SA Power Networks

Supporting document 5.7

Strategic Asset Management Plan (SAMP)

2020-2025 Regulatory Proposal

January 2019

Strategic Asset Management Plan – Manual No. 15

Delivering energy services that customers value through excellence in asset management

SA Power Networks

www.sapowernetworks.com.au

GENERAL MANAGER NETWORK MANAGEMENT MESSAGE

I am pleased to present our first Strategic Asset Management Plan. The plan outlines our strategic direction and priorities for electricity distribution assets. These assets play a significant role in delivering energy services that our customers value.

As an organisation that strives for excellence in asset management, we are not just maintaining and improving our assets but also planning how to best use them in the future — in line with our customer, shareholder and stakeholder expectations.

The success of this plan lies in our ability to incorporate our shared goals in the day-to-day operations of SA Power Networks, for the benefit of both the organisation and the customers we serve. It is the intention that this plan will play an active role in supporting delivery of excellence in asset management.

The implementation of this plan will be underpinned by supporting documents and processes such as asset management plans, annual budgets, key performance indicators and staff performance management for on-ground implementation.

I look forward to working with our key stakeholders inside and outside of the business to achieve the objectives and strategic priorities set out in this plan.

Mark Vincent

General Manager Network Management

Contents

Document Version

Version	Date	Notes
1.0	9 November 2018	Final version for release. Supersedes Network Asset Management Plan NB: Financials to be updated prior to 30 January 2019 issue to the AER
2.0	15 January 2018	Financial Forecast Update to section 9

OWNERSHIP OF STANDARD

Name of Standard/Manual:	Strategic Asset Management Plan – Manual No. 15
Standard/Manual Owner	Title: GM Network Management Name: Mark Vincent
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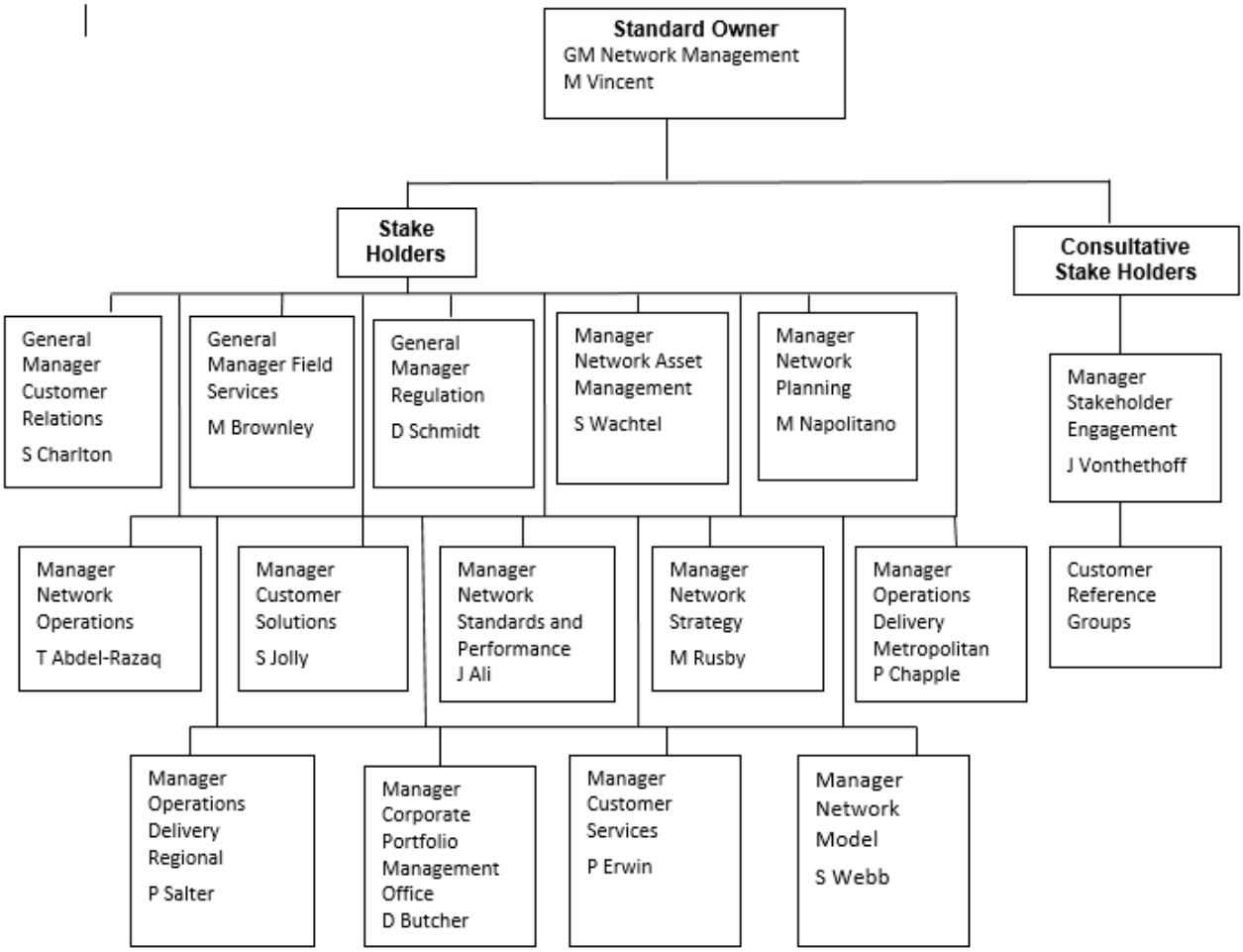
STANDARD/MANUAL OWNERSHIP STRUCTURE



OTHER RELATED MANUALS

Manual 16 – PAMP (Power Asset Management Plan)

Abbreviations

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CBRM	condition based risk management
ESCoSA	Essential Services Commission of South Australia
NEM	National Electricity Market
OTR	Office of the Technical Regulator
PPM	Project Portfolio Management
PV	photovoltaic
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	supervisory control and data acquisition
SRMTMP	Safety, Reliability, Maintenance and Technical Management Plan

Glossary

5-minute rule: Amendment to the National Electricity Rules that changes trade settlement periods from 30-minutes to 5-minutes in the National Electricity Market

Asset Management Working Group: a high-level group with membership from the functional areas of the business, working to embed, integrate, monitor, support and report on the development and implementation of asset management practices at SA Power Networks

Bushfire risk area category: areas across the state are classified as either none bushfire risk areas, medium bushfire risk areas or high bushfire risk areas depending on the potential impact of a bushfire in that area

Corrosion zones: zones across the state are classified as either low, medium, high or extreme corrosion zones depending on the corrosive properties of the air in that area

Customer: any individual, business or other party who pays us directly or indirectly to use our network infrastructure to receive or provide a service; a customer may be residential, commercial or industrial

Demand aggregator: an entity to enters into multiple contracts with individual customers and aggregates their demand reduction capabilities and offers this into the national electricity market during peak demand events

Distributed energy resources: energy resources such as solar PV and battery storage that is distributed throughout the network

Distribution network: from connection points shared with the transmission company (ElectraNet) and extending to the customer's point of supply, the distribution network is made of the sub-transmission system, substations, the high voltage distribution network and the low voltage network

Levels of service: measures of the performance of services that customers experience such as average outage duration, time to respond to enquiries and accuracy of outage information

Major event day: a day on which the daily system average interruption duration exceeds a threshold value. This usually happens during major storms or other major system disturbances. Outages occurring on a major event day are excluded from the Service Target Performance Incentive Scheme.

Stakeholder: any individual, business or other party who can affect or be affected by our actions and performance

Virtual power plant: an aggregation of multiple generation sources (typically small scale distributed energy resources) that act as a single generation plant in the national electricity market

Work value: the quantified measure of the benefit of undertaking a job; the sum of the reduction in risk and the benefits gained by undertaking work

Executive summary

As our State's electricity distributor, SA Power Networks plays an important role in our community, managing the distribution network that delivers electricity to 860,000 homes and businesses across South Australia.

We are recognised as an industry leader in reliability and safety. We are also number one for efficiency on a state-by-state basis and that has enabled us to keep a lid on our prices over many years - holding increases in line with inflation since 1999. Currently our charges account for approximately a quarter of the average residential electricity bill.

We are also a major South Australian employer, with more than 1,800 employees and additional contractors delivering 24/7 service, 365 days of the year.

This SAMP outlines the challenges we face and how we plan to evolve our asset management practices and the network itself. It aims to outline how we balance the investment required to maintain a safe and reliable network and ensure we can accommodate the changing ways customers are using energy, with the very real need to keep our costs down.

Our customers and stakeholders

SA Power Networks customers and stakeholders are widespread, diverse and evolving. We serve almost the entire population of South Australia and as the state develops the number of customers we serve continues to grow.

Our customers' and stakeholders' expectations are changing rapidly as technological changes sweep through the energy industry. They want to be able to use the network in new ways and be both exporters as well as consumers of energy. They want us to provide better information about outages and predicted restoration times, and they want to understand our costs better.

Above all, our customers want us to:

1. keep prices down;
2. maintain our reliability and safety; and
3. carefully transition to a new energy future in a prudent way.

Our assets and key strategic issues we face

SA Power Networks have the oldest fleet of assets in the National Electricity Market and we currently maintain them with a remarkably low level of expenditure with, on average, only 0.30% of our assets being replaced per year. As those assets continue to age, delivering the levels of service our customers are expecting will be challenging. To do so will require increased investment in asset maintenance and replacements. The start of this has been seen over the last five years where the asset replacement rate has grown significantly.

South Australia is transitioning to a future where up to 45% of all electricity may be generated by customers by 2050, the opposite of the system's original design. Historically, the network was designed to allow a one-way flow of energy, from big centralised generators through to our customers. Today, we face specific technical challenges in accommodating the two-way energy flows arising from the proliferation of rooftop solar photovoltaic and other distributed energy resources e.g. batteries and electric vehicles. These technologies cause the flows of energy in the network to reverse, they push and pull energy onto the network in unpredictable (and often unchecked) manner. The challenges this poses for the management and development of the network are significant and will require investment and new ways of operating the network.

While the ageing asset and changing demands on the network will require significant investment, the intense political and customer pressure to reduce electricity prices demands that we be even more effective with the money we use to manage the network.

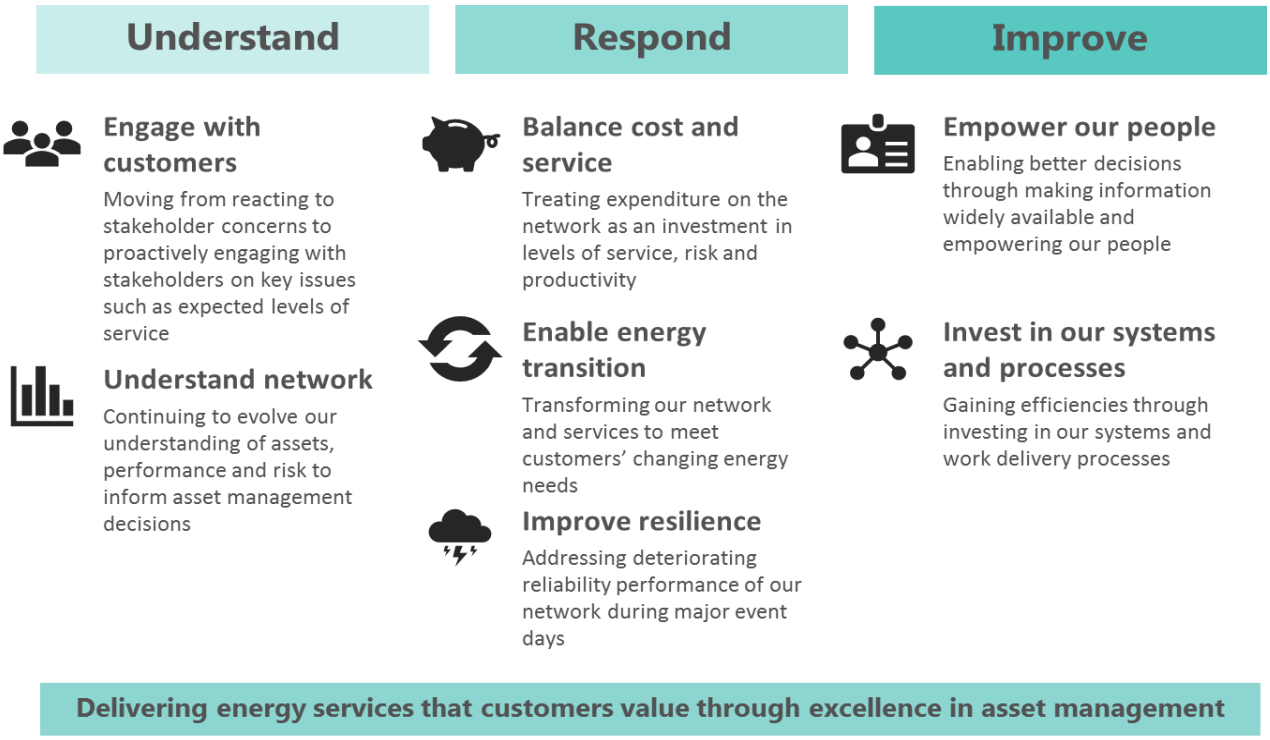
Our challenge is to continue to maintain the performance of the network as it ages, while transforming it to accommodate the new uses, and doing so in a way that keeps prices down. We will continue to manage the network at the lowest sustainable cost and understand that how we develop and manage the network can reduce the 75% of the customer bill that we have limited control over.

Our plans strike the right balance between sustainable prices and service.

Our response and strategies

Our overarching means to meet our goals is to improve our asset management capabilities. To facilitate this our executive oversees the development of our Asset Management System through the Asset Management Working Group.

We are focused on the key responses outlined below.



Engage with our customers

Given the progressive nature our customers' requirements (and the technologies they use) we are working to ensure that we understand who, how, when, where and why users access our services, and that we design communication and services to meet their needs. We continue our shift from an 'inside out' approach to an 'outside in' approach that ensures we understand, and respond appropriately to, what our stakeholders and customers value.

This can be seen in our extensive customer engagement and our maturing stakeholder reference group structures. It can also be seen in the development of our levels of service measures and targets that aim to strike a balance between the needs of our various stakeholders.

We will also improve our ability to accurately forecast the sizes and locations of the electrical demands that customers will place on the network in the future.

Understanding our assets

Optimising the use of our assets requires us to better understand our assets. This means understanding where they are, what their capacity is, what condition they are in, how they are being used now and into the future, and the impact they are having on service and risk.

We are increasing the quantity and coverage of asset inspections, improving our asset data collection practices, and developing better ways to assess the condition, performance and risk the assets present both now and in the future.

We are developing a low voltage model of the network that will enable us to assess the impact of increasing penetration of distributed energy resources enabling more informed decision making.

Balance cost and service

To strike the right balance between cost and service means we need to understand how any asset expenditure will impact on levels of service, risk and productivity. We invest in developing systems that help us to predict the present and future value of those impacts, which then enables us to ensure expenditure is directed towards activities that generate the highest return on investment. We will continue to invest significant efforts into our work selection and resource allocation systems.

We also focus on continuously improving each aspect of the asset lifecycle to maximise useful life and minimise the costs of acquisition and construction, use, maintenance and disposal of network assets. We also prudently defer replacement where possible.

Enable energy transition

An increasing number of small and large embedded generators, traders, virtual power plants, communities and individuals continue to seek access to the distribution network to trade energy. The challenge is to adapt SA Power Networks business to position for the evolving energy future, while continuing to deliver a safe, secure and reliable supply of energy.

Our Future Network Strategy sets out the roadmap for managing the transition from a centralised energy system to one increasingly defined by the actions of many distributed energy resources.

Our initial focus is on managing our low voltage network better, which is where most of the distributed energy resources are connected. This involves modelling the hosting capacity of the low voltage network and monitoring the low voltage network.

We are also developing a roadmap to implement the ‘distribution system operator’ capabilities we will need to manage the network. We continue to conduct pilots and trials to understand the network impacts of the energy transition.

Improve resilience

Our network spans a vast distance and is exposed to increasingly severe and frequent weather events. The consequent extended interruptions when our assets are damaged by those events has clearly been felt by our customers. Our Resilience Program aims to address deteriorating reliability during major event days by hardening the most vulnerable sections of the distribution network against storms and lightning.

Empower our people

To achieve the best possible outcomes, we aim to empower our people with the right information, and mobility tools, so they can make decisions and improve customer experience.

Our improvement initiatives focus on enabling decisions to be made closer to the front line of the organisation by providing timely and accurate information required to make informed and robust decisions. This shows up in how we allocate resources and select work, in our planning and scheduling, and in our safety management.

Invest in our systems and processes

Our Digital Strategy and supporting programs consider four key investment areas: data, processes, systems and people.

Our Assets and Work Program improves existing capabilities and introduces new initiatives throughout the asset management life cycle. This program supports the rest of the initiatives described in this Strategic Asset Management Plan and gives a 10 year view of our investment systems and processes.

1 Introduction

SA Power Networks provides a fully managed service of delivering electricity that is safe and reliable at guaranteed service levels. We monitor the distribution network 24/7, connect new customers, ensure the network has the capacity to support customer load and embedded generation, manage safety risks, address reliability and quality of supply issues, promptly restore supply when outages do occur, keep customers informed, and comply with all Acts and regulations.

