for the impacts of the COVID-19 pandemic to minimise the impacts on the Western Power Network and our customers.

2.2 Actual AA4 capital expenditure

37. Over the AA4 period, Western Power will have invested $4,098.2 million in capex compared to a forecast $4,221.1 million. Figure 2.1 provides a comparison of actual and forecast capex over the AA4 period.

Figure 2.1: AA4 total capex – actual compared to forecast, $million, real at 30 June 2022



38. Total capital investment for the AA4 period is 2.9 per cent less than that included in AA4 target revenue and reflects:

- 25.2 per cent more transmission capex than forecast
- 12.1 per cent less distribution capex than forecast
- 13.9 per cent more corporate capex than forecast.

39. The variation in our capex compared to the AA4 final decision has been driven by the following factors:

- a larger than forecast increase in the uptake of rooftop PV during the AA4 period (from 93 2 MW in 2018 to over 1,357 MW in 2021[9]) has resulted in a significant shift in the patterns of high and low load demand on the network. This trend has led to an increase in low load system events, causing power quality and network instability issues. Long term solutions are being developed to better integrate distributed energy resources (**DER**) into the network. In the meantime, we have installed 350MVAr of reactors in the network across three stages, and 13 community batteries in areas where the distribution network would otherwise need upgrading to maintain power quality and reduce/avoid overloading on distribution transformers
- the potential impacts of increasingly sophisticated cyber-attacks on the operation of the Western Power Network have come into sharp focus during the AA4 period. In response to the increasing threat landscape, Western Power has been implementing enhanced cyber security arrangements in recent years to reduce the risk of cyber-attacks and protect Western Power's systems, networks, and technologies

[9] Qlik dashboard PV

- the implementation of long-term least-cost solutions and asset management practices that have delivered savings across several capex categories during the AA4 period, such as:
  - the risk-based approach to manage distribution overhead assets which balances risk reduction and efficient delivery
  - implementation of SPS to address asset risk, which is a long-term least cost solution[10] and deliver better customer outcomes
  - piloting of digital substations to assess viability of 'digitisation' of substation assets as a method to enable transitioning preventative routine maintenance programs in the transmission network from time-based to condition-based
- a reduction in distribution customer-driven work compared to forecast due to weakened economic conditions in Western Australia which resulted in lower than forecast expenditure on customer-driven distribution capex
- higher customer-driven transmission access and line relocation investment than forecast due to increased access for renewable generators and capacity credits, and major transport infrastructure projects (such as Metronet) that are being delivered as part of the economic stimulus in response to the COVID-19 pandemic.[11]

40. We spent $281 million less than forecast for expenditure categories subject to the IAM in the AA4 period. This mechanism ensures that where Western Power does not spend as much as forecast in these expenditure categories, the revenue associated with this amount is returned to customers in the next access arrangement period.[12] Through the IAM we will return $39.2 million (in NPV terms as at 30 June 2022) to customers during the AA5 period.

41. Further detail about the actual capex undertaken during the AA4 period, the outcomes associated with the AA4 capex program and the reasons for the variances are provided in the following sections.

42. Table 2.1 shows actual capex compared to forecast by regulatory category.

Table 2.1: AA4 total capex by regulatory category, $million, real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Transmission				
Asset replacement and renewal	265.2	234.5	-30.8	-11.6%
Growth	186.3	405.7	219.4	117.8%
Compliance	183.4	122.0	-61.4	-33.5%
Improvement in service	78.2	130.6	52.3	66.9%
Transmission total	**713.2**	**892.8**	**179.6**	**25.2%**
Distribution				
Asset replacement and renewal	1,489.8	1,428.0	-61.8	-4.1%
Growth	1,313.4	937.3	-376.1	-28.6%

10 Implementation SPS will deliver savings in the longer-term, although there has not been significant reduction of asset replacement costs during the AA4 period due the relatively new and limited deployment of these solutions

11 https://www.wa.gov.au/government/wa-recovery

12 The IAM adjustment accounts for the return on asset and depreciation that had been included the revenue, and therefore prices over the AA4 period for expenditure categories subject to the IAM.

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Compliance	201.6	199.0	-2.6	-1.3%
Improvement in service	32.9	105.8	72.9	221.5%
Distribution total	**3,037.7**	**2,670.0**	**-367.7**	**-12.1%**
Corporate total	**470.2**	**535.4**	**65.1**	**13.9%**
AA4 total capex	**4,221.1**	**4,098.2**	**-123.0**	**-2.9%**

2.3 Outcomes from the AA4 capital expenditure program

43. The following section describes the significant outcomes we have achieved for customers over the AA4 period as a result of the capex program.

2.3.1 Transmission network outcomes

Transmission network outcomes - Growth

44. During the AA4 period, Western Power invested $405.7 million in transmission growth projects to expand the capacity of the transmission network to meet growth in demand and connect new customers. This represented 45 per cent of total AA4 transmission capital investment and included:

- extending the network capacity in the Eastern Goldfield region including:
  - providing 43 MW of reference-service capacity in the Eastern Goldfield region load area to overcome network constraints, and connecting major customer loads and additional generation capacity across the Western Power Network
  - developing an Eastern Goldfields Load Permissive Scheme which will allow prospective customers in the Eastern Goldfields to access non-reference power. There are a number of customers progressing connection under this arrangement
  - completion of the West Kalgoorlie Static Var Compensator (**SVC**) Replacement project. The SVC Replacement project 'maintains' existing network capacity
- establishing four new substations (Yandin Terminal, Badgingarra Wind Farm, Eneabba Terminal, and Leath Road) to connect new large customers
- installation of 350 MVAr of reactors to address reactive power issues across the Western Power Network due to minimum demand
- installation of a 490 MVAr transformer at Kemerton terminal to address the asset condition issues and cater for the forecast uplift in customer load
- reinforcing the Geraldton Transmission System to address the asset issues related to deteriorated condition of assets and the risk of explosive failure of the aged and deteriorated pitch-filled switchboard by installing a third 132/22 kV transformer and express feeders.

Transmission network outcomes – Non-Growth

45. We invested $487.1 million in transmission non-growth activities, which represented 55 per cent of total transmission capital investment. This investment generally related to maintaining the provision of covered services to existing customers to ensure the ongoing safe and reliable operation of transmission assets. The outcomes delivered by our AA4 transmission non-growth capex program are summarised by expenditure category below.

Asset Replacement

46. During the AA4 period we invested $234.5 million in transmission asset replacement activities. The key outcomes delivered by our asset replacement program are:

- **power transformers**:
  - replacement of six power transformers in various locations, including five 132 kV (Wagerup, Mullaloo, Capel and two in Picton) and a critical 220 kV bus-tie transformer in a terminal substation (Muja)
  - installation of a new 132-66 kV/22 kV 33 MVAr transformer at Capel substation to mitigate network reliability risk of in-service primary asset failure, address the N-1 capacity shortfall and meet forecast demand for the foreseeable future, while facilitating the transformation of the network by catering for future upgrade to 132 kV
  - refurbishment of 27 power transformers of various voltages
  - purchased two sets of reactors and four power transformers as strategic spares
- **protection**: replacement of 209 protection relays, including 71 obsolete relays
- **switchboards**: replacement of one switchboard (Osborne Park) and ongoing refurbishment of six (three in each of Hay Street and Milligan Street)
- **transmission primary plant**:
  - successful trial and implementation of refurbishment methods for key primary plant assets (power transformers, switchboards, circuit breakers) that will enable Western Power to manage its aging fleet with a prudent investment as well as support transformation by extending the life of the assets until the network is mature enough for conversion (e.g. uprate from 66 kV to 132 kV in the Western Terminal load area)
  - replacement of failed and poor condition primary plant[13] assets comprising 68 circuit breakers (66 outdoor circuit breakers plus two indoor circuit breakers), 263 instrument transformers, 297 disconnectors and disconnectors with earth switches, 90 surge arresters, 15 reactors and other assets (one station transformer, one earthing compensator and 18 relays) in zone and terminal substations
  - successful trial of online condition monitoring of key primary plant and determination of the approach to rollout online condition monitoring across several critical transmission assets in the AA5 period
- **other transmission replacement:** replacement of 2,530 transmission poles and reinforced of a further 8,008.