1.1 Purpose

This Strategic Asset Management Plan aims to align our asset management activities across the business to deliver the most value to our customers and stakeholders. It does this by outlining the operating environment and the challenges we face in delivering the service now and into the future, and the overarching strategies we are implementing to deliver a valuable service to customers.

> *Our asset management practices aim to maximise value for all stakeholders of the network*

1.2 Audience

The intended audience for this plan is:

- senior management, asset managers and other staff who play a role in the delivery of electricity service to our customers;
- customers and other stakeholders wanting to understand how we manage our assets;
- shareholders, to provide assurance and explain governance of our asset management practices; and
- regulators, to clarify our approach to the Australian Energy Regulator (AER), Essential Services Commission of South Australia (ESCoSA) and Office of the Technical Regulator (OTR).

1.3 How to read this document

This document has nine sections:

- Section 1 (this one) introduces the purpose of the document, its audience, how to read it and how it fits within our overall document structure.
- Sections 2–7 describe the environment in which we operate. Each section is represented by one of the outer circles in Figure 1, with the relevant circle highlighted in the figure at the start of each of these six sections. A summary table of the key points made in that section sits below the figure.
- Section 8, depicted by the inner circle in Figure 1, describes our strategies in response to these six factors.
- Section 9 gives a summary of our asset management programs, including financial forecasts.

Figure 1: SAMP diagram

1.4 Relationship with other plans and strategies

Several SA Power Networks plans and strategies are related and inform the Strategic Asset Management Plan:

- **Strategic Plan and other corporate strategies:** details our strategic direction, key priorities and core areas of focus, and sets the overarching direction for the organisation. Includes Customer Engagement Strategy, Future Network Strategy and Digital Strategy.
- **Asset Management Policy:** sets out the principles we apply to our asset management activities.
- **Power Asset Management Plan:** details the levels of service that we aim to deliver, the assets required to deliver these levels of service, the risks we face, asset life-cycle strategies and forecasted expenditure to deliver the service levels and address risks.
- **Reset Submission(s):** summarises our business plans with a focus on a specific regulatory control period submitted to the AER for consideration during five-yearly price determinations.
- **Distribution Annual Planning Report:** informs National Electricity Market (NEM) regulators, participants and stakeholders about the existing and forecast system limitations on our distribution network; preparation of this document is a regulatory requirement.
- **Safety, Reliability, Maintenance and Technical Management Plan** (**SRMTMP):** details the management framework, key procedures and associated performance indicators for the safety and technical management of SA Power Networks electricity infrastructure through its life cycle; preparation of this document is a regulatory requirement.
- **Detailed strategies, plans, manuals, policies, processes and procedures:** gives detailed guidance for maintenance and day-to-day operation activities.

Figure 2 shows the relationship between these plans and strategies.

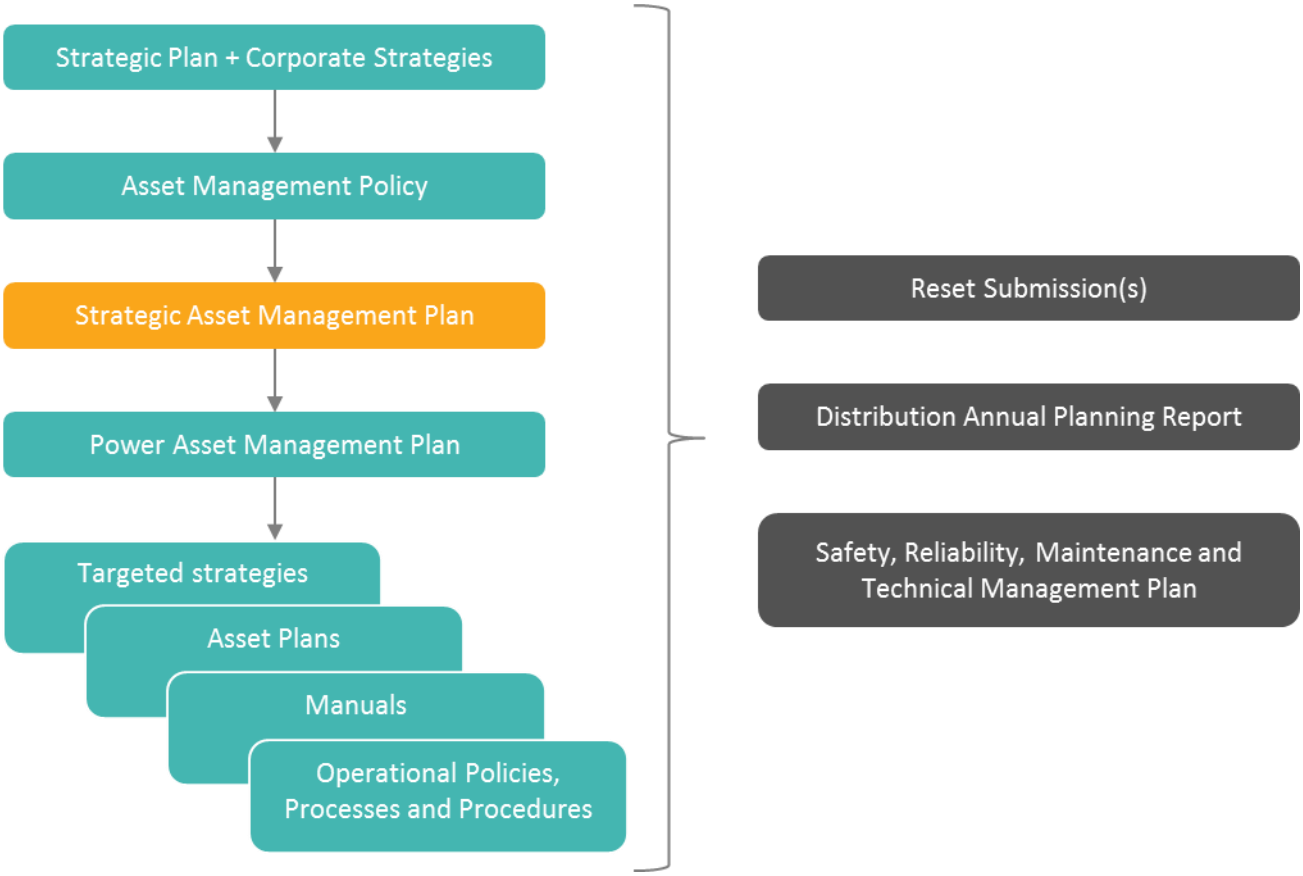
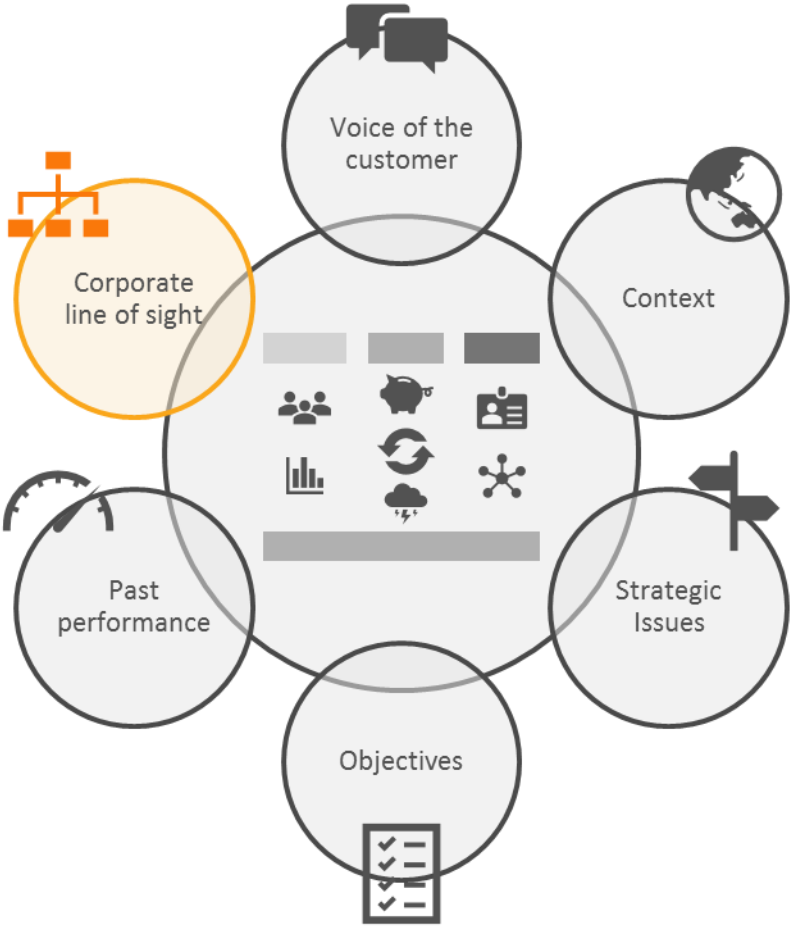


Figure 2: **Strategic Asset Management Plan relationship to other SA Power Networks plans and strategies**

2 Corporate line of sight

The business objectives and direction of SA Power Networks guide its approach to asset management.



Corporate Strategy	• Our strategic intent is to be a leader in delivering energy services that customers value • Our key priorities are employee safety, customer-centric decision making, sustainable cost efficiency and working together • Our asset management system links our actions to our corporate objectives
Risk appetite	• Zero tolerance to wilful or negligent behaviours towards work health and safety • Reducing tolerance for bushfire risk • An appetite to operate existing assets within the full range of their engineering specification • Increasing appetite to invest in technology, processes and shorter life assets • Increasing appetite to explore new markets and options
Asset Management Policy	• Our asset management policy governs our asset management activities
Governance	• Our cross-functional asset management working group oversees our asset management activities • Our quality management system is ISO 9001:2015 certified • We are actively aligning with the ISO 14001 Environmental Management System standard and the ISO 55000 Asset Management System standard

2.1 Corporate strategy

Over the last few years we at SA Power Networks have generally met our strategic objectives and goals. However, we recognise that we must continually improve in an ever-changing industry.

We strive to continue to lead our peers on all key dimensions by adding to our existing strengths. The scope of the services we offer is evolving as we focus on understanding customers and the services they value. As our business model changes we must be flexible enough to integrate current and future customer technologies such as micro-generation and storage.

This focus is reflected in our strategic intent:

> *To be a leader in delivering energy services that customers value.*

Our Strategic Framework (Figure 3) shows our business objectives, strategies and philosophies. It clarifies how individual efforts and departmental projects can be connected to achieve the best organisational outcome.

Among other things, it reflects key priorities that:

- emphasise employee and community **safety** as our top priority;
- engage **customers** and provide services to meet their electricity needs;
- provide a safe, reliable and flexible **network**;
- recognise the need for overriding sustainable **cost** efficiency; and
- enhance opportunities for innovation and business **growth**.

Our asset management system links our corporate objectives to the asset management actions taken by the business.

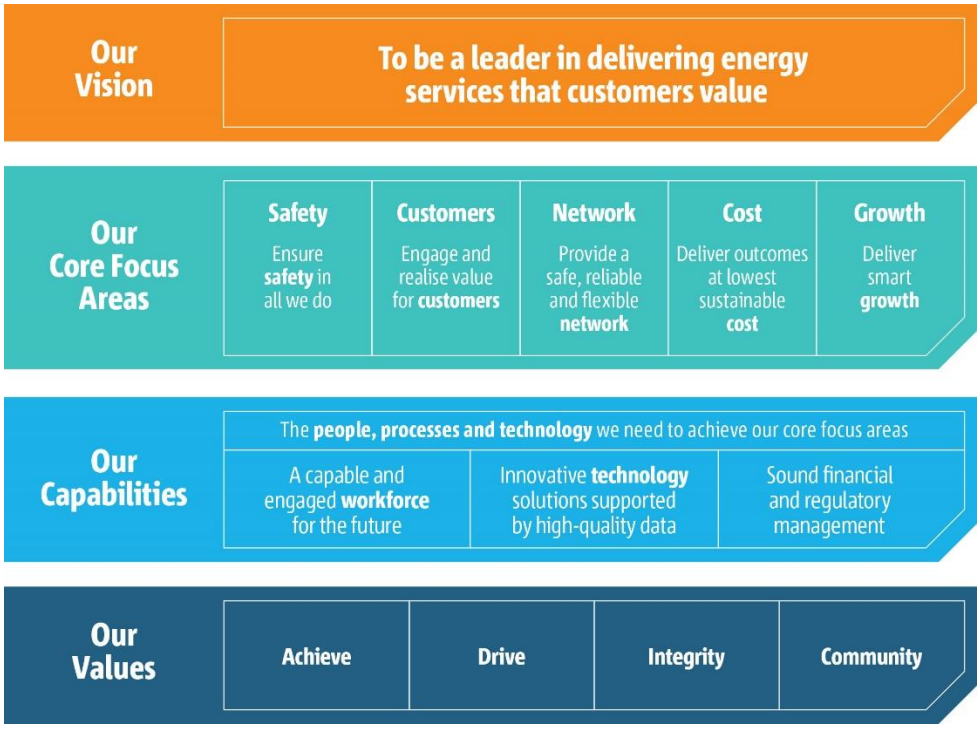


Figure 3: SA Power Networks Corporate Strategic Framework

2.2 Risk appetite

Our Risk Appetite Statement[1] draws together how and where SA Power Networks makes explicit its appetite and tolerance for risk in guiding key decisions made by the Board and senior management.

The Board takes a 'zero tolerance' approach to wilful or negligent behaviours towards work health and safety policies and directives that potentially put the safety of staff, customers and other stakeholders at risk.

The Board also has a reducing tolerance for bushfire risk relative to previous years consistent with community expectations and our legal obligations to take all reasonable steps. Management is expected to monitor and evaluate our bushfire risk exposure and identify the optimal mitigation plan. SA Power Networks is then expected to be fully compliant with the adopted bushfire management plans.

The Board has an appetite to operate existing assets within the full range of their engineering specification based on adopting a risk-based approach to operating and maintaining assets.

The Board also has an increasing appetite to invest in technology, systems, processes and shorter life assets that confer the capability to be a leader in delivering energy services that customers value. It has an increasing appetite to explore new markets and options with new customers.

2.3 Asset management policy

The asset management policy[2] applies to all SA Power Networks assets and associated activities, and supports excellence in asset management and delivery of essential services.

Our asset management policy states that we will employ good asset management practices that:

- provide a safe environment for employees, contractors and the community;
- are guided by the Corporate Strategic Plan;
- are driven by the levels of service that customers value;
- ensure we comply with our regulatory obligations;
- deliver a prudent risk based approach; and
- foster continuous improvement.

2.4 Governance

2.4.1 Asset Management Working Group

The Asset Management Working Group is a high-level group whose membership spans the functional areas of the business, primarily Corporate Strategy, Customer Relations, Network Management and Field Services. Its purpose is to embed, integrate, monitor, support and report on the development and implementation of asset management practices at SA Power Networks.

The working group has been established to ensure our asset management efforts are customer centric, aligned and coordinated across the business.

[1] For more detail please refer to the latest Risk Appetite Statement

[2] For more detail please refer to the latest Asset Management Policy

2.4.2 ISO 9001:2015 Quality Management System certification

We frequently need to demonstrate compliance with laws and regulations. Our quality management system for network management, certified to ISO 9001:2015 Quality Management Standard, helps us manage regulatory requirements, improves the predictability of our processes and provides clear guidance to our staff.

2.4.3 Alignment with ISO 55000:2014 Asset Management System

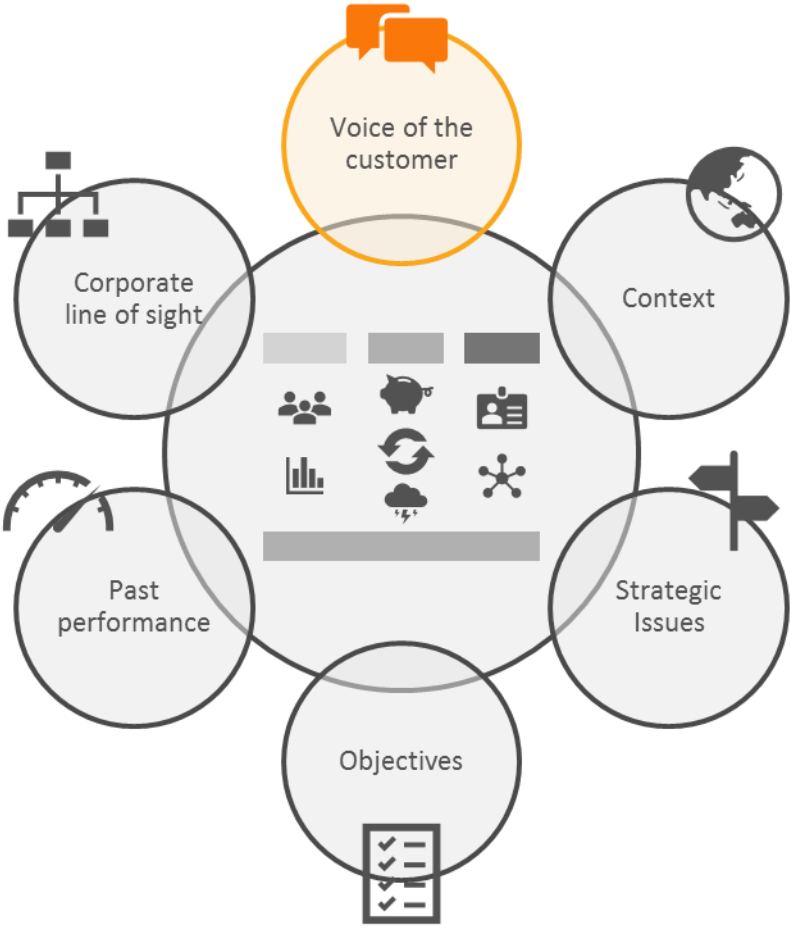
In addition to our quality system already being ISO 9001 certified, we are committed to aligning our processes with that of the ISO 55000:2014 Asset Management framework. Increasingly the benefits of an integrated, risk-based, whole life cycle asset management system are being demonstrated around the world.

2.4.4 Alignment with ISO 14001:2015 Environmental Management

We maintain an Environmental Management System in line with ISO 14001:2015 that provides employees and contractors with the skills, knowledge and resources to protect and improve the environment. In addition, the SA Power Networks Environment Policy, Climate Change Policy and Environmental Management Plan provide the direction for ensuring environmental risks are minimised throughout the asset life cycle.

3 Voice of the customer

SA Power Networks' customers and stakeholders are widespread, diverse and evolving.



Who are our customers and stakeholders	• Our customers and stakeholders are evolving and diverse • The industry is changing, with new entrants such as virtual power plants, aggregators and traders • Our shareholders are focused on safety, corporate reputation and delivering shareholder value • We are heavily regulated by both state and national bodies
Engagement activities	• We have ongoing engagement with our customers and stakeholders • Our current focus is on making sure the expectations, views and priorities of our customers and stakeholders are reasonably reflected in our plans for the 2020–2025 Regulatory Control Period
What we've heard	Customers want us to: • keep the lid on price • provide acceptable reliability for all • prudently enable the energy transition

3.1 Who are our customers and stakeholders?

We define our customers as any individual, business or other party who pays us directly or indirectly to use our network infrastructure to receive or provide a service as depicted in Figure 4. Traditionally this service included distributing energy from supply points to customers and providing a connection point to the NEM to sell energy. In the future, it may include system security services, and the ability to trade demand and storage.

A stakeholder is any individual, business or other party who can affect or be affected by our actions and performance. The expectations of customers and stakeholders vary significantly depending on individual or organisational expectations and needs.

Figure 4: SA Power Networks customers and stakeholders

3.1.1 Direct customers

We manage the distribution network that delivers electricity to 860,000 homes and businesses across South Australia. Each year we receive more than 20,000 customer requests for a new or altered service. Connections typically take three main forms:

- **Residential connections:** Generally, a basic connection service which requires minimal or no extension or upgrade (augmentation) to the distribution network; includes residential customers, small business and small embedded generator connections
- **Commercial and industrial connections:** New connections or alterations to existing connections to commercial or industrial developments or for larger property developments
- **Real estate developments:** Construction of a distribution network for greenfield or multi-tenanted apartment (usually) residential developments to facilitate final connection by the eventual resident owner or tenant

Over the last five years the number of customer connections has been steadily rising (Figure 5). From 1 April 2018 metering contestability came into full effect, meaning new solar photovoltaic (PV) import/export meter connections are no longer the responsibility of SA Power Networks; they are the responsibility of retailers.

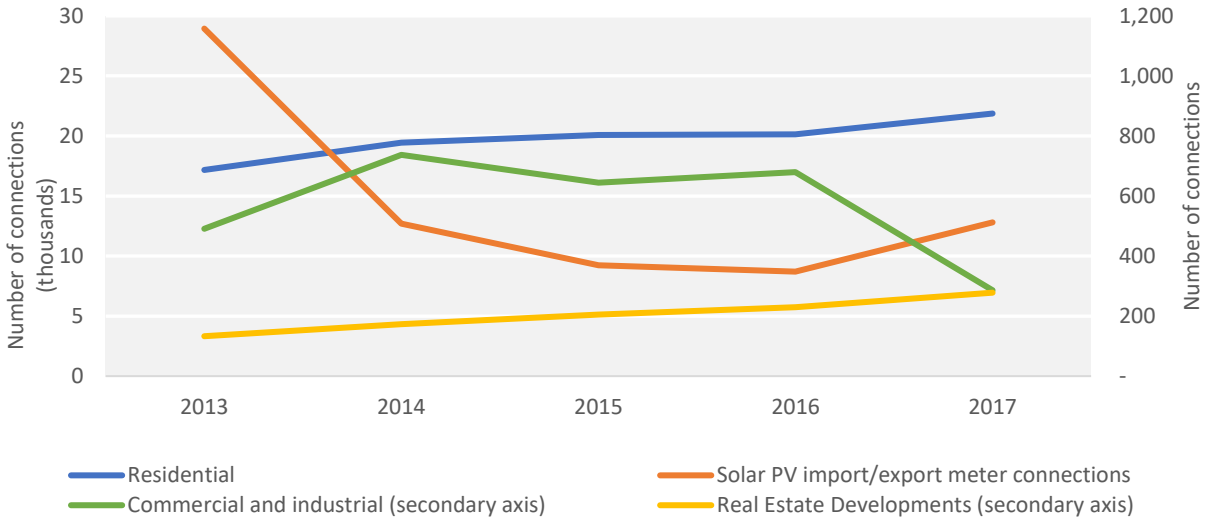


Figure 5: Historic numbers of customer connections

Traditionally, residential users were strictly passive consumers of electricity and at an aggregated level they had predictable energy usage over time (both daily fluctuation and annual growth). Today, many have embedded generation such as rooftop solar PV, which means they can be consumers or generators at different times of the day. Figure 6 shows the installed capacity of solar PV on our network.

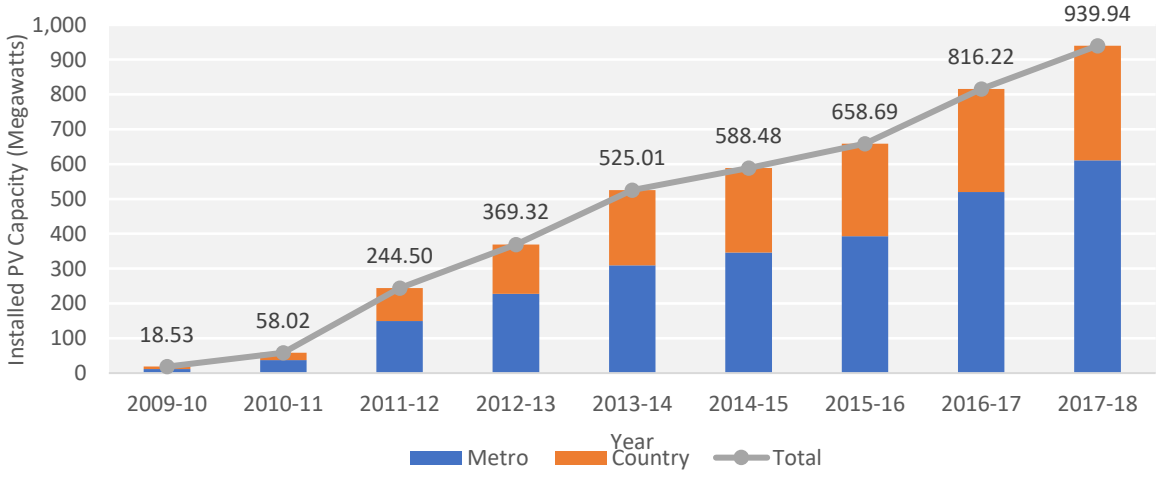


Figure 6: Historic take up of solar PV, South Australia[3]

[3] South Australia's total generation capacity is 5,436MW, meaning rooftop solar PV makes up 14%.

Residential solar PV generation is non-dispatchable — if the sun is shining the system generates energy and pushes it onto the network. Generation from large plants is dispatchable, or controlled.

In addition to the prolific take up of solar PV, the emergence of residential scale batteries means these customers can now be consumers or generators at any time (Figure 7).

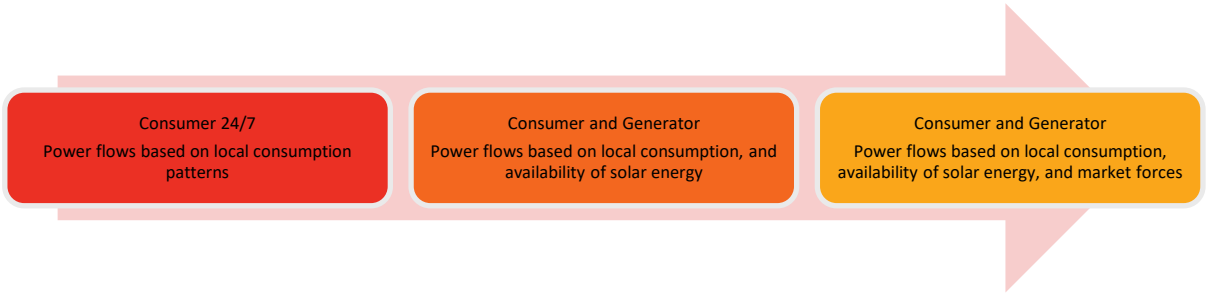


Figure 7: Evolution of our customers

The use of batteries can be driven by factors not coincident with their local usage or supply of solar energy, for example charging the battery in preparation for a storm, discharging the battery when market prices are high.

Commercial users have evolved more slowly than residential users. More recently they are adopting significant levels of solar PV and are expected to also adopt batteries.

Industrial users evolved earlier than residential users to become both consumers and generators with the advent of cogeneration systems. They are now adopting significant levels of solar PV and are expected to also adopt batteries.

An important impact of these customer side technologies is the forecast customer electricity generation exceeding customer demand under certain conditions, particularly during the middle of the day during summer when PV generation is at its highest and demand is at its lowest. This is forecast to result in customer generation exceeding summer minimum demand in around 2025/26 (Figure 8).

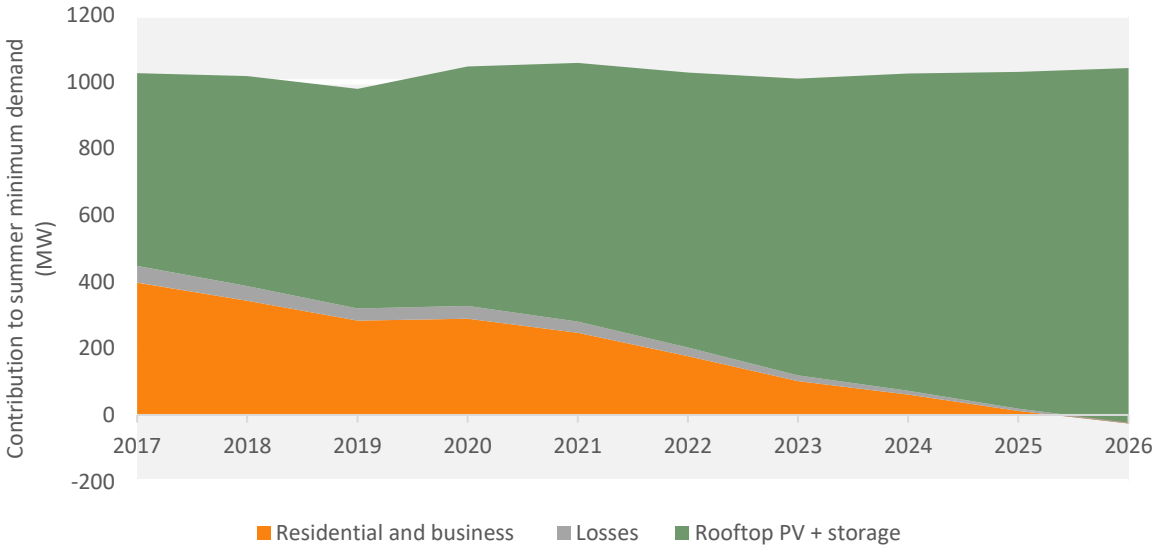


Figure 8: Summer minimum demand forecast segments for South Australia (neutral scenario)[4]

[4] Source: AEMO, 2018, National Electricity & Gas Forecasting data portal.

3.1.2 Industry

Our customers are increasing the complexity of the technologies they use. We're no longer the only experts in providing energy services to customers in South Australia. New market entrants are increasingly playing a role and wanting to use our network to provide services. The key players in the electricity industry, including new market entrants, are described below.

Generators

At a national level the mix of commercial generation in Australia has changed significantly and is expected to change further over the coming years. Figure 9 shows the current generation capacity within the NEM by technology and includes committed (in construction) projects, proposed projects and retirements.

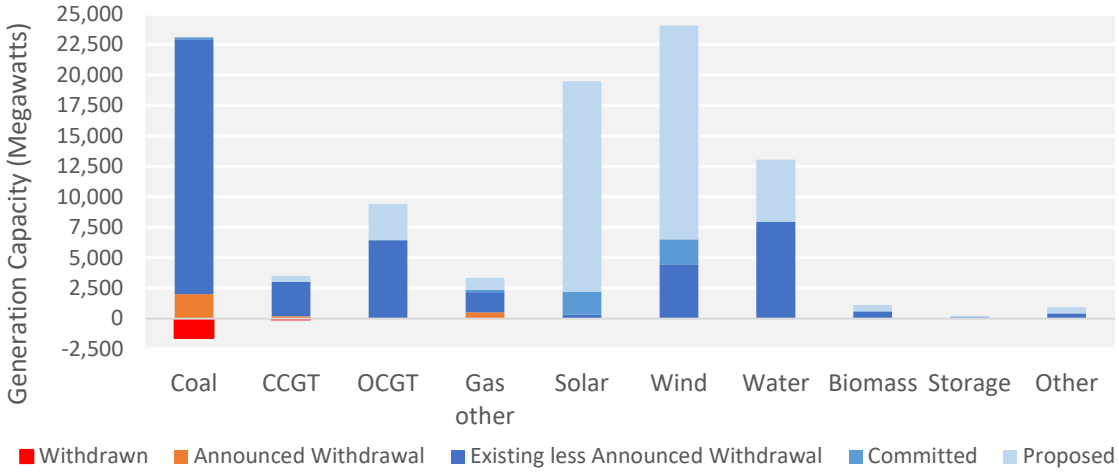


Figure 9: NEM generation capacity[5]

The amount of large-scale intermittent energy connected to the network, mainly wind energy and solar energy, has significantly increased over the last 10 years. These large-scale generators are connected to either the transmission network or the distribution network, with the trend for commercial solar farms to be connected directly to the distribution network.

Large generators do not have unlimited access to export energy and must bid into the market to access the network. By contrast, small scale solar systems generally have open access to the network, only limited by local network capacity. To get the most out of their investment, generators want unlimited access to export to the network.

Transmission network

The transmission network has traditionally been responsible for interconnecting the electricity markets between states and territories, and transporting energy from large generators to bulk supply points near population centres. As the role of the distribution network has changed, so has the role of the transmission network. Transmission networks are connecting large-scale generation from increasingly diverse sources and experiencing unpredictable loads. This unpredictability affects their ability to balance the system.

[5] Source: AEMO, Generation Information, data for Q1 2018. Excludes rooftop PV installations. CCGT: closed cycle gas turbine; OCGT: open cycle gas turbine

In South Australia the transmission network is owned and operated by ElectraNet. We work closely with ElectraNet on load forecasting, load control and during major electricity restoration events, generally after a storm.

Retailers

An increasing number of retailers operate within South Australia and use the distribution network to deliver services to their customers. The boundary between the role of the retailer and the role of the distribution network provider is beginning to blur as the way customers use the network changes.

Aggregators

Virtual power plants and demand aggregators represent new entrants to market and have the potential to change usage and generation patterns. They coordinate resources on the network to respond to macro market price signals and could cause micro network issues, which are often not considered. This could change local energy flows in unpredictable ways.

South Australia has been dubbed the centre of virtual power plant development. The growth in virtual power plants is expected to be exponential and already more than 13MW of controllable residential batteries and solar systems have been committed to be deployed in South Australia over the next four years.

3.1.3 Stakeholders

Shareholders

CK Infrastructure Holdings Limited and Power Assets together own a combined 51% stake in SA Power Networks; Spark Infrastructure, an ASX listed Australian company, owns the remaining 49%.

Key guidance from our shareholders on asset management:

- **Safety**: Safety is the number one priority and we adopt a ‘zero tolerance’ approach to wilful or negligent behaviours towards our safety policies and directives that potentially put the safety of employees, customers and other stakeholders at risk.
- **Corporate reputation**: We continue to maintain a positive reputation in South Australia.
- **Delivering shareholder value**: We continue to deliver a commercial return to shareholders.

Regulators

As a monopoly service provider, SA Power Networks is subject to heavy regulation that is intended to ensure appropriate outcomes for customers, the South Australian community and investors. We are required to comply with multiple Acts, regulations and guidelines that govern the electricity industry. We are part of the NEM and are governed by several agencies at national and state levels, as shown in Figure 10.