Service Improvement

47. During the AA4 period we invested $130.6 million in transmission service improvement activities. Alongside the Western Power Network, we also own, operate, and maintain a large multi-technology telecommunications network that provides the services required to protect, operate and manage the transmission and distribution networks and the Wholesale Electricity Market (**WEM**).

48. The key outcomes of the service improvement activities in the AA4 period related to required upgrades of SCADA and telecommunication assets, including:

[13] Some primary plant assets such as circuit breakers can be replaced phase by phase or as whole units. The volumes referred in this document relate to whole units. Volumes reported in AA3 outcomes are expressed in phases (1 unit = 3 phases)

- replacement of obsolete of SCADA and telecommunication assets, enabling a range of services critical to the operation of the Western Power Network, including:
  - electrical protection (automated real-time monitoring of network condition to detect faults and trigger the immediate isolation of network elements. This ensures safe network operation, minimum customer impacts, and prevention of damage to other network assets)
  - substation SCADA and distribution automation (automated real-time central monitoring and control of asset condition and network performance)
  - operational voice communications (creating a wide area network linking the Network Operations and Control Centres, operational depots, substations, and field services workforce, as well as interfacing with emergency services)
- replacement of the 'out of support' Communications Network Management System (**CNMS**) with a capable, expandable, reliable system
- investment in the SCADA Corporate Master Station Technology operating the transmission network, including real-time monitoring, control, and management of electrical and telecommunications networks and mitigating the risks of disruption to the network resulting in material implications to Western Power's obligations as a network service provider and Western Australia's economy[14]
- investment in the Energy Network Management System Programme which will improve and, where possible, consolidate capabilities from the distribution and transmission management systems.

Compliance

49. During the AA4 period we invested $122.0 million in compliance activities, including:

- rectifying structural and building services defects at multiple substations where defects were identified during structural inspections and assessed as having potential to cause a workforce safety or network reliability risk
- removing all asbestos containing materials from three substations (Rockingham, Kwinana and Northern Terminal) where these materials could be removed without the need for network modification.

2.3.2 Distribution network outcomes

Distribution network outcomes – Growth

50. During the AA4 period, Western Power invested $937.3 million on distribution growth projects to expand the capacity of the distribution network to meet growth in demand and connect new customers. This represented 35 per cent of the total investment in distribution capital activities and included the following:

- installed new feeders and reinforced existing feeders to increase capacity, reduce feeder peak loading and reduce the risk of long duration outages at Henley Brook and Rangeway zone substations
- connected 89,147 new customers to the distribution network increasing total customers connected by approximately 3 per cent to more than 1.16 million customers
- completed 17 SUPP projects in partnership with the State Government and local governments in a number of metro and rural locations:

[14] Note, the cost of the investment in the SCADA Corporate Master Station Technology is split between transmission and distribution as this technology supports the operation of both the transmission and distribution networks.

  - metro locations: Bicton North, Melville North, Alfred Cove East, Carlisle North, Kardinya South, Trigg, Victoria Park West, Shelley West, Collier, Victoria Park East, Menora, Floreat East, Floreat North and Floreat West
  - rural locations: Pinjarra, Geraldton
  - these undergrounding projects removed:
    - 67 km of HV overhead
    - 168 km of LV overhead
    - 4,223 poles
- converted Nedlands distribution network from 6.6 kV to more efficient 11 kV to increase the capacity of the load area caused by growth of the suburb including a new hospital
- installed 13 community powerbank distribution storage batteries as a new technology to address overloaded distribution transformers and improve network voltage compliance issues.[15]

Distribution network outcomes – Non-Growth

51. We invested the remaining 65 per cent or $1,732.8 million on distribution non-growth activities.

Asset Replacement

52. During the AA4 period we invested $1,428.0 million in distribution asset replacement activities. The key outcomes delivered by our asset replacement program are:

- **pole management:** replaced 55,383 and reinforced 82,519 distribution poles based on our asset risk prioritisation framework. Poles replaced either failed in service or had underlying conditions that warranted replacement or reinforcement
- **protective device management:** replaced 4,075 protective devices to enable the safe and reliable operation of the overhead network. This included replacement of drop out fuses, reclosers, sectionalisers and surge arresters that failed in service and based on our asset risk prioritisation framework
- **conductor management:** replaced 1,627 km of conductor identified to be in poor condition to maintain the current level of unassisted conductor failure risk
- **metering:** installed a total of 415,783 meters. Of those, 25,292 were non-AMI, 73,686 were AMI capable and 316,805 were AMI ready. Of the 415,783 meters installed, 89,147 meters were for new connections and 326,636 replaced existing meters as part of network maintenance and customer requested services
- **streetlight management**:
  - continued the metal streetlight pole management program to reduce the public safety risk associated with pole failure and unsafe defects by treating 8,200 streetlight poles (including replacing 4,025 poles and reinforcing 4,175 poles)
  - replaced faulty streetlight luminaires and streetlight underground cables that failed in service. LED luminaires were also introduced as a standard replacement during this period

[15] Note, the total cost (capex and opex) of the battery investments has been split between regulated expenditure and unregulated expenditure. Western Power has undertaken an internal assessment of the recommended capital expenditure in each battery business case to determine the proportion of capital expenditure that should be classified as regulated expenditure and recovered via the regulated tariff revenue. The remaining expenditure has been classified as unregulated expenditure and reflects a strategic investment by Western Power that will be funded by incremental unregulated revenue.

- **substation:** decommissioned Forrest Avenue Substation to address the asset issues related to the risk of explosive failure of the aged and deteriorated pitch filled switchboard and the need to address the transformer noise. The substation load was transferred to a neighbouring substation via the installation of express feeders[16]
- **transformer management:** the transformer management program included distribution transformers (both pole top and ground mounted) and voltage regulators. During the AA4 period we replaced 1,912 overhead transformers, 469 ground mounted transformers and 31 voltage regulators
- **switchgear management:** the switchgear management program comprised three asset types: ring main units, capacitor banks and LV overhead disconnectors. During the AA4 period we replaced 266 ring main units, 9 capacitor banks and 1,023 LV Switch disconnectors
- **cable management:** under this program, Western Power replaced cables that failed in service, cables identified in poor condition and feeder exit cables.

53. Alternative solutions to asset replacement were implemented that were more economic and provided better outcomes for customers:

- **SPS:** installed 197 SPS including 52 SPS units across the SWIS up to 2020/21, with a further 145 planned for 2021/22
- **undergrounding** of parts of the following geographical area: City of South Perth, City of Canning, City of Nedlands, Claremont and Wembley-West Leederville. These undergrounding projects removed:
  - 37km of HV overhead
  - 79km of LV overhead
  - 2,376 poles.