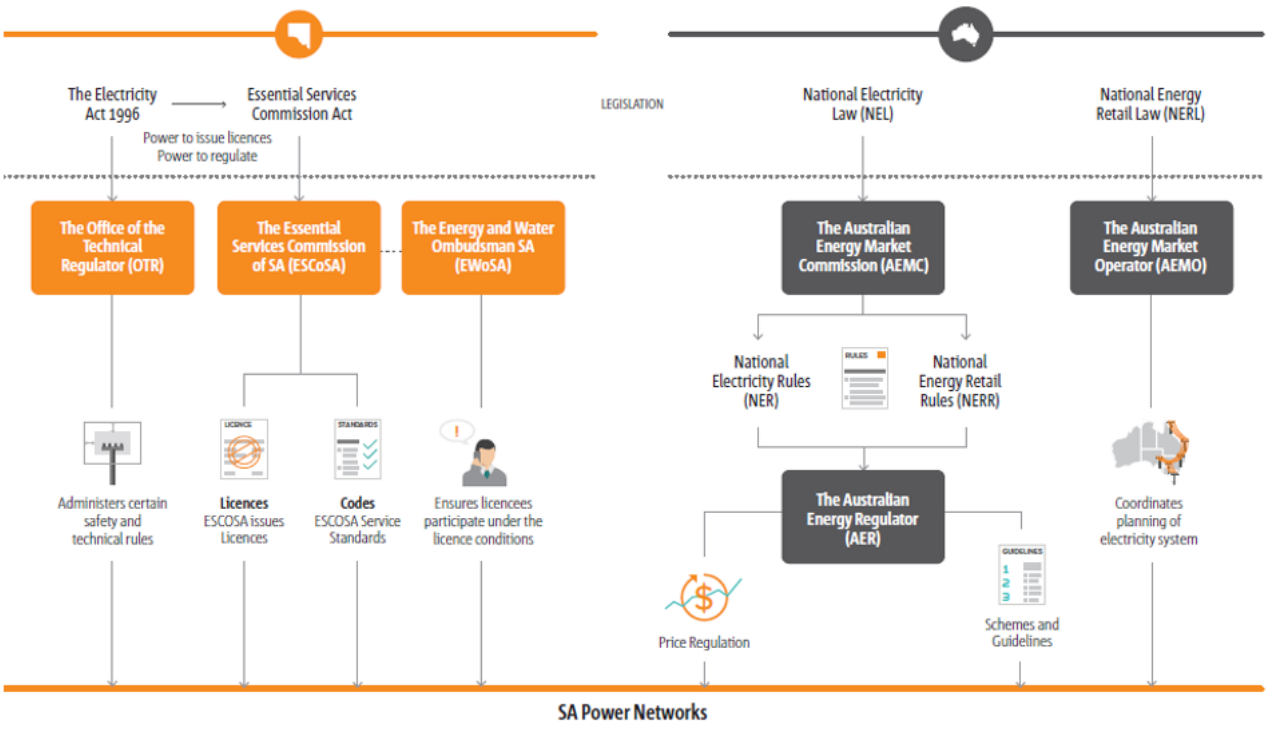


Figure 10: SA Power Networks regulatory framework

Government bodies

We have an interdependent relationship with federal and state government bodies and agencies on issues such as energy policy, infrastructure development and planning, environmental management, emergency services and pricing and tariffs. We also work with local governments on issues such as public lighting and vegetation (tree management).

Industry bodies

We rely on industry bodies such as the Urban Development Institute of Australia, Property Council of Australia, Housing Industry Association, and National Electrical and Communications Association for advice. We have strong industry partnerships with other network companies through our involvement with Energy Networks Australia.

Special interest groups

There are numerous special interest groups in South Australia that helps us understand the specific issues faced by our customers, industry and stakeholders. We engage collaboratively with these groups through our Customer Consultative Panel and Reference Groups as described in section 8.2.

Employees

SA Power Networks is one of the largest South Australian employers, with a committed and growing workforce of more than 2,200 employees. Our industry is technically specialised with an inherently high-risk work environment. It takes considerable time and resources to train and develop new workers and apprentices to adequately manage the large network of diverse assets.

Our employees depend on us to provide a safe working environment, meaningful work and development opportunities.

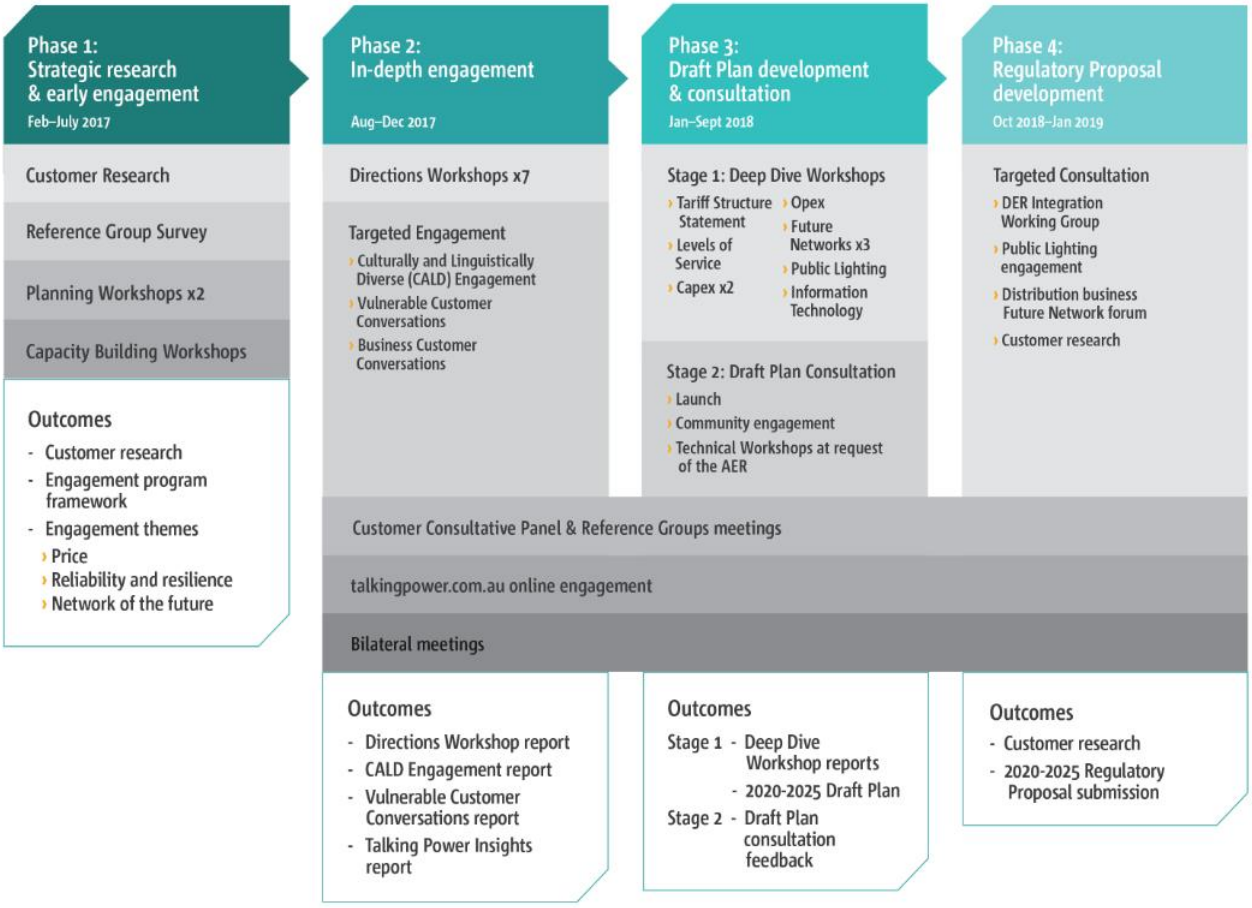
3.2 Customer and stakeholder engagement activities

We have been engaging with stakeholders and consumers on a broad range of issues and projects for a number of years. Our Customer Consultative Panel (established in 2015) has four reference groups: Business Reference Group (established 2017), Renewables Reference Group (established 2017), Community Groups Reference Group (established 2017) and Arborist Reference Group (established 2014). See Section 8.2.2 for more information on the panel and reference groups.

As we prepare for our 2020–2025 Regulatory Control Period proposal, we've been undertaking an extensive stakeholder engagement program. It is during this time that our customers and key stakeholders can have the most influence on our future direction. Our goal is to understand the expectations, views and priorities of our customers and stakeholders, to ensure our plans for the 2020–2025 Regulatory Control Period reasonably reflect what customers value.

We are undertaking this engagement in four phases:

1. strategic research and early engagement: market research to understand current customer needs, values and priorities;
2. in-depth engagement: engagement program that allows multiple and diverse opportunities for dialogue, reveals timely customer and stakeholder insights, and produces meaningful results to inform our business plans; and
3. draft plan engagement: collate, analyse and report outcomes of the in-depth engagement phase, and seek feedback on a draft plan.
4. regulatory proposal development: targeted consultation to inform the final 2020-2025 regulatory submission.



3.3 What we've heard

The key areas of importance highlighted by our stakeholders include:

- acceptable reliability for all — improving reliability in poor performing areas;
- prudent investments — keeping electricity prices down;
- support for enabling the energy transition — preparing for the future role of the network;
- strong support from customers to balance current network investment with future uncertainty;
- outage communications — providing reliable information;
- customers to co-design solutions; and
- vegetation management — improving outcomes.

Table 1 gives a detailed summary of what we heard during our customer engagement sessions. These outcomes have been considered during the development of our response and strategies, and feed into our 2020–2025 Regulatory Reset Submission.

Table 1: Detailed summary of what we heard during customer engagement sessions

Session	Who we engaged with	What we heard
Strategic research and early engagement outcomes (Phase 1)	• Eight focus groups in metro and rural regions • Survey of more than 800 residential and business customers • Several one-on-one interviews	Customer priorities: • How to improve network reliability and reduce community concerns about future electricity supply • Pricing and ways households can feel less stressed about rising electricity prices • Sustainability • Future network options — education and opportunities • How South Australia can be more self-reliant and less vulnerable in its electricity supply • Communicating with customers during power outages

Direction workshops (Phase 2)	• 134 customers across seven workshops
	• 54% residential, 46% business/government
	• Areas: Renmark, Port Augusta, Mount Gambier, Port Lincoln, Adelaide, Adelaide Hills
		Customer priorities (first preference):
		• 49% — reliability
		  ○ Topic of most interest was acceptable levels of reliability for all customers, with 53% supporting increased investment in reliability and resilience
		• 25% — network of the future
		  ○ 42% supported a moderate level of investment to support the take up of new technologies
		• 26% — price
		  ○ Price impacts on business and vulnerable customers
		
		Example quotes:
		• *Expect smart spending of money on OPEX and CAPEX.*
		• *Spend it once, spend it well.*

Culturally and linguistically diverse focus groups (Phase 2)	• Co-facilitated, translated sessions with 54 participants in four communities (Bhutanese, Vietnamese, Chinese and Burmese) • Overall gender mix 50% male, 50% female	Customer priorities: • 43% — reliability of the network • 29% — maintaining network prices • 14% — customer information during outages • 14% — restoring power after outages. Example quotes: • *Reliable power is important to maintain lifestyle and convenience.* • *In a country like Australia, we didn't expect blackouts!* • *The price is going up and up … we feel frustrated, we want to know why.*

Session	Who we engaged with	What we heard
	• Participant ages: 20–70 years old	• *We can do nothing if we don't know what to expect. We can manage if we know what's happening.*
Vulnerable customer conversations (Phase 2)	• Number of participants: 68 • 54% from metro Adelaide; 46% from regional townships and countryside • Age ranges: 17–95 • Number of engagement sessions held: 6	Customer priorities: • Price — of the eight themes explored, 'network price' was a clear top priority for low income and disadvantaged individuals from metropolitan Adelaide areas (54% of participants), which corresponds to feedback from stakeholders who represent such community members • 'Network reliability' was the top priority for low income individuals from regional townships and countryside (46% of participants), closely followed by price Example quotes: • *I look after 2 children on my own, I really have to rug up in winter because I can't afford higher bills.* • *It costs more to be low income than high income.* • *There are less of us paying for power when people use their solar.* • *Reliability is not useful if you can't afford to put it [electricity] on.* • *You can't do without electricity.*
Online (Phase 2)	• Conducted over a four-month period in 2017 • 1,770 customers visited Talking Power website • 336 engaged in either a quick poll, contributed to a forum or used our interactive engagement tools	Poll findings on network reliability: • 71% are aware that SA Power Networks relies on customers to report outages on the network • 58% believe 1–2 is an acceptable number of unplanned outages per year • 36% believe 1–2 hours is an acceptable length for a single unplanned outage • 72% found reliability of electricity to their home or business to be good or excellent Example quotes: • *A modern and technology aware power provider should be able to tell when a system or section goes down. You shouldn't need us to tell you, you should already know that something is wrong.* • *Modern tech cost money, do you want your bill to go up even more, to fund this idea. It's not hard to make a phone call to report it.* Poll findings on outage communications: • 67% receive Power@MyPlace messages • 73% prefer to hear from SA Power Networks via SMS/text in an unplanned outage • 54% have used the online power outage reporting tool on SA Power Networks' website Example quotes: • *What would be very useful is knowledge of the cause for the disruption, as this will provide some insight into the possible length of the disruption. The explanation can be simple, storm damage, fallen tree, motor vehicle accident, vandalism to infrastructure, wire damage, bushfire in location, etc.* • *Accurate information on the expected length of time for power restoration would be very useful. Past notifications always indicate a long period of time, if the disruption is going to be a long time, I would*

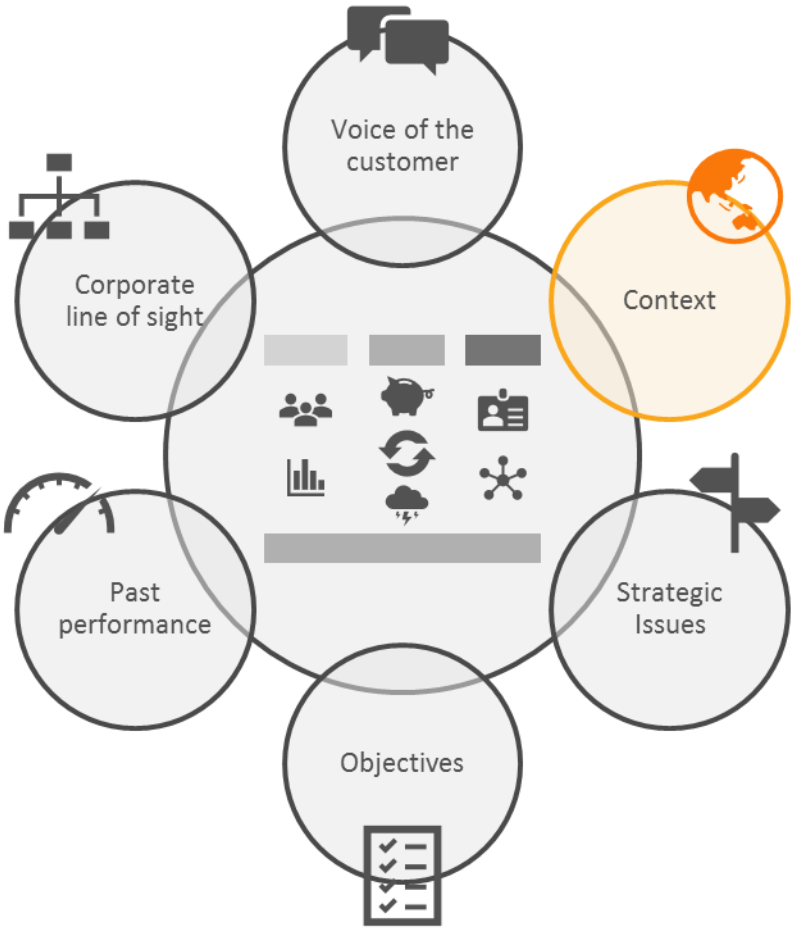
Session	Who we engaged with	What we heard
		need to put in place alternative arrangements, particularly for refrigerated goods. The earlier I know this the sooner I can set things up. Poll findings on network of the future: • This topic attracted, by far, the most interest • 69% have solar PV • 40% rated the following as being most important feature of a solar system: 'I can sell my surplus energy to make money' • 69% rated the following as being most important feature of a solar system: 'It reduces the amount of energy I need to buy from retailers' • 4% have battery storage Example quotes: • *My solution is to get the government involved in another subsidised scheme like the solar rebate but with battery storage at home.* • *Increasingly the cost of poles and wires will have to be met by less people and the cost of power to those without solar may become prohibitive.* • *The future is undoubtedly going to include home PV, home battery storage and electric vehicle battery storage. The integration of those three will be vital to the success of our future grid.* • *Perhaps these aren't the only possible solutions? Perhaps a more community-connected solution is possible, eg requiring some local energy storage in each block or area? So the whole community becomes more resilient.*
Levels of service workshop (Phase 3)	• Full day workshop with 13 representatives from the customer consultative panel and reference groups	Customer priorities: • Reliability and quality of supply measures were identified as the most important service levels to customers • Customer experience measures such as time taken to answer calls or respond to enquiries were also of high relevance to customers • Environmental measures were of high relevance • Two-way grid measures were not rated high; however, increased monitoring and visibility of the network was recognised as being needed in response to what is an already evident problem The outcomes of this workshop and how they have been incorporated into our targets are described in more detail in the Power Asset Management Plan

Capital expenditure proposal workshops (Phase 3)	• Two full day workshops with 23 representatives from the customer consultative panel, reference group members and the regulator	Outcomes:
		• **Customer connections proposal**: people wanted more detail about the cost to the customer for a connection, how costs are shared, and more explanation of SA Power Networks Connection Policy.
		• **Asset replacement proposal**: most felt more explanation was needed on asset management practices. Two main issues were raised:
		  ○ from a vulnerable customer point of view deferring expenditure to keep costs down was desirable, but raised concern that the age of assets is continuing to be pushed out
		  ○ the methodology of the proposed replacement expenditure approach needed explanation; how does life extension change the 'effective' age profile of a safe reliable network?
		• **Meeting reliability service standards proposal**: Discussion indicated concern about the use of the Australian Energy Market Operator's

Session	Who we engaged with	What we heard
		(AEMO) value of customer reliability data, which they considered outdated. A very high priority was wanting to understand how synergies between expenditure programs could help maintain reliability. • **Hardening the network proposal**: More than half of workshop participants supported investment in hardening the network against storms, recognising that frequency of severe weather events is likely to increase. They questioned whether these costs could be covered in other expenditure programs. • **Poorly-served customers proposal**: There was strong support for investment in a program to improve the reliability to our poorly served customers. It was suggested that more data be collected on those customers to better inform decisions. • **Managing bushfire start risk proposal**: The approach to managing bushfire start risk was supported but 46% of participants were uncertain and wanted more detail. There was still some uncertainty about how the bushfire program fits in with other reliability spending. • **Mitigating bushfire start risk proposal**: About a third of participants supported the investment to mitigate bushfire start risk, including analysis modelling, but 45% were unsure and thought more work was needed. Some queried if this was different from regular maintenance.
Future network workshops (Phase 3)	• Full day workshop with 22 representatives from customer consultative panel, reference groups, government, retailers and regulators	Outcomes: • Participants supported moving away from placing fixed limits on distributed energy resources that would mean excluding later installations on residential premises as a fair and equitable way to proceed • Participants largely agreed that SA Power Networks and AEMO need to have better visibility into the state of the network, and improved monitoring and control during constraints • Participants wanted to be sure that plans were in the best interest of customers • Participants all agreed that something had to change, even if questions remained about the modelling and costing of what was being proposed • Participants broadly supported ongoing investment in non-network solutions, and encouraged SA Power Networks to keep an open mind to a range of solutions • Participants felt that with more options and community discussion, customers could actively participate in non-network decision making and SA Power Networks should continue to create opportunities to engage customers in identifying solutions together
IT Workshop (Phase 3)	• Full day workshop with 13 representatives from customer consultative panel, reference groups, government and regulators	Outcomes: • In all elements of the proposed IT expenditure, participants wished to reinforce that direct links to positive and measurable customer outcomes were critical • Participants broadly agreed that the overarching narrative for IT needed to be clearer so stakeholders could understand the whole picture • Participants noted that the IT landscape appears overly complex and questioned if it is necessarily so, or if SA Power Networks could make decisions to rationalise the complexity • A repeated theme through the workshop from participants was the observation that many organisations fall into the trap of needing 'the latest and greatest' IT solutions and sought reassurance that this was not SA Power Networks approach

4 Asset management context

SA Power Networks manages its assets in a vast state with a widely spread population and harsh conditions. Readers familiar with our business may wish to skip to the next section.



Role of the distribution network	• Fully managed service of delivering electricity that is safe and reliable • A changing role with the change in generation sources such as solar PV
Our infrastructure	• 174,000km of overhead conductors, 18,000km of underground cables, 400 zone substations, 77,000 transformers, 647,000 Stobie poles • 30% of our customers are rural and serviced by 70% of the network • Our total asset replacement cost is $37 billion
Environmental factors	• Our network intersects bushfire risk areas • Corrosion due to coastal proximity is a problem for our overhead network • Hot and dry South Australian climate leads to peaky demand • Our assets are increasingly exposed to severe weather events • Our network is susceptible to trees near powerlines
Energy demand	• Overall peak demand in South Australia is flat • Some regions still experiencing growth and require localised network upgrades
Culture, the organisation and asset management	• We are one of the largest employers in South Australia • Safety is imbedded in our business culture • Our industry is technically specialised and it takes time to train new staff • The skills mix we need is changing in light of our changing role • We are committed to diversity and inclusion

4.1 Role of the distribution network

Our role has traditionally been to provide a fully managed service of delivering electricity that is safe and reliable with guaranteed service levels. Our assets extend from connection points shared with the transmission company (ElectraNet) to the customer's point of supply. Figure 11 illustrates our functional role in the electricity supply chain.

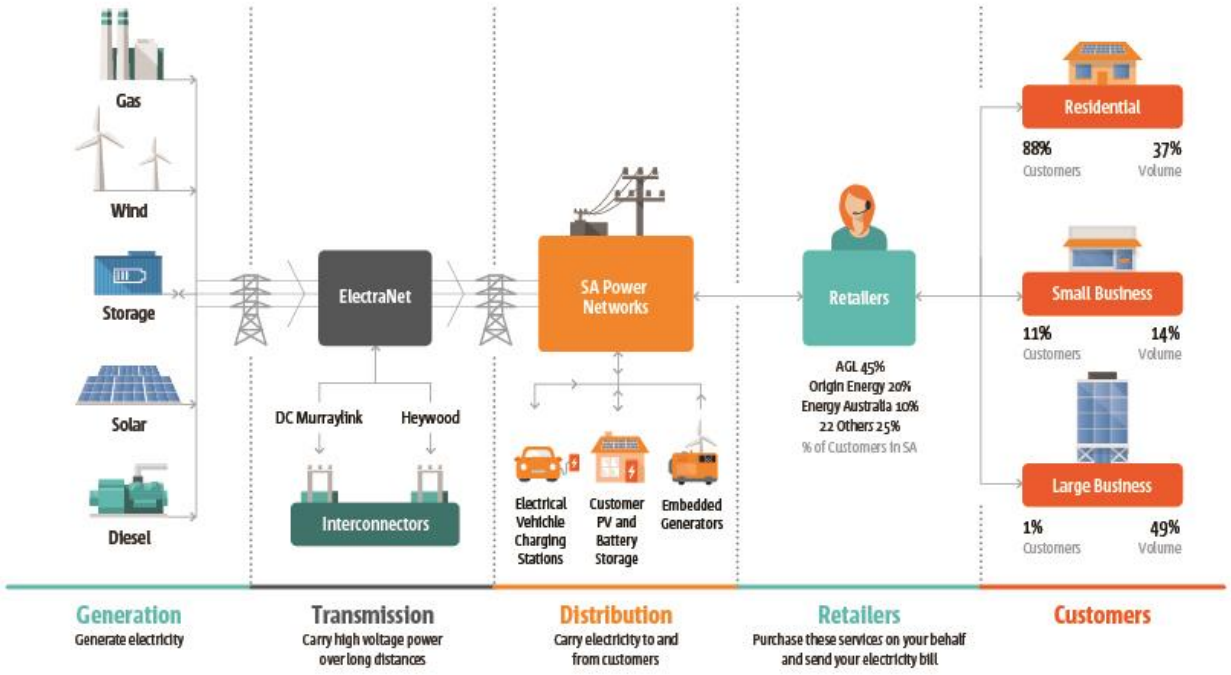


Figure 11: South Australia's electricity supply chain

However, electricity is now distributed from diverse electricity sources and thus the network has two-way flow (Table 2). This transformation of the energy system presents opportunities for SA Power Networks and the community.

SA Power Networks could play a role in enabling customers to get the most from their grid connected solar PV and batteries. In addition, we could leverage new technologies to improve the efficiency of the network. Electric vehicles also represent a new market for us to supply with energy.

Such two-way flow also presents challenges to our assets and business in maintaining regulated voltage levels, threatening to exceed thermal ratings of equipment, and placing overall system security of supply at risk by displacing traditional synchronous generation sources such as gas and coal generators.

Table 2: Past and current electricity distribution

Past	Current
Few large generators/retailers	Many generators
Passive consumers	Active consumers
One-way flow	Two-way flow
Distributor metering (high visibility of data)	Retailer metering (low visibility)
No aggregation	Generator aggregation Demand aggregation

4.2 Our infrastructure

The distribution network in South Australia is vast. It covers an area of more than 178,000km^2 along a coastline longer than 5,000km. The network extends more than 89,000km across difficult and remote terrain and operates in demanding conditions. It includes 400 zone substations, 77,000 transformers, 647,000 Stobie poles, 174,000km of overhead conductors and 18,000km of underground cables. Figure 12 shows the extent of our service area.

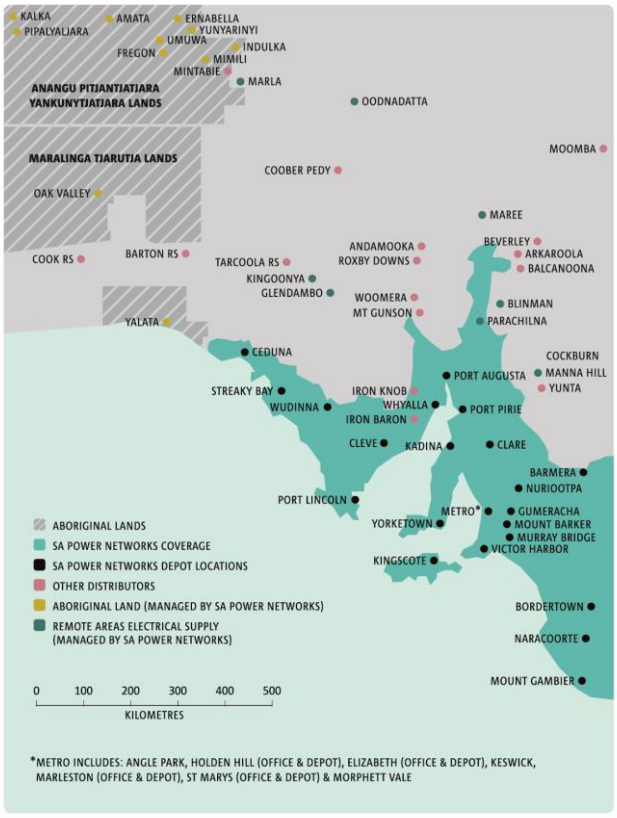


Figure 12: SA Power Networks service area

Apart from urban coastal areas, South Australia is very sparsely settled. Approximately 70% of SA Power Networks' customers reside in major metropolitan areas, including the great majority of business and commercial customers. However, the extensive area serviced by our distribution system means 70% of the network infrastructure (in route length) delivers energy to the remaining 30% of customers. Compared with other states, South Australia has relatively few regional centres, and they are generally small and sparsely located. The average customer density per kilometre of distribution line in South Australia is thus the lowest among Australian distributors.

The distribution network is made up of the sub-transmission system, substations, the high voltage distribution network and the low voltage network. The sub-transmission network supplies and connects zone substations, operating at 66,000 volts and 33,000 volts. In rural and remote areas, long single-phase lines connect remote customers. About a third of our network comprises these long 'single wire earth return' lines operating at 19,000 volts. In higher density rural and urban locations, the three-phase high voltage distribution network operates at 11,000 volts. The standard low voltage customer supply is 230 volts at 50Hz.

Our major electricity distribution assets, summarised in Table 3, also include many ancillary systems as well as fleet and depot facilities spread across South Australia. We supply electricity to customers on isolated

farms in rural areas through to industry precincts, regional and metropolitan residential homes, businesses and city centres.

Table 3: SA Power Networks electricity distribution assets summary

Asset classification	Quantity	Replacement value ($m)[6]
Underground cables (circuit km)	18,064	16,864
Poles	647,497	5,667
Overhead conductors (conductor km)	174,293	8,212
Transformers	76,696	1,684
SCADA network control and protection systems	13,335	2,269
Switchgear	15,541	1,412
Service lines	796,125	429
Other: DNSP defined	miscellaneous	456
Total		36,996

Pole top structure

Distribution transformers

Substation transformer

Underground cable

Figure 13: Selected examples of SA Power Networks infrastructure assets

[6] Calculated as historic replacement cost x units in service

4.3 Environmental factors

4.3.1 Bushfire risk areas and corrosion zones

Figure 14 illustrates the three bushfire risk areas in South Australia. The South Australian distribution network intersects with several protected natural reserves, conservation parks and forestry plantations. Operating the distribution network in forested areas poses significant bushfire risks.

In addition, SA Power Networks' overhead electricity distribution network is predominantly located along the coast, where exposure to a saline environment is high and leads to high levels of corrosion. Figure 15 shows the levels and location of the atmospheric corrosion zones in South Australia. A large part of the distribution network (see Figure 12), is in severe and very severe corrosion zones.

To effectively manage our asset portfolio, SA Power Networks specifies and considers the bushfire risk area category and the corrosion zone for each asset in our asset management database.

Figure 14: Bushfire risk area, South Australia

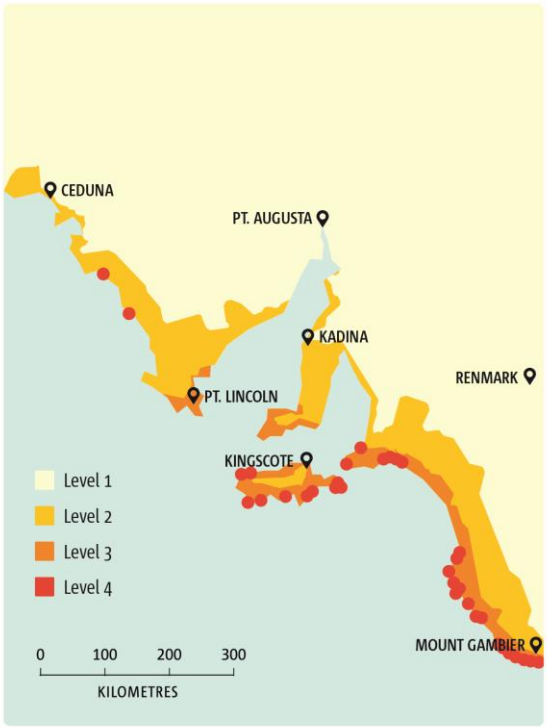


Figure 15: Atmospheric corrosion zone, South Australia

4.3.2 Hot and dry climate

Adelaide and much of South Australia has a dry climate featuring greater extremes of summer temperature than most other Australian capitals. Extended periods of heatwave conditions can occur in summer. During these heatwave periods, summer daytime temperatures can exceed 40 degrees Celsius for several days in a row; overnight minimums can remain above 30 degrees Celsius for some of those days.

South Australia thus has one of the peakiest electricity demands in the world driven by the demand for cooling during our hot summers. On the few extremely hot days of a South Australian summer, typically around six to nine days each year, air conditioning loads cause South Australia's electricity demand to double relative to average demand levels. For many customers, air conditioning plays an important role in maintaining reasonable levels of comfort, and can be critical for their health. Customers expect us to ensure sufficient capacity exists in our network (with the support of non-network solutions), to meet these peak demands that occur for less than 2% of the year.

4.3.3 Severe weather events

Our electricity system is vulnerable to weather and climatic changes including coastal flooding, extreme heat, drought, wind speed and bushfires.

The climate in South Australia is changing and will continue to change. The CSIRO report, Climate Change in Australia[7], shows a plausible range of climate system responses to given emission scenarios and the range of natural variability for a given climate. The report indicates higher temperatures, hotter and more frequent hot days, less rainfall in winter and spring, increased intensity of heavy rainfall events, longer drought duration, slower winter mean wind speed, increased solar radiation and reduced relative humidity in winter and spring, increased evaporation rates, and reduced soil moisture and runoff.

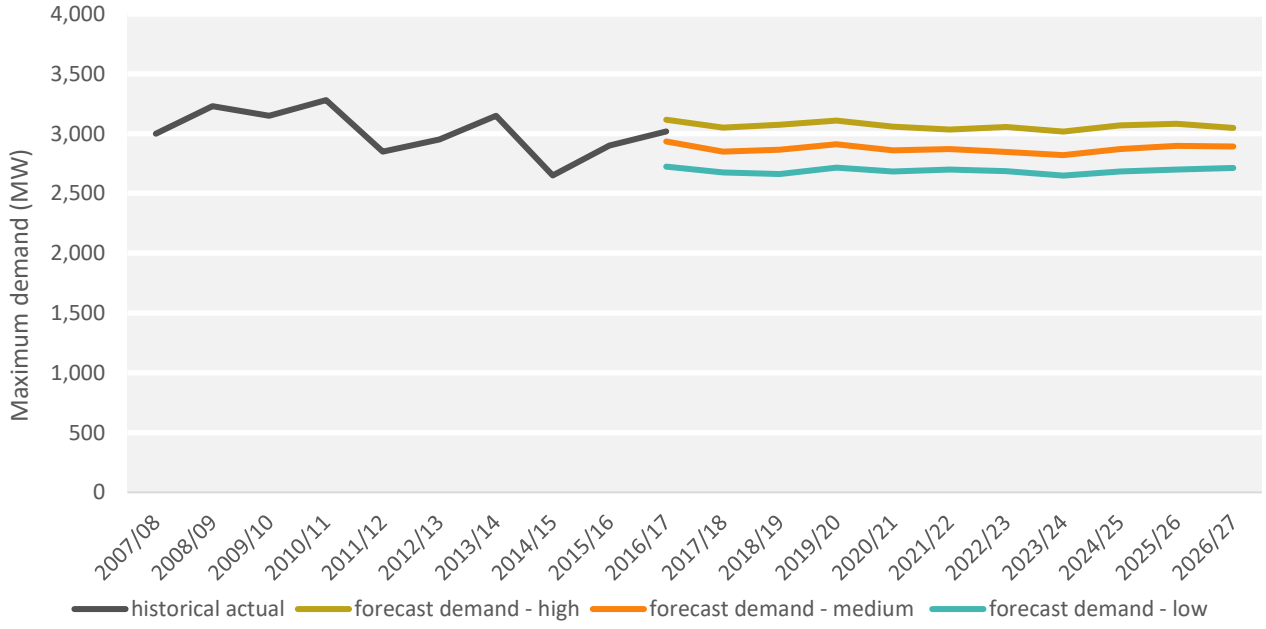
These changes have implications for the electricity service we provide to our customers, especially electricity demand, supply and reliability. Severe weather events are the major cause of prolonged interruptions to power supply in South Australia. The challenge of maintaining overall reliability of the network under changing climatic conditions will remain high.