Service Improvement

54. During the AA4 period we invested $105.8 million in distribution service improvement activities. The key outcomes of the service improvement activities are:

- replacement of obsolete SCADA and telecommunication assets, enabling a range of services critical to the operation of the Western Power Network, including:
  - replacement of obsolete and unsupported in-service telecommunication and distribution automation assets critical to the operations and management of the distribution network including bushfire mitigation
  - replacement of obsolete remote control and monitoring equipment to maintain the high electricity network availability requirements for the Perth CBD in compliance with regulatory obligations
  - replacement of obsolete and unsupported distribution automation and telecommunication assets which form part of the distribution telecommunication network in the South Country region. These assets are critical to providing safe, reliable, and efficient provision of electricity
  - investment in the SCADA corporate master station technology operating the distribution network, including real-time monitoring, control, and management of electrical and telecommunications networks and mitigating the risks of disruption to the network resulting in

[16] Note, the expenditure for this activity is split between transmission and distribution with the bulk of the expenditure in distribution category.

material implications to Western Power's obligations as a network service provider and Western Australia's economy [17]

  - upgraded the Energy Management System (**EMS**) to address an aging hardware platform and the end of support of those systems. This was assessed as posing a high operational risk, as not maintaining supported operating systems and software releases may lead to software malfunction with possible major impact on reliant system interfaces. Failures in the EMS could lead to reduced ability to operate and maintain the electricity network, with direct impact to a large number of connected customers from more frequent and extended outages, a safety incident, or unacceptable levels of power quality
  - investment in a Radio Frequency mesh two-way communications network to support AMI
- investments to improve reliability on the distribution network, including:
  - implemented a 5 MW microgrid in Kalbarri (one of Australia's largest microgrids) to run in complete renewable mode, which means it can draw energy solely from the connected wind farm and feed-in from residential rooftop PV, serving a 1,500 people community
  - implemented the under fault rated conductor migration program to reduce public safety risks.

Compliance

55. During the AA4 period we invested $199.0 million in compliance activities. The key outcomes of the compliance management activities are:

- **pole management:** replaced 4,137 stays, 9,255 cross arms and 46,718 insulators that failed in service and based on our asset risk prioritisation framework
- **bushfire management:** installed 1,908 LV spreaders and remediated 682 HV clashing bays as part of the bushfire management activities to mitigate the risk of overhead conductors coming into contact with each other and causing sparks
- **connection management:** implemented Service Connection Condition Monitoring, and replaced 4,641 defective/older (twisties type) overhead service connections and 6,566 URD pillars that failed in service
- **conductor management:** remediated 318 bays that were identified with sub-standard clearances. These bays are prioritised based on their location (across road crossings and in highly traversable areas) and pose a public safety risk due vehicle and people contact
- **power quality compliance:** remediation of power quality issues in order to maintain compliance on the transmission and distribution network.

2.3.3 Corporate outcomes

56. In AA4 we invested $535.4 million on corporate support activities including the following IT investments to improve the effectiveness of key operational processes and work practices:

- cyber security strategy, which implemented the response to cyber security risks in alignment to the Australian Energy Sector Cyber Security Framework (**AESCSF**) developed by the Australian Energy Market Operator (**AEMO**) and applicable to Wester Power as an electricity utility who owns assets classified as critical infrastructure
- upgrade to the Enterprise Resource Planning (**ERP**) system (Ellipse 6.3) which supports the core business functions of asset management, works management, finance, human resource management,

[17] Note, the cost of the investment in the SCADA Corporate Master Station Technology is split between transmission and distribution as this technology supports the operation of both the transmission and distribution networks.

payroll, and inventory management. The system had not been upgraded since 2010 and was no longer supported by the manufacturer

- design and implementation of the Enterprise Grid Transformation Engine (**GTEng**) for distribution which is a new Network Planning tool to manage transformation of the distribution network. The use of the distribution network is changing, primarily driven by changing consumer needs, behaviours, and technologies (such as PVs, storage, and electric vehicles). As the requirements of the distribution network change, there is an increased financial risk of asset stranding, compounded by the need to decide whether or not to invest in asset replacement (with 50 year-plus asset lives) as multiple overhead distribution network assets approach end-of-life. In response, Western Power identified the need for an enhanced planning capability to allow modelling of the distribution network against possible future scenarios. This, in turn, helps with identifying the prudent level and nature of investments required to meet our customers' energy needs at the most competitive cost
- implementation of a Customer Management System (**CMS**) capability to provide the current services to customers by replacing the functionality from an obsolete core customer service platform, improve Western Power's capability to enhance our customers' experience, including by providing more accurate 24/7 information via their preferred communication channels and improve Western Power's productivity.

57. In addition to the IT investments, some key facilities were upgraded, rebuilt, or rationalised in order to comply with safety, legislative or financial requirements, better meeting the operational needs of the business. These facilities included:

- transitioned the East Perth Control Centre to a new location and established a new backup control centre for business continuity office and critical communications. This was to reduce the inherent 'Extreme' risk associated with controlling network operations in the event of an extended outage of the existing facility in the absence of adequate alternative facilities
- progressed the delivery of the Depot Optimisation and Consolidation Program which aimed to provide fit for purpose depot facilities and a reduction in the number of Western Power depots in the Perth Metropolitan and Southwest region of Western Australia generating cost reductions and disposals benefits. The main depots delivered or nearing completion during the AA4 period were Vasse, South Metro, Pinjarra, and Albany.

2.4 AA4 capital expenditure program variances

58. The following section describes the key variances in the actual AA4 capex program compared with Western Power's AA4 investment proposal as approved by the ERA final decision. This section should be read in conjunction with the confidential AA4 Capital Expenditure Variance Analysis, provided in Attachment 5.2. The AA4 Capital Expenditure Variance Analysis provides detail of AA4 capex variances by regulatory expenditure category and provides high level commentary on key projects.

2.4.1 Variances in growth-related capital expenditure

59. Over the AA4 period, we spent $156.7 million less than forecast on growth-related capital investments (see Table 2.2).

Table 2.2: AA4 growth-related capex – actual compared to forecast, $ million real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Transmission				

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Capacity expansion	59.6	108.0	48.3	81.0%
Customer driven	126.7	297.7	171.1	135.1%
Transmission total	**186.3**	**405.7**	**219.4**	**117.8%**
Distribution				
Capacity expansion	190.2	73.5	-116.6	-61.3%
Customer driven	682.4	587.8	-94.6	-13.9%
Gifted assets	440.8	275.9	-164.9	-37.4%
Distribution total	**1,313.4**	**937.3**	**-376.1**	**-28.6%**
Growth total	**1,499.7**	**1,343.0**	**-156.7**	**-10.5%**

60. The AA4 growth-related capex was underpinned by a high growth forecast, evidenced by:

- peak demand increasing on average by 147 MW per year over the prior decade
- record numbers of major load and generator connection applications
- an estimated 130,000 new distribution customers connecting to the network.

61. Over the AA4 period, Western Power saw a continued slowdown in the growth rate of peak demand. The slowed growth reflects a change in a range of factors including:

- a series of mild summers, resulting in feeder peaks being lower than expected
- the continued take-up of self-generation via solar PV and energy efficiency appliances
- changing consumer behaviour, driven in part by prices and the economic climate.

62. The reduction in growth rate and load forecasts led to a review of the need for proposed growth-related distribution expenditure. This resulted in a number of distribution growth-related projects being postponed.

63. The increased PV penetration has led to a number of challenges for the operation of the transmission and distribution network relating to voltage and power quality. At the time of the AA4 proposal, the focus of capacity expansion expenditure was to mitigate undervoltage risks. Throughout the AA4 period, this has not eventuated, however, the increased PV penetration has shifted focus to overvoltage mitigation. Midway through the AA4 period, significant unexpected transmission expenditure was required to mitigate and manage the overvoltage risk. This work has also had downstream flow on effects, resulting in less expenditure required to manage voltage issues on the distribution network.

64. The larger investment was also required during the AA4 period to mitigate reactive power issues on the distribution network as a result of minimum demand events. This issue became prevalent midway through the AA4 period, and therefore expenditure was not allocated at the time of the AA4 Final Determination.

65. The SUPP was underspent because Western Power, in collaboration with EPWA, have put the development of round 7 on hold while assessing the feasibility of a new undergrounding program and funding arrangement. The intent is that the new program will provide a more equitable outcome and greater benefits for the local governments and ratepayers as well as targeted strategic benefits for the network.

66. Under the IAM the difference in financing costs between forecast and actual growth-related investment for AA4 ($176.8 million) is returned to customers in the AA5 period via an adjustment to AA5 target revenue. This ensures customers do not pay for the forecast growth-related capex that does not occur.