4.3.4 Trees near powerlines

Vegetation and trees form a key part of our urban and rural landscape and give us a wide range of aesthetic and environmental benefits and values. However, trees pose risks when in the proximity of powerlines. Managing trees and vegetation near powerlines is critical to ensuring community safety, mitigating bushfire risk, and providing a reliable and safe supply of electricity to our customers. We are required by legislation to inspect and clear vegetation from around powerlines at intervals of no more than three years. We also target repeat vegetation interruptions with reliability programs.

4.4 Energy demand

The Australian Energy Market Operator (AEMO) undertakes overall demand forecasts for the whole of South Australia. Figure 16 shows the historic and forecast peak demand for South Australia.



[7]Source: CSIRO, Climate Change in Australia Projections Cluster Report - Southern and South-Western Flatlands, 2015

Figure 16: Peak electricity demand forecasts for South Australia[8]

The long-term trend for peak electricity demand in South Australia is forecast to remain relatively flat. Although the South Australian population, business growth and uptake of electric vehicles is forecast to increase, future demand should remain relatively flat largely due to:

- improved energy efficiency in household appliances;
- continued growth in rooftop solar PV;
- increase in integrated solar PV and storage systems; and
- households and businesses managing their usage.

Although demand at a state macro level may be relatively flat, demand within planning regions may be increasing or decreasing (Figure 17). That is, parts of the network may be experiencing growth which is not offset by decreases in other parts of the network and still requires localised network upgrades to increase capacity. We incorporate these changes in spatial demand forecasts to assess any network constraints.

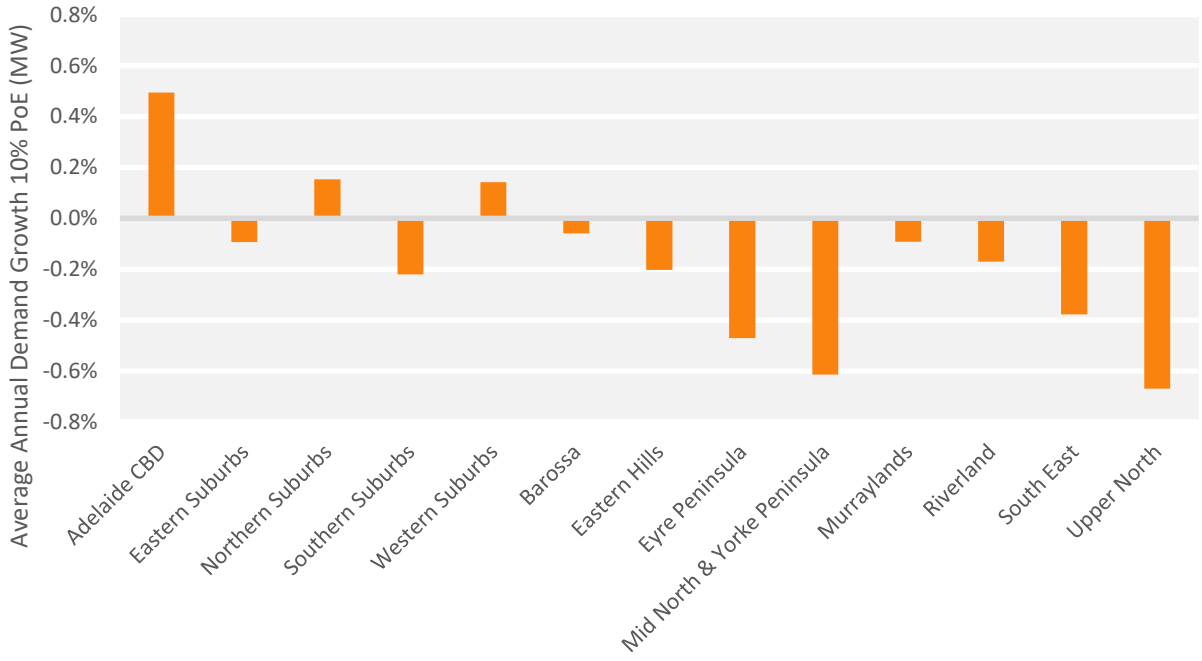


Figure 17: Regional annual electricity demand change forecasts (2016–2030)

4.5 Culture, the organisation and asset management

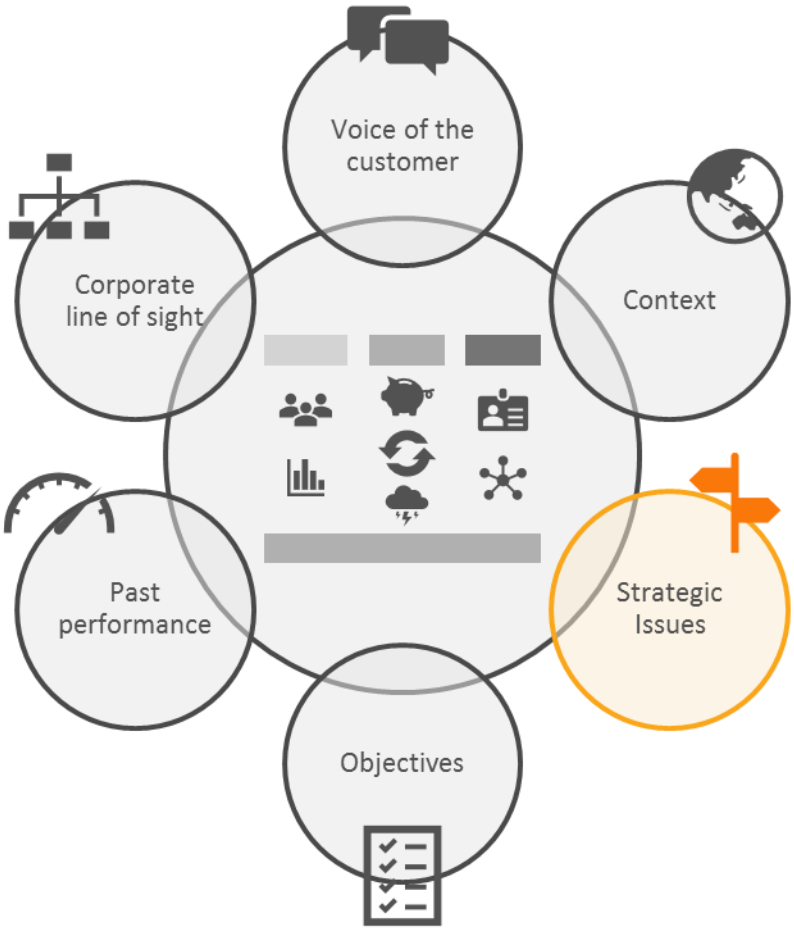
We invest in ongoing training, mentoring and graduate programs, as well as leadership and apprentice programs to ensure we have the right mix of skills and resources to meet current and future needs. We also recognise the need to continually upskill our workforce to keep up with, and ahead of, new technology. We have an increased focus on diversity and inclusion, and actively support the development, advancement and success of a diverse workforce.

Our safety performance has led our industry for many years. Safety is embedded in our business culture, and ensuring safe outcomes for our people, contractors, customers and the South Australian community is our number one priority.

[8]Source: AEMO, 2017, South Australian Demand Forecasts, July 2017

5 Key strategic issues

The electricity industry in which we operate is evolving at a rapid pace. Internal and external issues challenge our electricity service delivery now and into the future, and we have a range of options to address them.



Pressure on electricity prices	• Intense political and customer pressure on prices • Customer concern about increases in forecasted network expenditure • Customers may move to off-grid energy solutions as they become more attractive • Regulators focused on reducing network cost could lead to inadequate expenditure allowance to manage our assets
Security of supply and reliability	• Changing mix of generation responding in unexpected ways during major system disturbances (eg state wide blackout) • Growing risk of insufficient generation in market to meet demand • Significant number of outages due to severe weather events • These events affecting how people perceive reliability of the network • Our role in security of supply is growing
Ageing infrastructure	• Large proportion of assets built during 1950s and 1960s • Low historic investment in renewal expenditure (0.30% of asset replacement value per annum) • Increase in risk on network due to degrading condition of assets • Entering renewal cycle for many of our assets, which could lead to unpalatable increases in expenditure

Changing value of network	• Changing use of grid with the continued uptake of new energy technologies -> two-way flow • Moving from passive use of grid to active use of grid (ie customers choosing when to charge batteries) -> demand on network unpredictable • Electric vehicles could rapidly increase underlying network demand • Generators want unlimited access to the network • Renewable energy becoming cheaper that traditional sources • Rapidly rising rate of complaints about power quality issues in local network • Uncertain rate of electric vehicle take-up • The network is unable to support unlimited amounts of distributed energy • Some economic value from renewable sources could be lost
New and heightened customer expectations	• Customers being exposed to responsive, innovative and timely service from other providers • Customer interest in electricity due to rising prices and availability of new technologies • Customers want accurate real-time information via a wide range of channels including smart phone applications and social networking sites • Customers want less inconvenience from planned and unplanned outages

Policy volatility	• Multiple regulatory and market reviews in last 5 years
	  ○ Metering function has become contestable
	  ○ Regulatory investment tests are being extended to replacement projects
	  ○ Ring fencing changes recently introduced
	  ○ Rising regulatory reporting requirements
	• Need for auditable and robust asset information
	• Ineffective market mechanisms driving cost increases
	• Cumbersome regulation driving further cost increases

Accelerating technology capabilities	• Steady decrease in cost of technology • Manufacturers driving innovation of products • Improved safety through better network monitoring • Potential improvement in network operations made possible by technology • Electronic ‘smart’ assets leading to increased complexity and changing skill set

5.1 The pressure on electricity prices

The political and customer pressure to reduce electricity prices is intense. Australia wide the increases in electricity prices have been driven primarily through investment in network reliability by government-owned distribution businesses in eastern states; in South Australia the increases have been due to increases in generation costs.

The distribution network component of electricity prices in South Australia is the same today as it was at privatisation in 1999 (Figure 18). However, customers in South Australia exposed to national media and unaware of the reasons for price increases in their own state, can easily assume that the increase is due to large network investments.

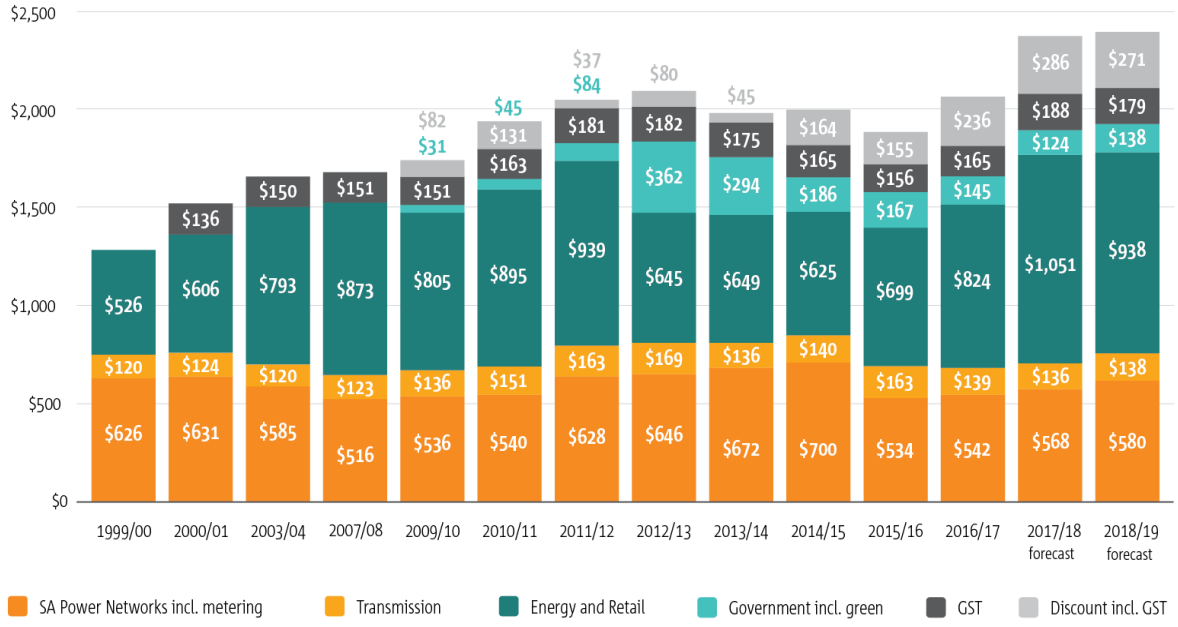


Figure 18: Average annual residential bill, South Australia[9]

Regardless of their underlying reason, price increases are causing customer dissatisfaction and could lead to customers taking up off-grid energy solutions, which, in turn, would increase prices for the customers remaining connected to the network. Our stakeholder engagement has given us a clear message that our plans need to strike the right balance between sustainable prices and service.

Further, the AER can directly impact the network component of the bill. This presents a potential risk to our organisation: we may not get approval for efficient levels of expenditure on the network, despite having a history of efficiently meeting our obligations.

5.2 Security of supply and reliability

In September 2016 the changing mix of generation in South Australia responded in an unexpected way during a major system disturbance on the state's transmission network. It contributed to a state-wide

[9] Based on 5MWh consumption per annum (in real terms, excluding the effect of inflation). PV FiT: State Government Solar Feed-in Tariff Scheme; REES: Retailer Energy Efficiency Scheme; Renewable: Federal Government Energy Incentive Scheme

blackout. Since then concerns have grown that synchronous generation may be insufficient in South Australia to meet demand.

These events affect how people perceive reliability of the network. It was further exacerbated by a significant number of outages on our network in localised areas due to severe weather events in 2016. Although these events are excluded from our reliability performance measures by ESCoSA, they still provoke customer concerns over our reliability performance. In addition, our role in security of supply is increasing with the growing uptake of distributed energy.

5.3 Ageing infrastructure

A large proportion of our assets were built during 1950s and 1960s, meaning many are now 45–65 years old and reaching the end of their expected life (Figure 19).

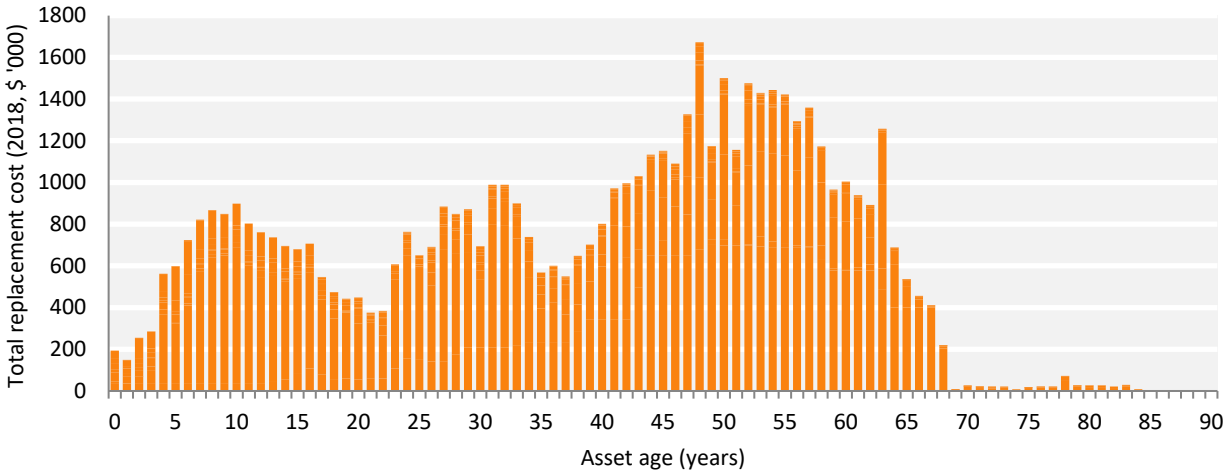


Figure 19: Asset replacement cost by age

During the 2015–2020 regulatory period a significant increase in replacement expenditure was allowed by the AER, recognising that our assets are aged. However, even with this increase we are now replacing only 0.25% of our assets each year.

As our network continues to age it will become harder to manage service levels. Our current level of service won't be able to be maintained without a change in investment or further improvements in our approach. Ageing assets and their subsequent replacement may pose a commercial risk and community risk due to significant peaks in required investment levels if not forecasted and managed appropriately. Figure 20 shows we have the oldest assets in the NEM.