2.4.2 Variances in non-growth-related capital expenditure

67. Over the AA4 period, we invested $31.4 million or 1.4 per cent less than forecast on non-growth capex (see Table 2.3).

Table 2.3: AA4 non-growth-related capex – actual compared to forecast, $ million real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Transmission				
Asset replacement	265.2	234.5	-30.8	-11.6%
Compliance	183.4	122.0	-61.4	-33.5%
Improvement in service	78.2	130.6	52.3	66.9%
Transmission total	**526.9**	**487.1**	**-39.8**	**-7.6%**
Distribution				
Asset replacement	1,489.8	1,428.0	-61.8	-4.1%
Compliance	201.6	199.0	-2.6	-1.3%
Improvement in service	32.9	105.8	72.9	221.5%
Distribution total	**1,724.3**	**1,732.8**	8.5	**-3.1%**
Non-growth total	**2,251.2**	**2,219.8**	**-31.4**	**-1.4%**

68. The major programs contributing to this variance are discussed below. Additional detail regarding the reasons for variance by each major project or program of capex in AA4 is provided in the confidential AA4 Capital Expenditure Variance Analysis, provided in Attachment 5.2.

Asset replacement and renewal

69. During the AA4 period, Western Power invested a total of $92.6 million less than forecast in asset replacement and renewal. This comprised a -4.1 per cent variance for distribution asset replacement and renewal and -11.6 per cent variance on transmission asset replacement and renewal (see Table 2.4). Overall, the asset replacement and renewal expenditure is 5.3 per cent less than the AA4 proposal.

Table 2.4: AA4 Asset replacement and renewal – actual compared to forecast, $ million real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Transmission				
Asset replacement and renewal	265.2	234.5	-30.8	-11.6%
Transmission total	**265.2**	**234.5**	**-30.8**	**-11.6%**
Distribution				
Asset replacement and renewal	462.9	440.0	-22.9	-4.9%

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Pole Management	704.3	702.5	-1.8	-0.3%
Metering	157.1	163.3	6.2	4.0%
SUPP	165.6	122.3	-43.4	-26.2%
Distribution total	**1,489.8**	**1,428.0**	**-61.8**	**-4.1%**
Total asset replacement and renewal	**1,755.1**	**1,662.5**	**-92.6**	**-5.3%**

70. The main variances at a program level are set out below.

Transmission

71. Our transmission asset replacement and renewal investments were $30.8 million less than forecast. The variances at a program level that contributed to this difference in expenditure are:

- **power transformers:** we spent approximately $16.7 million less than forecast on replacement of transmission power transformers. This was due to changes in the long-term strategy to decommission the 66 kV network. Innovative alternative options such as refurbishment, procurement of strategic spares, as well as contingency planning were carried out to manage the risk associated with the deferral of replacements. For example, the Tate Street T1 and T3 replacement was descoped and changed to a decommission project and the 66 kV transformers in the east country have been deferred to allow time for the new DER strategy and 66 kV network rationalisation strategy to be developed. This change in strategy has enabled us to replace and renew power transformers at lower cost than forecast, resulting in a better outcome for the community.
- **protection:** we spent $10.9 million more than forecast due to the complexities with the replacement of protection systems. In order to comply with new standards and achieve standardisation (which provides benefits in the long term), associated systems need to be upgraded, resulting in additional costs and volumes compared to forecast.
- **SVC:** our actual expenditure for the SVC was $6.5 million higher than forecast. Due to the more technically complex and bespoke nature of the project than anticipated, significant additional internal work was required to manage the design, construct, and commissioning procurement. The vendor price also exceeded Western Power's initial estimates due to required changes in the design and commissioning scope.
- **switchboards:** we spent $48.8 million less than forecast on replacement of switchboards. This was in part due to a change in approach during the period, which resulted in lower replacement costs. Subsequent to the AA4 submission, Western Power, supported by the original equipment manufacturer, undertook a detailed investigation to test the viability of refurbishment of the substation pitch filled switchboards at Hay Street and Milligan Street rather than replacement of the switchboards. The primary objective was to identify treatment options that could manage these risks to tolerable levels with a lower capital investment, compared to the previous plan (and the basis for the AA4 cost estimate) which involved replacement of the switchboards. As a result, the investment was completed on schedule and under budget, due to identifying a lower cost alternative to the initial plan to replace the switchboards. Delays to the Osborne Park switchboard replacement due to access constraints and the unexpected failure of the T2 transformer cable box resulted in the subsequent delay of Manning Street and Yokine switchboard replacements to the AA5 period. Due to the configuration of the network, when we work on one of these three substations we need to transfer

load to the other two substations, so works could not happen at these sites in parallel. As such, there was a reduction in the overall expenditure on switchboard replacements.

- **primary plant:** our proposed expenditure for the AA4 period was developed based on the actual expenditure during the AA3 period. Since the forecast was developed, we have improved the robustness of the commercial and compliance processes and outsourced the design process, which has contributed to the increased cost of the program. Overall, we spent $8.7 million more than forecast.

Distribution

72. Our distribution asset replacement and renewal investments were $61.8 million less than forecast. The variances at a program level that contributed to this difference in expenditure are:

- **pole management (asset replacement)**: we replaced or reinforced about 138,000 distribution poles. The expenditure on the pole management program is $1.8 million less than forecast. This is the result of changing strategy to reinforce poles, where possible, as agreed with the safety regulator after the AA4 final decision. As such, the volume of pole replacements reduced, however pole reinforcement volumes increased. The reduction in cost of the pole management program as a result of this change in strategy was offset by an increase in pole replacement unit rates (due to a number of factors including contractor rate variations, change in delivery mix, new environmental compliance costs, and work practice changes to implement new safety management requirements under AS5577).
- **conductor management:** we replaced 1,627 km of conductor. The expenditure on the conductor management (replacement) program is $96 million lower than forecast mainly due to reduction in volumes due to alternate strategies to manage the risk including undergrounding and SPS.
- **metering:** the metering program is $6.2 million higher than forecast due to the deployment of more AMI than forecast, and the inclusion of communication and ICT infrastructure to support AMI. Only capex associated with the installation of AMI meters was included in the forecast. Changes to legislation during the AA4 period enable the recovery of capex relating to communications and ICT in the AA4 period.
- **streetlight replacement:** the streetlight replacement program is $32.7 million higher than forecast mainly due to the addition of the streetlight luminaires replacement program, and minor increases in streetlight underground cable fault replacements and unit rates.
- **transformer management:** expenditure on the transformer program is $22.4 million lower than forecast due to a reduction in the volume of transformers that needed to be replaced based on our risk-based methodology and a significant reduction in the unit rate driven by a change in transformer suppliers.
- **cable management:** the cable management program is $9.9 million higher than forecast due to the capitalisation of work that was historically classified as opex in addition to the replacement of feeder exit cables associated with switchboard replacement and upgrade works at Zone Substations that were not foreseen prior to the AA4 period.
- **switchgear management:** expenditure for the switchgear management program is $4.2 million lower than forecast due to a change in the works mix, including less complex ring main unit replacements and less switch disconnector replacements than was forecasted.

Improvement in service

73. During the AA4 period, Western Power invested a total of $125.2 million more than forecast in the improvement in service regulatory category (see Table 2.5).

Table 2.5: AA4 Improvement in service – actual compared to forecast, $ million real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Transmission				
Reliability driven	-	1.5	1.5	-
SCADA and communications	78.2	129.1	50.8	65.0%
Transmission total	**78.2**	**130.6**	**52.3**	**66.9%**
Distribution				
Reliability driven	11.4	21.7	10.4	91.2%
SCADA and communications	21.5	84.0	62.5	290.4%
Distribution total	**32.9**	**105.8**	**72.9**	**221.5%**
Total improvement in service	**111.1**	**236.3**	**125.2**	**112.6%**

SCADA and communications

74. The reasons for this variance are the growing risks associated with obsolete assets such as low reliability, technical compliance, cyber security, and ability to meet the emerging requirements. Western Power realised that only effective way to manage these risks long term is to improve the SCADA program delivery.