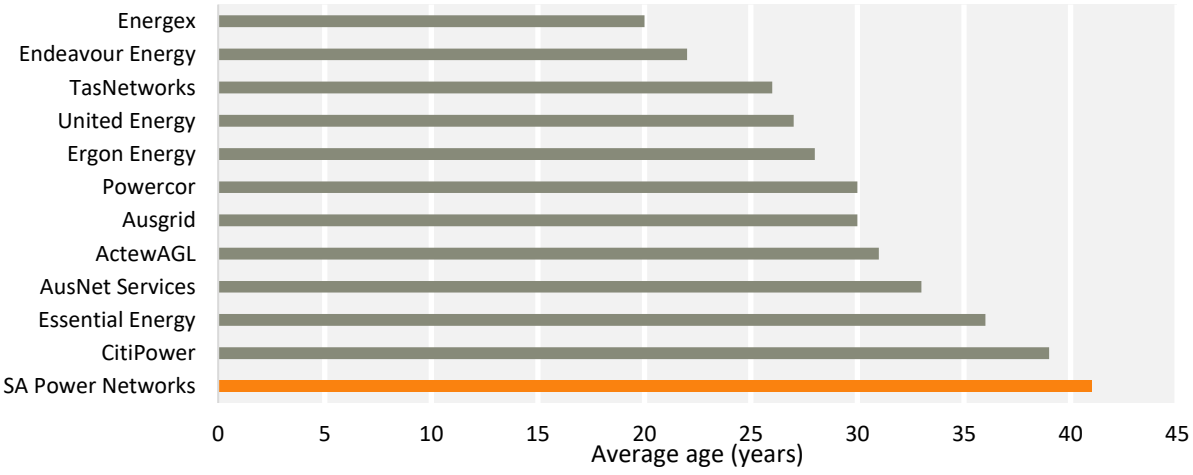


Figure 20 Average age of all network assets[10]

5.4 Changing value of network

The coming years will continue to be a period of tremendous change for the electricity industry. This is causing us to rethink the way we plan, build and operate the distribution network.

On the one hand, as distributed energy resources, such as solar PV and battery storage, continue to improve and become more cost-effective, elements of the distribution network may become redundant as standalone (off-grid) premises and/or local microgrids become more economic than a traditional network. The network as we know it may begin to fragment. On the other hand, new demands for electricity, such as from electric vehicles, and new market models, such as virtual power plants and localised peer-to-peer energy trading, may bring renewed value to the network. It could be an enabler of a low-carbon economy, and a platform for the dynamic exchange of energy between interconnected webs of customers who are both producers and consumers.

As a network operator we face specific technical challenges in accommodating the two-way energy flows arising from the rapid and ongoing proliferation of rooftop solar PV and other distributed energy resources. We are transitioning to a future where up to 45% of all electricity may be generated by customers by 2050, the opposite of the system's original design.

Our challenge is to adapt our business to position for the new energy future, while continuing to deliver on our primary responsibility to maintain a safe, secure and reliable supply of energy for the South Australian community.

5.5 New and heightened customer expectations

Customers' expectations are changing. They are being exposed to responsive, innovative and timely service from other providers and providers in other industries. They now expect the same service standard from us. Our customers also take an active interest in electricity due to rising prices and the availability of new technologies.

Customers expect to be able to access quality, real time information on a wide range of channels including smart phone applications and social networking sites. They want less inconvenience from planned and unplanned outages, and timely reliable information on when these outages can be expected. Our customers are also interested in better tree management outcomes and the aesthetics of new infrastructure.

To enhance our customer service culture, we need to understand and invest in customer insights, segment preferences, customer service channels and service capabilities. We need to better understand what our customers value in a changing and more competitive marketplace. As well as improving our current service offerings, we might need to offer different products and services.

5.6 Policy volatility

The regulatory environment under which SA Power Networks operates is changing. In just the last two years we have seen the metering function become contestable, regulatory investment tests extend to replacement projects, and the ring fencing of contestable works separate the monopoly and competitive parts of the business. These changes require us to adapt some aspects of our asset management.

[10] Preliminary analysis based on analysis of public AER Regulatory Information Notices data (2016-17 data)

Past decisions that have led to ineffective market mechanisms are driving cost increases. The rising regulatory reporting requirements of our assets and operations is driving further inefficiency. The need for auditable and robust asset information requires more powerful and agile asset information management systems and processes.

Current and future business models will be directly affected by the evolving attributes of the regulatory and legislative environment in which SA Power Networks asset management operates.

5.7 Accelerating technology capabilities

Evolving technology and innovation give customers more options. They also create opportunities for improvements to network operations such as new ways to monitor, control, maintain and augment assets that were previously cost prohibitive.

Remote monitoring and control technology is evolving rapidly and quickly expanding the range of cost effective solutions available. Installation of more intelligent devices such as distribution transformer monitors, supervisory control and data acquisition (SCADA) enabled remote-controlled switching devices and advanced meters will help us to manage risk and network performance. These technologies also facilitate flexibility in our network operations that will enable the two-way network of the future.

These changes require new ways to manage these predominantly electronic devices. The focus would be on configuration management, daily operation, maintenance and eventual replacement programs.

6 Asset management objectives

Given our asset management context and the key strategic issues we face, SA Power Networks has developed six key asset management objectives.

Safety	• Keep the public, our staff and contractors safe
Engagement	• Develop levels of service that are supported by comprehensive customer and key stakeholder engagement
Service	• Achieve agreed current and future levels of service while complying with legislative requirements
Efficiency	• Deliver sustainable network investments and performance that are cost efficient and consistent with prudent risk management approaches
Regulatory support	• Maintain an asset management system that satisfies the criteria and evidentiary needs of our regulatory stakeholders
Stakeholder confidence	• Promote clarity and transparency to build stakeholder confidence

6.1 Safety

Safety is our number one priority. As an organisation that operates infrastructure that has the potential to injure or kill members of the public, our staff or our contractors, we must stay focused on managing safety. This includes understanding and managing the bushfire risk posed by our assets.

6.2 Engagement

Customer expectations are a critical input into our levels of service. We continually engage with our customers to help us understand their expectations through operational and targeted touch points. SA Power Networks values and respects the opinions and concerns of our stakeholders and actively gears its asset management system to deliver energy services that our customers value.

6.3 Service delivery

Our service delivery is the result that asset management achieves. It is the levels of service our customers experience. Our levels of service targets are outlined in more detail in the Power Asset Management Plan.

The categories we consider for service delivery are:

- customer service experience;
- reliability and power quality;
- environment;
- aesthetics;
- multi-flow grid; and
- communication and information.

6.4 Efficiency

We aim to manage life-cycle costs and optimise asset management outcomes for the long term. Effective asset management strategies require that both physical and non-physical assets are holistically managed and operated.

6.5 Regulatory support

To ensure adequate expenditure allowances, we need to demonstrate the effectiveness of our management system and decisions to both state and national regulatory bodies.

In addition, it is only through a consistent and long-term vision of the network that we will be able to get support for changes to legislation as our role changes.

6.6 Stakeholder confidence

We aim to build stakeholder confidence through understanding our customers and consistently delivering on our commitments. This requires us to build consistent processes that deliver predictable outcomes. We also aim to be transparent in our decision making and act with integrity and social responsibility.

6.7 Success measures

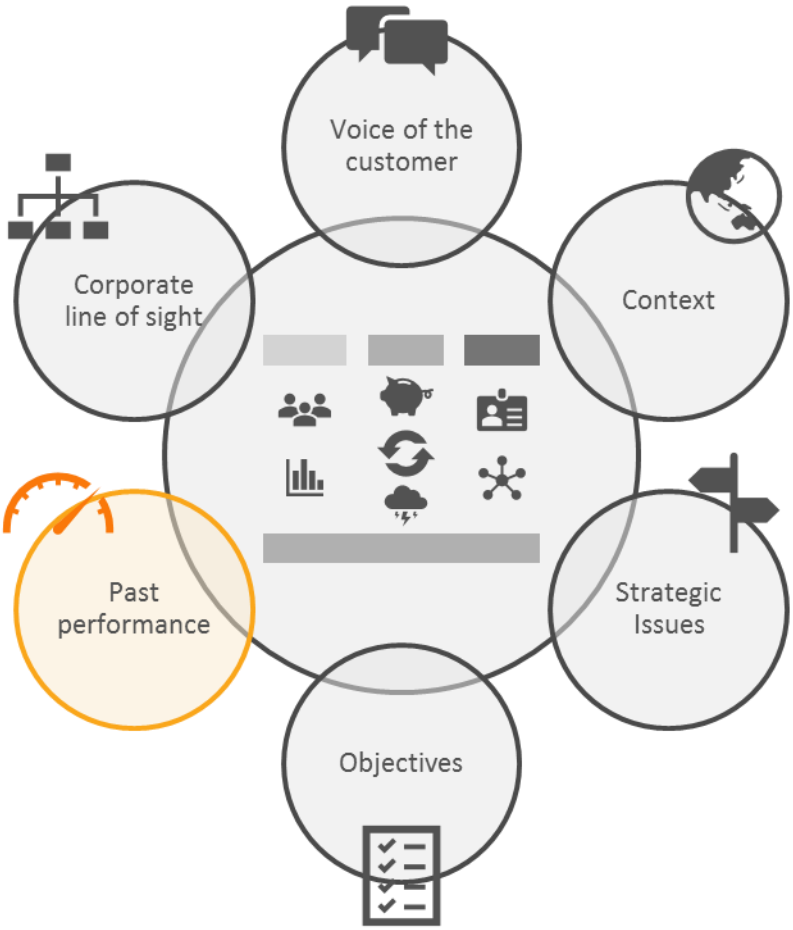
The measures and targets by which we ascertain success are listed in Table 4.

Table 4: Success measures and targets

Measure	Target	By when
Safe		
Number of fatal risk incidents per year attributable to network assets and/or asset management activities	0 pa	Ongoing
Engagement		
Stakeholders engaged	Stakeholders identified, engagement activities established and plans shared	Dec 2018
Levels of service incorporate stakeholder requirements	Levels of service established in consultation with stakeholders	Ongoing
Levels of service		
As described in Power Asset Management Plan		
Efficient		
Relative performance efficiency rank compared to other Australian electricity distributors	Upper quartile	Ongoing
Regulatory support		
Regulatory proposal forecasts	Funding requirements for 2020–2025 clearly understood	By Jan 2019
Acceptable regulatory outcome	In line with funding required to effectively manage assets (as per regulatory proposal)	Before start of 2020–25 regulatory period
Stakeholder confidence		
TBC	TBC	TBC

7 Past performance

SA Power Networks is a high performing and cost-efficient organisation that has historically met most of our regulatory requirements. We are funded to maintain the reliability and safety of the network. However, customers are changing how they measure our performance.



Efficiency	• We benchmark well against our peers • Most efficient distributor in Australia on a state-wide basis in 2017
Safety	• We have a strong focus on safety and benchmark well against our peers
Reliability	• We generally meet our reliability targets • Duration of outages during major events such as storms has been increasing
Quality of supply	• High voltage complaints have been rapidly rising
Customer satisfaction	• Customer satisfaction was impacted by poor reliability

7.1 Economic efficiency

The AER undertakes national benchmarking of all distribution network system operators each year. In 2017, the AER benchmarked SA Power Networks as the most efficient distributor in Australia on a state-wide basis (Figure 21).

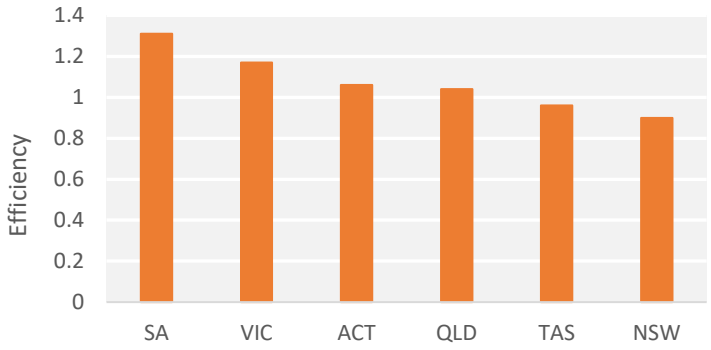


Figure 21: Efficiency on a state-wide basis[11]

7.2 Safety

Our electricity network is inherently high risk. We have the potential to start a major bushfire, cause widespread property damage, and injure or kill staff or members of the public. Our Board and senior management continues to drive a safety culture throughout the organisation. When making decisions we always put the safety of people before the protection of assets and the protection of assets before continuity of supply. Our key priority is to ensure we provide a safe network service to our community and a safe working environment for our people.

Energy Networks Australia, in partnership with the Australian Energy Council, previously undertook safety benchmarking for a number of safety measures across the electricity distribution sector with the most recent comparison in 2015–2016. Figure 22 shows the lost time injury frequency rate for SA Power Networks direct operational employees compared to other Australian distribution network service providers.

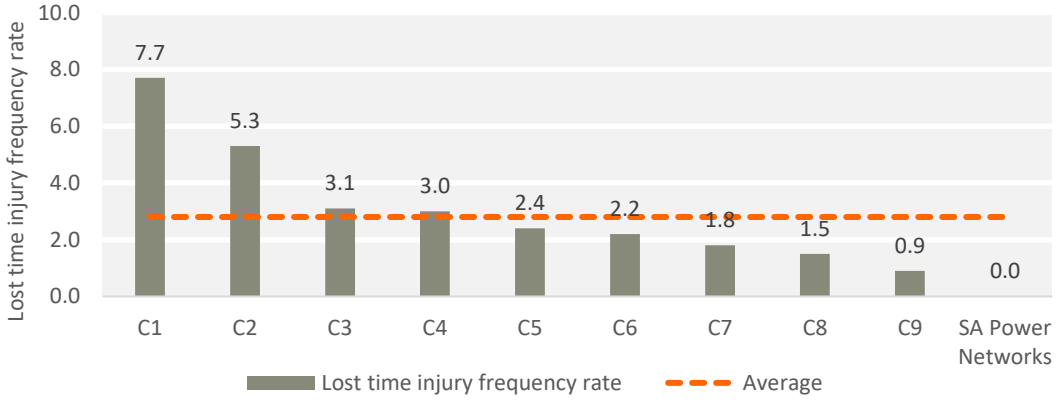


Figure 22: Lost time injury frequency rate (2015–2016)

[11] Source: AER 2017 Annual Benchmarking Report

Fire starts related to the network rarely lead to larger bushfires. Each one is investigated to understand its underlying cause and to monitor trends for emerging issues. Fire starts due to equipment failures have remained relatively stable since 2005 (Figure 23).

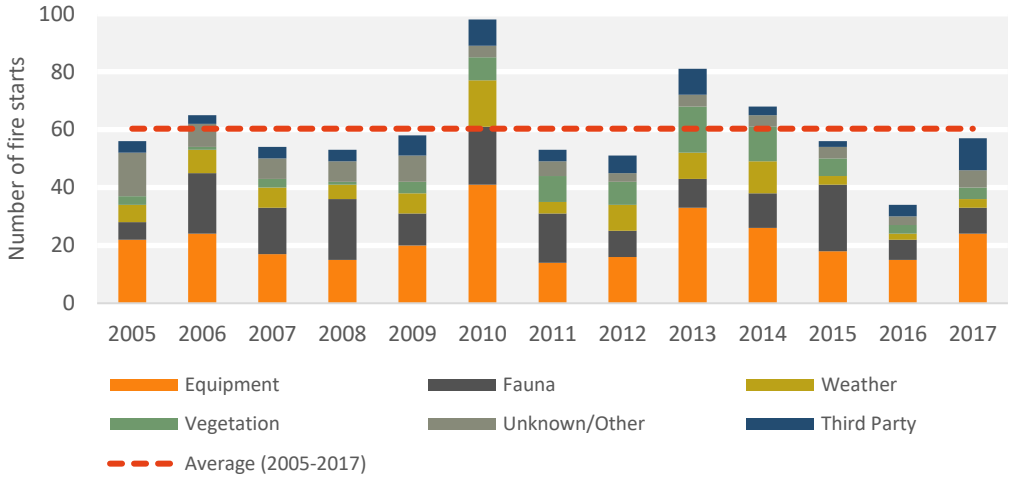


Figure 23: Annual fire start events in South Australia near powerline infrastructure

7.3 Reliability

We generally meet our reliability targets. Figure 24 and Figure 25 show our historic performance for outage duration and outage frequency against the current and previous regulatory targets for unplanned interruptions, excluding major event days. The figures show we have consistently met our targets for both System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) in most years since 2005–2006, with a long-term downward trend for both SAIDI and SAIFI.