75. The ERA in the AA4 Final Determination acknowledged that Western Power needed to address large number of obsolete (unsupportable and aged) Distribution and Transmission SCADA and Telecommunications assets. However due to concerns about Western Power's ability to deliver a large SCADA investment program, the ERA approved only a level of expenditure consistent with the level of expenditure in the AA3 period.

During the AA4 period Western Power was able to deliver to the originally proposed expenditure, which included completing critical work, reducing risks assessed as high and preventing further deterioration of assets.

Reliability driven

76. Distribution reliability expenditure is also higher than forecast due to an integration of storage projects in response to emerging minimum demand issues, which realised a step change to the network's energy topology and are expected to result in improvements to reliability performance. These investment options were not considered at the time of the AA4 proposal as the technology was not widely used due to economics of the technology.

77. The expenditure on the Kalbarri microgrid was also higher than forecast at the time of the AA4 proposal. This was due to the initial cost estimate being based on a feasibility assessment in the context of this being a new technological solution for the network. Further scoping and design of the delivery solution (as capability matured) resulted in a more accurate estimate of costs, which were higher than the initial feasibility estimates.

Regulatory compliance

78. During the AA4 period, Western Power invested $64.0 million less than forecast for capital works required to comply with external obligations with respect to the transmission and distribution networks (see Table 2.6).

Table 2.6: AA4 Regulatory compliance – actual compared to forecast, $ million real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Transmission	201.6	199.0	-2.6	-1.3%
Distribution	183.4	122.0	-61.4	-33.5%
Total regulatory compliance	**385.0**	**321.0**	**-64.0**	**-16.6%**

79. The majority of the variance can be explained by the following changes in delivery of regulatory compliance works.

Transmission

80. Our transmission regulatory compliance investments were $61.4 million less than forecast. At an overall level this was largely due to a change in delivery strategy during the AA4 period that resulted in a number of programs which were previously stand-alone programs with targeted asset lists being progressed to a zonal treatment approach, therefore reducing targeted volumes, resulting in better outcomes for the community. Further, a heavy commitment of resources was required to be diverted to conduct testing and subsequent asset replacement for a particular model of current transformers which experienced an unexpected failure rate.

81. The main variances at a program level that contributed to this difference in expenditure are:

- **transmission poles and towers:** we spent $19.5 million less than forecast on the transmission wood pole replacement and reinforcement program due to numerous delivery challenges associated with scoping and long-term planning as well as various different access constraints, including network access and site access. We have made changes to our approach to the wood pole replacement and reinforcement program to mitigate these delivery challenges in the future.
- **substation security:** we spent $43.7 million less than forecast on substation security activities during the AA4 period due to several factors including:
  - delays to the completion of the revised Network Facilities Assets strategy which caused some reprioritisation and scope changes to the sites being addressed in the AA4 period
  - phase two of the substation fence replacement program has been delayed, with some of this program expected to fall into the AA5 period
  - reduced scope for the Edmund Street and O'Connor Substations. These were planned as a full fence replacement, however, after consideration of the design report the works were downgraded to only electronic security which is being delivered under the volumetric Hot Spot Project
  - the scope for the Western Terminal fence and site security upgrades was significantly reduced due to the site being identified for future decommissioning.

Distribution

82. Our distribution regulatory compliance investments were $2.6 million less than forecast. The main variances at a program level that contributed to this difference in expenditure are:

- bushfire management costs were $21.9 million lower than forecast due to the introduction of new surveying technology (LiDAR), which has enabled more effective assessment of clashing conductor bays, and introduction of a HV spreader solution which has led to lower costs

- Pole management compliance program costs were $29.9 million higher than forecast due to increase in cross arm and insulator replacement volumes in the last two years to manage pole top fire risk resulting from a change in strategy, impacts from pausing the Pole Top siliconing program due to a workforce safety incident and due to impact from Cyclone Seroja – all of which resulted in close to double the number of volumes replaced. AA4 approved unit rate was based primarily on planned work which was more dispersed (PAR), while actuals replacements included more reactive and clustered (planned) work, which are both cheaper. Cross Arm Replacement contribute to the increase by $11.69 million and insulator replacement by ~ $15.36 million.
- there was a $14.2 million reduction in power quality remediation work compared to forecast due to high level transmission solutions being implemented that resulted in MV and therefore LV voltage reductions, reducing the need for power quality remediation work on the distribution network
- connection management costs were $9.9 million higher than forecast because our AA4 proposal only included the initial stage of the Service Connections Condition Monitoring program. Stage 2 of the program was brought forward into the AA4 period as part of the WA Government's Recovery Plan.[18]

2.4.3 Variances related to corporate expenditure

83. During the AA4 period, Western Power invested $65.1 million more than forecast on corporate support capex (see Table 2.7).

Table 2.7: AA4 Corporate – actual compared to forecast, $ million real at 30 June 2022

Expenditure category	AA4 Forecast	Actual	$ variance	% variance
Business support	248.7	241.9	-6.8	-2.8%
IT	221.5	293.5	72.0	32.5%
Total corporate	**470.2**	**535.4**	**65.1**	**13.9%**

84. Significant projects not specifically detailed in the AA4 proposal were the implementation of Cyber Security, GTEng and CMS:

- **Cyber Security Strategy:** implementation of the response to cyber security risks in alignment to the AESCSF developed by AEMO and applicable to Wester Power as an electricity utility classified as critical infrastructure.
- **GTEng**: design and implementation of the Enterprise GTEng which is a new capability that models the long-term planning of the network and enables its modernising and the embedding of new technologies and energy transformation scenarios.
- **CMS:** implementation of a fit for purpose enterprise customer management system and internal processes for managing all relationships and interactions with customers and potential customers to improve customers' experience and improve Western Power's productivity. The CMS:
  - retained Western Power's capability to provide the current services to its customers by replacing the functionality from an obsolete core customer service platform
  - improved our capability to enhance our customers' experience, including by providing more accurate information on a 24/7 basis via customers' preferred communication channels
  - realised $3.6 million (NPV) in financial benefits from Phase 1 of the CMS, from the avoided future cost of upgrading the on-premises Salesforce system and bringing customer surveys in-house

[18] https://www.wa.gov.au/government/wa-recovery

  - delivered non-financial benefits, including providing multi-channel access to customer information for customers, and increasing our capability to proactively communicate with customers to improve communications and operational safety, as requested by our customers.
- Regulatory reform associated ICT solutions in response to support the outcomes and policy changes.

3. Consistency with Access Code requirements

85. As outlined in section 2, the ERA has previously accepted forecasts of new facilities investment of $4,221.1 million as being consistent with the new facilities investment test set out in sections 6.51 to 6.54 of the Access Code.

86. The ERA's review was based on an ex-ante basis. Western Power is required to demonstrate that the new facilities investment undertaken in AA4 satisfies the NFIT at the time the expenditure was incurred.

87. This section sets out how our actual capex over the AA4 period is consistent with the Access Code.

3.1 Access Code requirements

88. Western Power is required to include information to support its proposal to add new facilities investment undertaken during the current regulatory period to the regulated asset base (**RAB**).

89. Section 6.51A of the Access Code provides that new facilities investment may be added to the RAB if it passes certain tests namely:

> *6.51A New facilities investment may be added to the capital base if:*
>
> *a) it satisfies the new facilities investment test; or*
>
> *b) the Authority otherwise approves it being added to the capital base if:*
>
> *i. it has been, or is expected to be, the subject of a contribution; and*
>
> *ii. it meets the requirements of section 6.52(a); and*
>
> *iii. the access arrangement contains a mechanism designed to ensure that there is no double recovery of costs as a result of the addition.*

90. Section 6.52 of the Access Code sets out the NFIT, which essentially has two parts which must be met. The first part emphasises the need to efficiently minimise costs:

> *6.52 New facilities investment satisfies the new facilities investment test if:*
>
> *a) the new facilities investment does not exceed the amount that would be invested by a service provider efficiently minimising costs, having regard, without limitation, to:*
>
> *i. whether the new facility exhibits economies of scale or scope and the increments in which capacity can be added; and*
>
> *ii. whether the lowest sustainable cost of providing the covered services forecast to be sold over a reasonable period may require the installation of a new facility with capacity sufficient to meet the forecast sales.*

91. Section 6.52(b) of the Access Code sets out a number of tests so that new facilities investment may only be added to the RAB if:

> *b) one or more of the following conditions is satisfied:*
>
> *i. either:*
>
> *A. the anticipated incremental revenue for the new facility is expected to at least recover the new facilities investment; or*

B. if a modified test has been approved under section 6.53 and the new facilities investment is below the test application threshold – the modified test is satisfied.

or

ii. the new facility provides a net benefit in the covered network over a reasonable period of time that justifies the approval of higher reference tariffs; or

iii. the new facility is necessary to maintain the safety or reliability of the covered network or its ability to provide contracted covered services.

92. The concepts of 'efficiently minimising costs' and 'good electricity industry practice' are also defined under the Access Code. Efficiently minimising cost is defined as:

> *the service provider incurring no more costs than would be incurred by a prudent service provider, acting efficiently, in accordance with good electricity industry practice, seeking to achieve the lowest sustainable cost of delivering covered services and without reducing service standards below the service standards benchmarks set for each covered service in the access arrangement contract for services.*

93. Good electricity industry practice is defined as:

> *the exercise of that degree of skill, diligence, prudence, and foresight that a skilled and experienced person would reasonably and ordinarily exercise under comparable conditions and circumstances consistent with applicable written laws and statutory instruments and applicable recognised codes, standards and guidelines.*

94. In demonstrating how our AA4 capex is consistent with the requirements of section 6.52(a) we have set out in the following sections the processes we have relied upon to make decisions about the capex. We have also set out the relevant tests under section 6.52(b) of the Access Code.

95. Western Power considers that our AA4 capex program is consistent with the NFIT requirements and has been added to the RAB.

96. We further note that section 6.54 of the Access Code requires that in applying the NFIT the ERA:

> *Must have regard to whether the new facilities investment was required by a written law or a statutory instrument.*

3.2 Investment governance

97. The primary goal of the Western Power Network is to connect and efficiently and safely deliver access services to customers. This is achieved by providing reliable and cost-effective outcomes with an unwavering focus on customer, community and workforce safety whilst complying with statutory and regulatory obligations.

98. Our corporate governance framework provides the overarching guidance for the development of policies and frameworks that support Western Power to achieve our corporate objectives and to meet legislative and regulatory obligations.

99. Under the Investment Management Policy is the Investment Governance Framework (**IGF**), strategies, standards, guidelines, and tools designed to support the capital investment process. There are three main aspects to the investment process, which are:

- identifying the current and future limitations of the network, and possible business improvements, to establish where investment is, or will be, required
- selecting which of the issues that require investment should be addressed
- addressing the chosen network limitations and business improvement opportunities through efficient delivery of selected investments and projects.

100. The Investment Management Policy is supported by other policies, such as the Assurance and Risk Policy (underpinned by the Enterprise Risk Management Framework) which embeds risk management across the business.

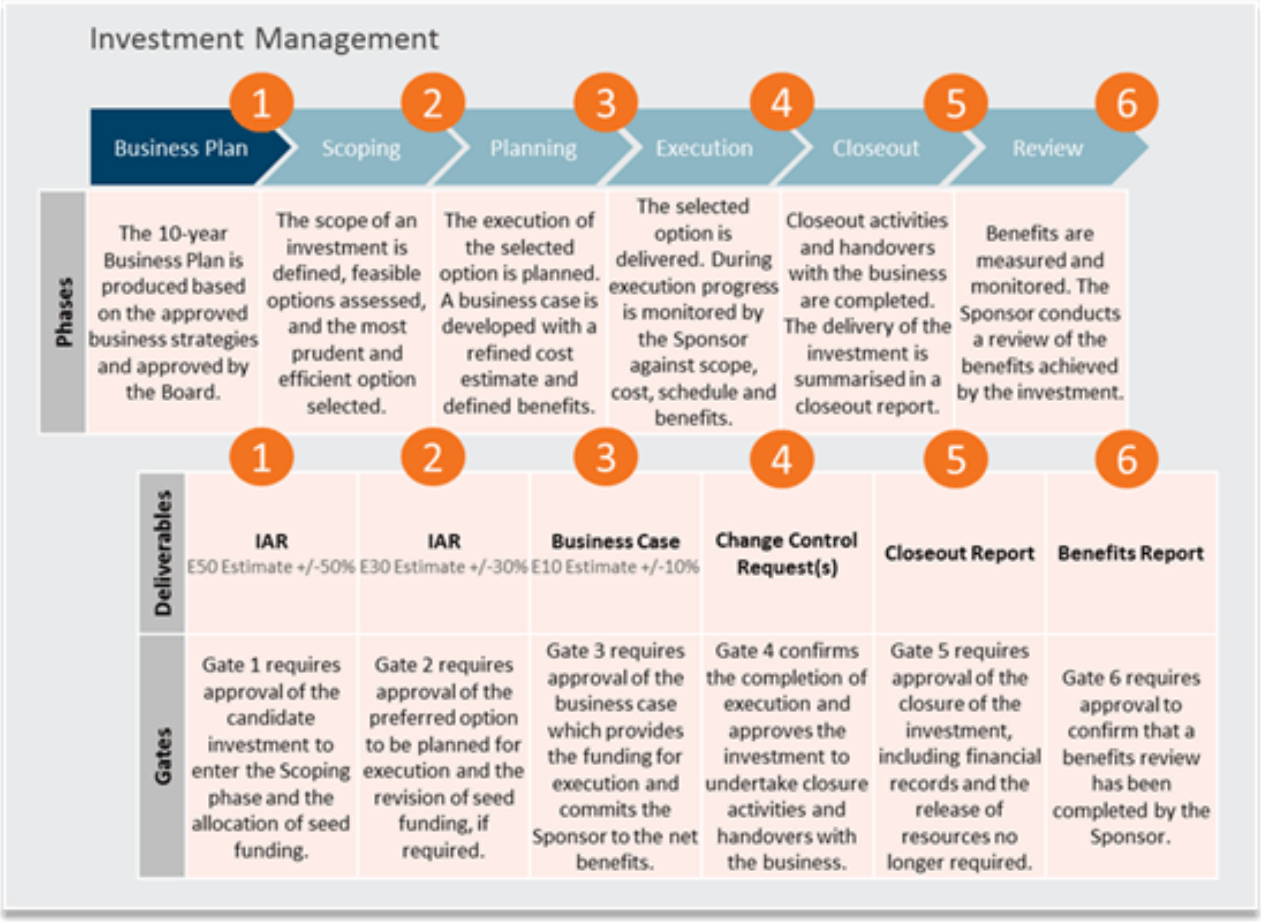
101. The IGF supports investment decision making, planning and delivery and has evolved over time. The changes made to the IGF have either been in response to internal initiatives, or continuous improvement opportunities identified through external reviews.

102. During the AA4 period, the IGF was applied and further strengthened by the monthly Investment Review Committee meeting with all the executives in attendance.

103. The IGF is applied via the corporate systems and controls and requires all investments and projects to be initiated, recorded, and managed in our investment governance system ensuring consistency and alignment with Western Power's corporate objectives. This includes clarity of roles and accountabilities, accurate and timely information, clear processes, and criteria to support decision making, and the opportunity to review and monitor the process and outcomes. The gated approvals process the IGF established remained, and end-to-end accountability of investment outcomes has been adopted to increase accountability and reduce inefficiencies.

104. Figure 3.1 below illustrates the lifecycle phases and gates of the IGF.

Figure 3.1: IGF Lifecycle phases and gates



105. Gates are points of control between lifecycle phases. Each gate ensures the decision to proceed to the next phase is controlled and documented. The IGF gates are for the purpose of:

- assessing whether or not to proceed to the next phase, based on business benefits and alignment to corporate objectives
- ensuring investment options and assessments are undertaken at the appropriate time
- providing an opportunity to confirm whether the justification for the project or program to continue remains
- obtaining the required approval to ensure compliance with Delegated Financial Authority (DFA) policy
- ensuring appropriate control is applied to manage delivery risk
- ensuring due process, evidence and transparency of decision making throughout the lifecycle of an investment or project.

106. The phases prior to gate three ensure the project and program options, and required assessments, are completed. This includes the need to confirm capital investments satisfy the NFIT prior to execution.

107. Gates four to six ensure the completion and performance of projects and programs is reviewed against the business case, lessons learned are identified for continuous improvement, and intended benefits are delivered and validated.

108. We are continually seeking improvement opportunities across our business and recognise investment governance best practice will continue to evolve.

109. Western Power's Asset Management System (**AMS**) contains a range of methodologies and processes that are applied for asset management decisions which support investments. The AMS is audited by an independent reviewer as a condition of Western Power's electricity transmission and distribution licence. The recent audits of these system included:

- the AMS review concluded in 2017[19] found that:

  The maturity of Western Power's Asset Management has significantly strengthened over time, particularly in relation to strategy, objectives, sophistication of approaches and supporting tools

  Western Power's approach to risk-based asset management can be considered effective, particularly as applied to asset maintenance and renewal.

  comprehensive and rigorous processes resulting in effective Asset Management plans, underpinned by systematic management and monitoring of operational activities and program delivery, enabling the desired outcomes to be achieved.

- the AMS review concluded in September 2020[20] reinforced the conclusion from the 2017 review:

  In general, it was observed that Western Power has developed a sophisticated, well-structured and disciplined Asset Management System

  The ERA considers that Western Power has an effective asset management system and has decided to increase the review period from 36 months to 48 months.

110. The AMS is certified to ISO55001:2014, an international standard on Asset Management. The certificate of approval was issued on 21 August 2019 and includes an annual surveillance audit as a condition of ongoing certification. The ISO 55001 audit[21] (concluded in June 2019) awarded the certificate against the requirements of ISO 55001:2014 to Western Power and found that:

> *Western Power has a number of industry leading practices, particularly in the areas of asset risk management and the "line of sight" linkages to organisational objectives, as well as the optimisation and prioritisation of programs and projects.*

3.3 Risk-based approach to asset management

111. Western Power applies a risk-based approach to asset management, guided by the likelihood and consequence of individual asset failure, where investment is prioritised to address assets which are at the highest risk of failure with the greatest consequence. Assessing the risks associated with network assets is essential for their management, as well as informing asset management strategies, plans for maintenance and renewal activities and prioritising investment.

112. The main asset management decisions that are guided by risk are:

- **strategy development:** guided by our understanding of when assets require treatment (based on risk tolerability and acceptance criteria); definition of how to treat assets (ensuring the risk reduction obtained from asset treatments justifies the cost); prioritisation criteria (defining which assets to treat first)
- **planning:** our understanding of risk and the cost-effectiveness of different network risk controls is an input to the investment planning process, including investment optimisation and prioritisation

19 CutlerMertz, Western Power 2017 Asset Management System Review, July 2017
20 AMCL+, Western Power 2020 Asset Management System Review, November 2020
21 ISO55001 Final Assessment report of Western Power's Asset Management System, 2019

- **delivery**: risk informs any in-year re-prioritisation or planning required to respond to major events, such as storms, also to assess and respond to any emerging risks. Risk is also used as an asset performance reporting metric (actual versus planned network risk reduction) for key programs.

113. Western Australian public safety jurisdictional obligations do not require conformance to a set of performance targets such as the number and impact of safety incidences, rather they require enterprises to adopt and implement risk management processes aimed at reducing risk to as low as reasonably practicable (**ALARP**). The ALARP principle is encapsulated in *Electricity (Network Safety) Regulations 2015* (WA).

114. Our approach to managing network risk is set out in our Network Risk Management Standard (**NRMS**). The NRMS is aligned with the *Australian Standard for Electricity Network Safety Management Systems* (AS5577) and the Enterprise Risk Management Standard. The NRMS ensures a consistent process for network risk management, whilst supporting a tailored approach to activities such as risk identification, risk analysis, risk evaluation and the justification of risk treatments – ensuring that the level of effort is proportionate to the risk. The NRMS includes:

- network risk management process, principles and concepts (including principles to make decisions and risk-cost trade-offs and prioritisation based on risk)
- criteria and standard values (including risk tolerability and acceptability criteria)
- requirements for application across the asset lifecycle.

115. Governed by the NRMS, network risks are assessed using risk methodologies appropriate to the context, level of risk and level of investment. These methodologies include qualitative, semi-quantitative and quantitative. Network risk assessment methodologies are applied depending on context and required output, as governed by the NRMS. Network risk assessments robustly justify investment in asset treatments and ensure asset strategies are prudent and reduce network risk to acceptable levels in accordance with AS5577 and legislative requirements.

Qualitative risk methodology

116. Qualitative network risk assessments are applied for distribution and transmission assets.

117. The current state of Western Power's assets is articulated using the qualitative Network Risk Assessment Criteria (**NRAC**). These criteria align with the Enterprise Risk Assessment Criteria (**ERAC**), with additional dimensions to reflect network risk consequences (e.g. fire, electric shock, physical impact, environment, reliability, power quality).

Quantitative risk methodology

118. The quantitative risk methodology is applied predominantly to distribution assets.

119. Our Network Risk Management Tool (**NRMT**) is a quantitative risk analysis tool that is used to model the risk of asset failure to customers, workforce and the community, and supports the implementation of the NRMS. It has been integrated into Western Power's asset management systems for distribution and transmission assets to provide a consistent approach to calculating and reporting network asset risks.

120. Our NRMT models six consequence categories:

- Safety – fire: property damage, injury, loss of life
- Safety – electric shock: human and/or livestock injury or loss of life
- Safety – physical impact: property damage, injury, loss of life

- Safety – workforce safety: injury, loss of life
- Reliability and power quality – customer supply: size of outage, loss of life
- Environment – environmental damage, loss of life.

121. These categories were defined based on an understanding of Western Power's historical incidents and were developed to align with business incident reporting and investment criteria.

122. Consequence modelling across different asset models is informed by analysis of historical incidents on the Western Power Network (e.g. how many wood pole failures convert to ground fires, electric shock, etc.). The dollar values assigned to consequences within the NRMT are derived from Australian and International studies showing the value that communities place on incidents such as fire, injury and loss of power.

123. The network asset data used to support decisions has been collected over many decades. Although its quality and completeness vary across assets classes due to historical variability in type and method of collection, it is considered adequate for assessing risk and prioritising investment. A sound understanding of the state (or health) of an asset provides insight into its likelihood of failure in the future and, along with consideration of the potential consequences of failure, permits an assessment of the risk it poses. We seek to continually improve the quality and completeness of this data through improvements in technology and collection, storage, and validation processes.

124. Our approach to asset and risk management is maturing continuously to support transparent risk-based prioritisation that is more robust and defensible. To support this, we publish an annual State of the Infrastructure Report to provide stakeholders with information about the performance and state of the Western Power Network. More information on this report and other reports published by Western Power is provided in Section 4.3.

3.4 Efficiently minimising cost

125. In addition to Western Power's risk-based asset management approach, we have efficiently minimised costs through our practices of:

- estimating costs based on most recent information and experience
- optimising our works program by activity type, geography, and operating and capex
- employing prudent procurement practices and competitively tendering the majority of our capital program.

126. We also continue to seek to adopt good electricity industry practice by sharing knowledge and benchmarking ourselves against other electricity network businesses in Australia.

127. Examples of our industry practice benchmarking activities include:

- **the ERA AMS Review process:** this process requires an annual review of the AMS with respect to technical and financial performance. Results of the review are fed back into the Asset Management policy, strategies, plans, processes, and procedures to continuously improve the AMS. It is the responsibility of each asset manager to conduct a review of the network assets for which they are responsible, and to ensure this information is considered during the annual review of the Network Management Plan.
- **benefits realisation:** as part of the works program governance model, Sponsors are required to conduct a benefits realisation for each project of work completed. Any benefits achieved are considered during this review process.

- **benchmarking:** a number of benchmarking activities are carried out to understand the effectiveness of Western Power's Asset Management practices against other utilities and its positioning against best practice Asset Management (e.g. ITOMS, reliability performance and targeted asset benchmarking). The results of these activities are expected be considered during the review of the Network Management Plan.
- **ongoing feedback:** this feedback is managed between each review through the means of a controlled register.

3.4.1 Network Delivery Strategy

128. Western Power adopts a composite resourcing approach which essentially means that we adopt a blended approach to resourcing, using a mix of three delivery arms for different types of work as appropriate:

- internal resources
- external resources under standard contract
- external resources under a preferred vendor model.

129. The composite resourcing approach is reviewed regularly and optimised to take account of prevailing conditions and any changes to the work program. The key elements of the composite resourcing approach are:

- improving the flexibility and responsiveness of Western Power's cost structure to changes in work volumes
- maintenance and improvement of core competencies
- maintenance of control over high-risk delivery areas
- ensuring work undertaken by external resources is competitively tendered.

3.4.2 Prudent procurement practices

130. Western Power adopts a robust and centralised approach to procurement. The centralised procurement function enables Western Power to leverage spend in order to achieve the following:

- gain maximum utilisation and savings
- standardise procurement policies and processes
- facilitate knowledge and resource-sharing
- provide transparency and governance.

131. The procurement policy establishes the principles and practices that govern Western Power's procurement activities for all goods, materials, services, and intellectual property assets. The key governing principles are:

- agreements must be established via a competitive process to meet Western Power's requirements and to deliver value for money
- the evaluation, selection and award processes are supported by the engagement of relevant subject matter experts to ensure that the goods and services obtained meet Western Power's requirements including compliance with safety, environmental, technical, commercial, and qualitative standards.

4. External review

132. Part of our AA4 capex program has been subject to additional review throughout the AA4 period. This has included reviews undertaken by the ERA to gain regulatory test approval for major augmentations. These reviews included consideration of the justification, assessment, and evaluation of cost of various projects. The extent of these further reviews is discussed in the following sections.

4.1 Reviews by the ERA

133. Network investment is subject to two tests under the Access Code on an ex-ante basis, namely the regulatory test in Chapter 9 and the NFIT under sections 6.52 to 6.55 of the Access Code.

4.1.1 Regulatory test

134. Under chapter 9 of the Access Code, it is mandatory to submit a regulatory test seeking approval from the ERA for major augmentations on an ex-ante basis. The focus of the regulatory test is on determining whether the chosen option maximises the net benefits of the project to the network.

135. The regulatory test is designed to apply specifically to 'major augmentations' where the value of the project exceeds the nominated threshold ($13.1 million for wholly distribution projects or $39.2 million if the project includes any transmission assets [as at 2021, CPI adjusted annually). The regulatory test application is completed for major augmentations as part of phase 2 (scoping) of our works program model.

136. During the AA4 period, Western Power submitted a regulatory test application to the ERA for the following project:

- CBD Hay Milligan Supply Reinforcement – having regard to Western Power's major augmentation proposal, the ERA determined that "pursuant to section 9.18 of the Access Code, that the regulatory test as defined in sections 9.3 and 9.4 and applied in accordance with section 9.20 of the Access Code is satisfied".

4.1.2 NFIT pre-approval submissions

137. Section 6.71 (b) of the Access Code provides for Western Power to apply at any time to the ERA to determine whether forecast new facilities investment proposed by the service provider meets the test in section 6.51A.

138. During the AA4 period, Western Power has not needed to seek pre-approval from the ERA for any project as investment governance has improved and the communication seeking advice from the ERA is ongoing and less formal.

4.2 Western Power Reporting and Transparency

139. Western Power is committed to transparent stakeholder engagement. Accordingly, we publish a number of annual reports regarding our network assets. These reports can be found on our website www.westernpower.com.au.

140. Key reports include the State of the Infrastructure Report, the Annual Planning Report, and the Annual Network Safety Performance Objectives. These are described in more detail below.

4.2.1 State of the Infrastructure Report

141. The primary purpose of Western Power's State of the Infrastructure (**SOTI**) Report is to provide stakeholders with information about the performance and state of the Western Power Network, with a particular focus on operational safety. This supports improvements in the quality, transparency and alignment of decision making by all stakeholders.

142. We first published annual performance and asset data in this format in 2011/12 in response to one of the recommendations of the Parliamentary Standing Committee on Public Administration (Report 14 - Unassisted Failure) in January 2012. The SOTI Report is updated and published annually, maintaining a consistent and independently verifiable source of performance data.

143. The SOTI Report covers key transmission and distribution network assets for each reporting period (1 July to 30 June) and provides:

- an overview of the operational safety performance of the Western Power Network with respect to the key impact areas of public safety, property damage and the environment over the reporting period
- a snapshot of the age profile, condition and risk of key transmission and distribution network assets as at 30 June, with a comparison of the same data from previous years.

144. The report does not present detailed information on strategies, treatment plans or network investment programs. These are captured in a range of other Western Power reports.

4.2.2 Annual Planning Report

145. Western Power publishes the Annual Planning Report (**APR**) annually to provide information to electricity market participants and interested members of the broader Western Australian community on the nature and location of the emerging capacity constraints on the Western Power Network. The APR:

- outlines existing and emerging capacity constraints
- highlights network investment opportunities on the distribution and transmission network
- details how we seek and integrate network solutions to maintain or improve service levels.

146. The APR provides an open and transparent view into the factors we consider in addressing network issues to produce timely network and non-network solutions to manage both emerging constraints and meet evolving customer needs. The APR aims to provide a strategic view of the network, illustrating the foundations for the planning and development of the Western Power Network into the future from a whole-of-network perspective.

4.2.3 Network Opportunity Map

147. Western Power published the first Network Opportunity Map (NOM) in October 2021.[22] The NOM offers an insight into the Western Power Network's challenges and intentions in the next five to ten years, in an environment of rapidly evolving technology and unprecedented penetration of renewable energy sources. The NOM will be updated and published annually and is primarily based on the APR and Network Plan.

148. The NOM has three distinct purposes:

1. to provide a snapshot of the challenges, risks and constraints emerging for the network in the planning period (5 years) and in the foreseeable long term (10 years)

[22] https://www.westernpower.com.au/suppliers/tenders-and-registrations-of-interest/network-opportunity-map/

2. to give all customers, industry, and market participants an opportunity to anticipate network needs and proactively provide alternative solutions to those traditionally available to Network Service Providers, and
3. to outline how Western Power will seek out, evaluate, and engage with interested parties in developing alternative solutions to network constraints.

149. To this end, the NOM contains details of identified emerging constraints and risks on the Western Power Network in a format that can be used to anticipate future opportunities for alternative solutions. The document also gives a broad overview of the methodologies used to identify and quantify these constraints, as well as outlining the frameworks and regulations that govern how Western Power invests in solutions addressing emerging network issues.

4.2.4 Annual Network Safety Performance Objectives

150. The *Electricity (Network Safety) Regulations 2015* require Western Power to publish annual objectives for a specified set of network safety performance incident types, expressed as the maximum number of incidents of that type expected to occur.

151. The Annual Safety Performance Objectives is a three-year forecast for a specified set of network safety incident types providing external visibility of the public safety risk posed by the network.