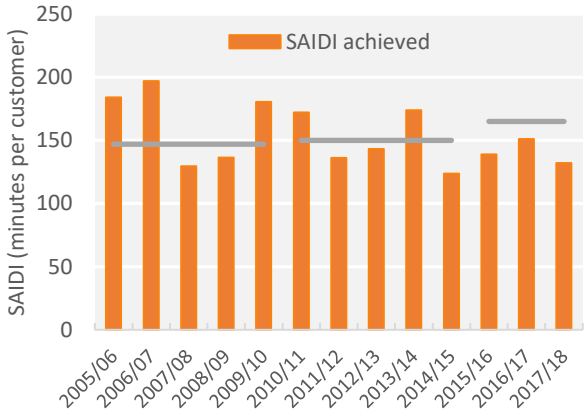


Figure 24: Historic SAIDI performance against regulatory targets

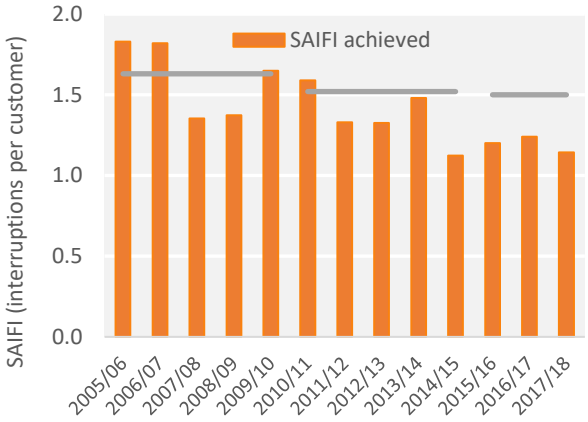


Figure 25: Historic SAIFI performance against regulatory targets

However, outage duration times our customers are experiencing during major event days have been increasing (Figure 26). We're also hearing from our stakeholders that they want us to address poor performing areas such as Eyre Peninsula.

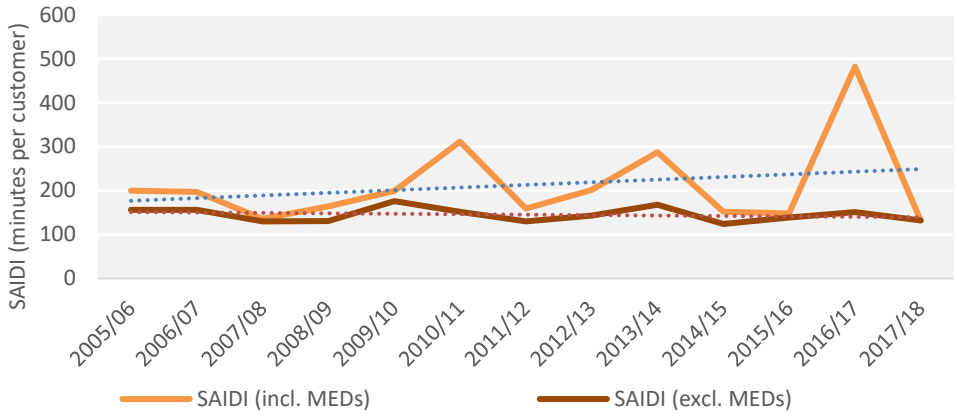


Figure 26: Outage duration trend including and excluding major event days

7.4 Quality of supply

In late 2017 customer complaints about solar PV-related high voltage in the network significantly increased (Figure 27). When the local network experiences high voltage, solar PV inverters turn off and prevent systems from exporting energy, thus reducing the income generated from these systems for their owners.

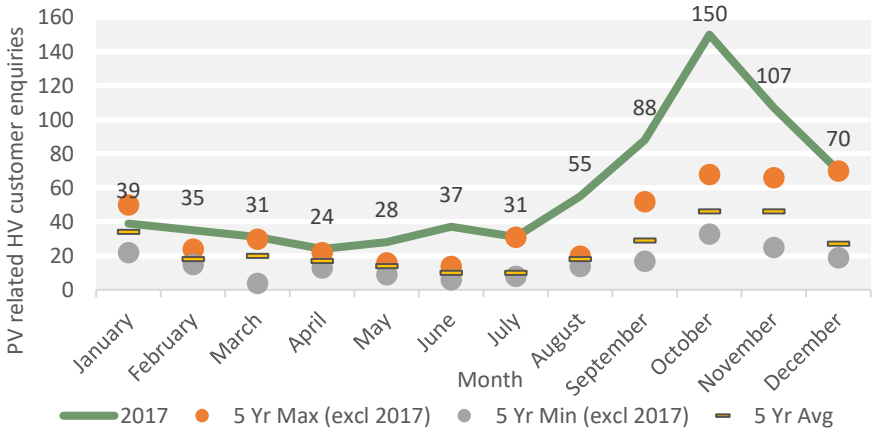


Figure 27: Solar PV related high voltage customer enquiries[12]

7.5 Customer satisfaction

Figure 28 shows that the combined satisfaction rate, as measured by the AER for SA Power Networks, has remained consistently satisfactory from 2013 and has generally met our target of 5.5. Customer satisfaction decreased in the six months after the state-wide blackout and repeated power outages event.

[12] Source: SA Power Networks

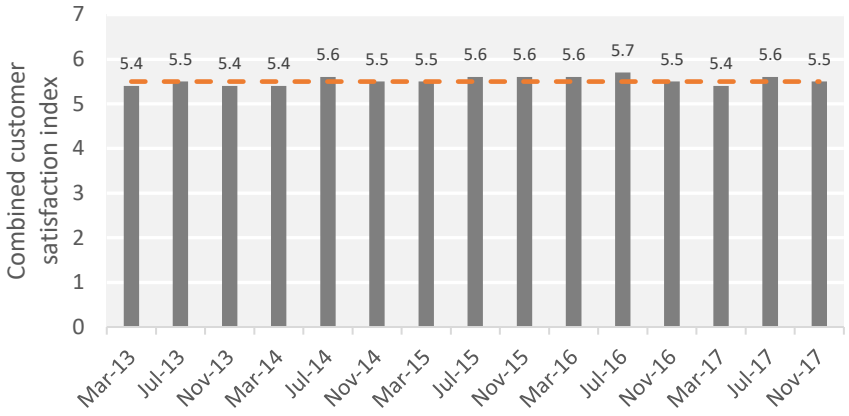
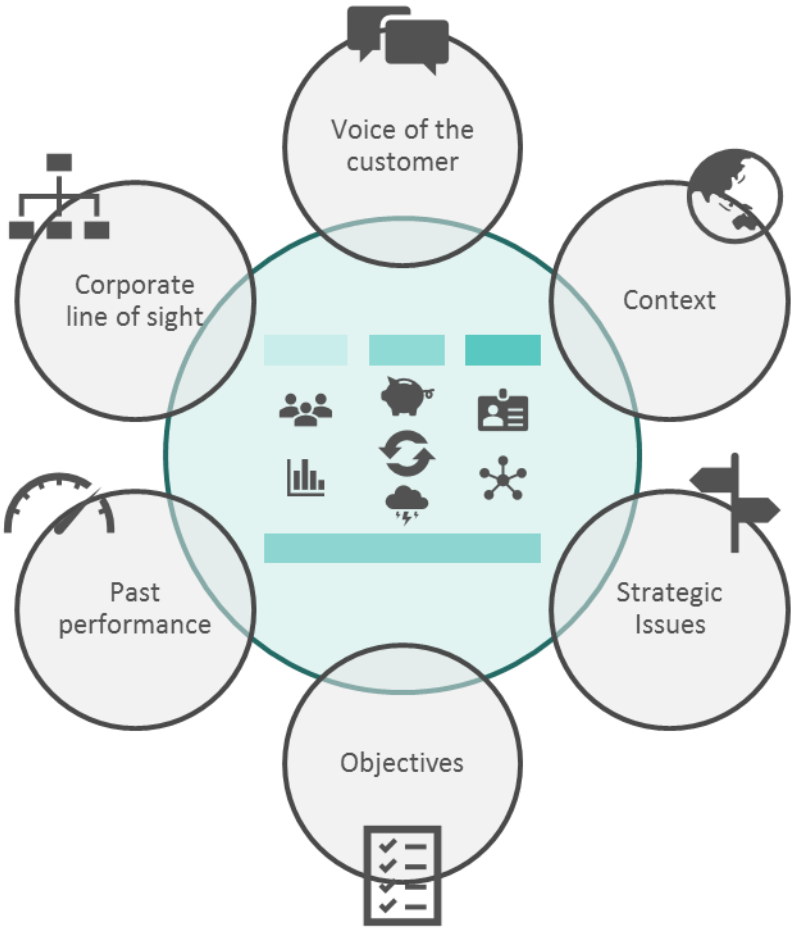


Figure 28: Combined satisfaction index[13]

[13] Source: AER 2017 Annual Benchmarking Report

8 Our response and strategies

SA Power Networks asset management system brings together the expectations of our stakeholders and the current capabilities of the organisation and its assets. Our strategies are designed to deliver energy services that customers value.



Understand	• We aim to understand what our customers and stakeholders value and co-design solutions with them • We continue to evolve our understanding of our network assets
Respond	• In light of our asset management context and what we understand about our customers and assets our asset management response is to: - balance the service we deliver against the cost of that service; - enable the transition to distributed energy; and - improve the resilience of the network in areas of poor performance
Improve	• We improve by investing in technology, systems, processes and our people

8.1 Overview

In response to our environment and corporate objectives we aim to employ good asset management practices that deliver our business objectives for the benefit of our customers and stakeholders. We aim to meet our regulatory obligations using a value-based approach and foster a continuous improvement culture.

First, we aim to **understand** what our customers and stakeholders value. We combine this with an evolving understanding of our network assets to inform our response. Based on those insights, our three main **responses** are:

- balancing the service we deliver against the cost of that service;
- enabling the transition to distributed energy; and
- improving the resilience of the network in areas of poor performance.

We also aim to continually **improve** how we do things by empowering our people, investing in our asset management system, and piloting and trialling new technologies and concepts.

Figure 29 gives an overview of our asset management strategies.

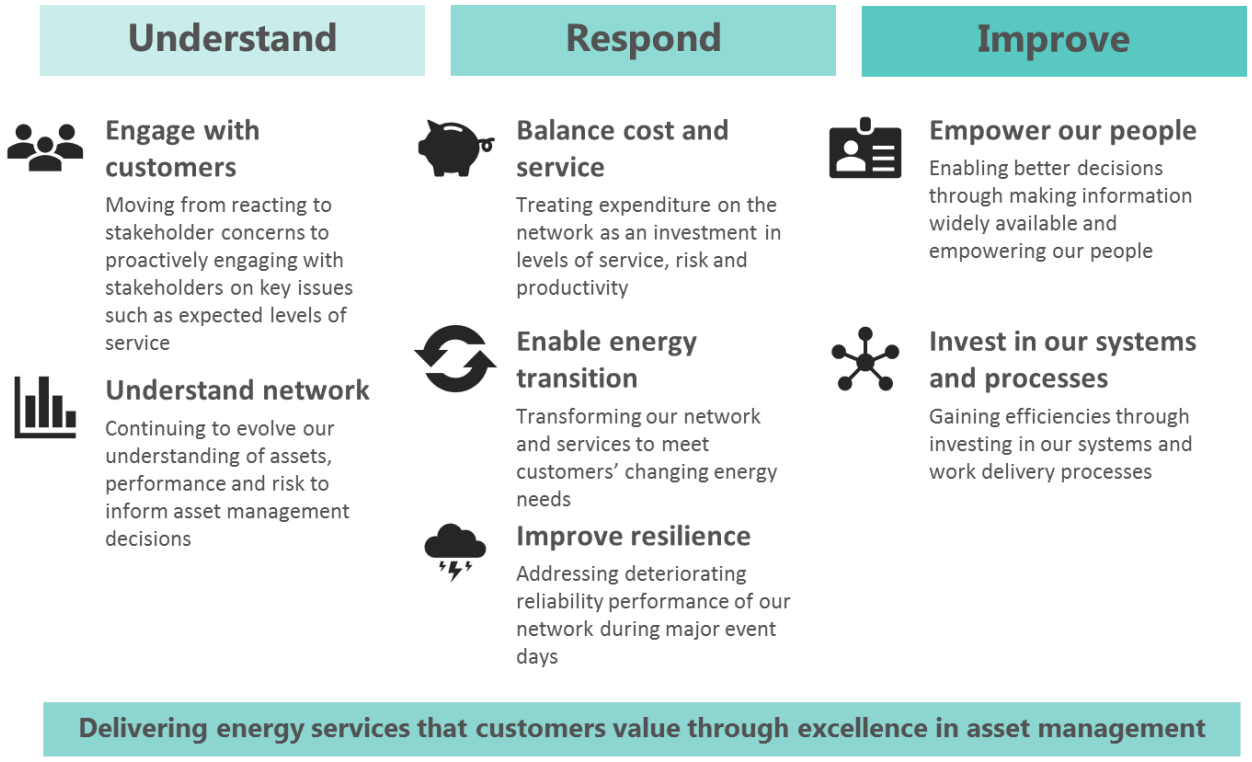


Figure 29 Asset management strategies

Each of these strategies is discussed individually below.

8.2 Engage with customers

Moving from reacting to stakeholder concerns to proactively engaging with stakeholders on key issues such as expected levels of service

8.2.1 Background

It is our strategic intent to deliver energy services that customers value. This intent is reiterated in our asset management policy which dictates that strategies, objectives and plans are set up to provide the level of service that our customers and the community seek and are prepared to pay for. It is also expressed as the goal of the ISO 55000 Asset Management System standard that we are aligning to.

From our engagement with customers to date we have learned that they want to co-design solutions with us. This is particularly important for envisioning the role of the distribution network in the transition to distributed energy.

Our customers and stakeholders are many and varied, and we must recognise this as we seek to understand what they value.

8.2.2 What this means in practice

As described in Section 3, Voice of the Customer, the key messages we have heard from our stakeholders as we develop our strategies are:

- energy prices need to reduce;
- reliability at acceptable levels for all; and
- investment to support the transition to distributed energy needs to be prudent.

These key messages are directly reflected in the three *Respond* strategies. However, our journey to understand our customers and co-design solutions with them doesn't end here.

We are working with customers and stakeholders to ensure that we understand who, how, when, where and why users access our services, and design communication and services to meet their needs. We do this every day by learning from every interaction we have with customers. More formally we have a Customer Consultative Panel and reference groups (Figure 30), through which we engage collaboratively with customers and stakeholders across a variety of topics.

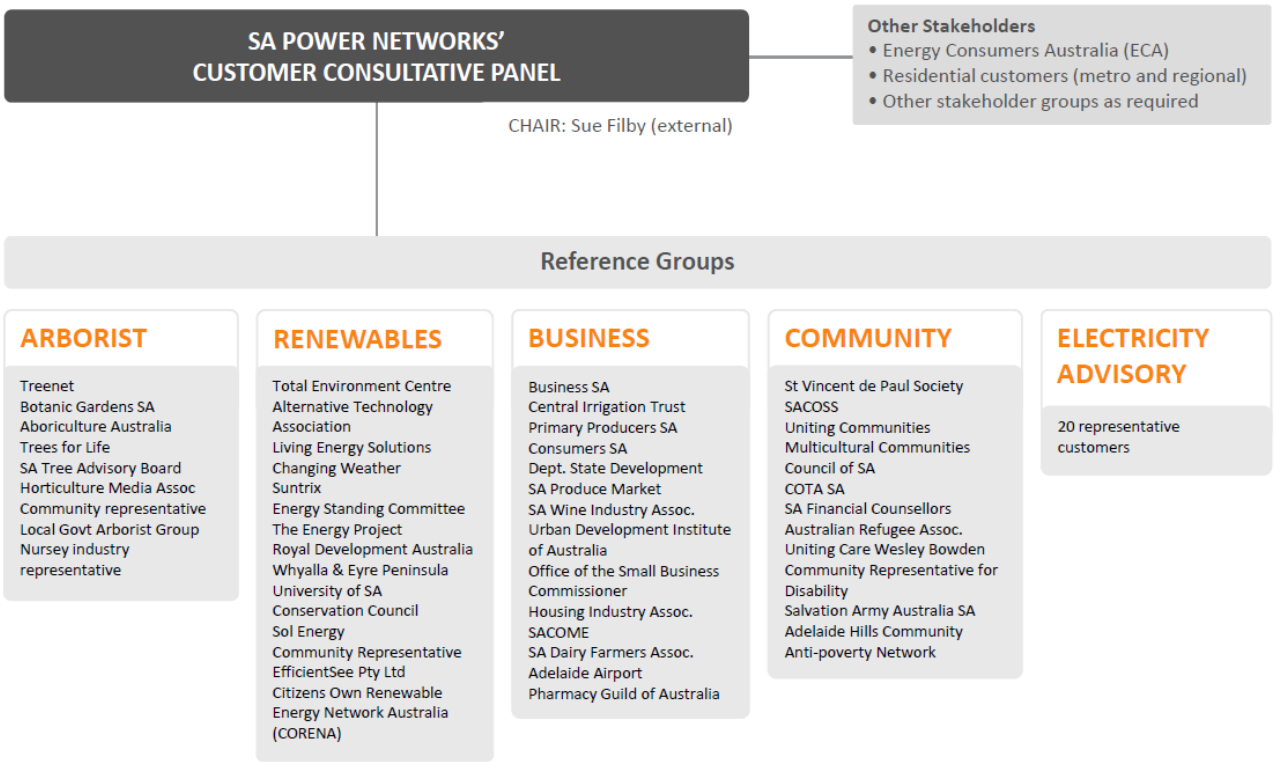


Figure 30 Customer Consultative Panel and reference groups

We also actively engage with government bodies, special interest groups and industry bodies.

Every year we prepare a Distribution Annual Planning Report and an SRMTMP to keep our national (AER) and state based (ESCoSA and OTR) regulators informed on what we do. In addition, we have frequent issue-specific interaction with our regulators.

ESCoSA is responsible for engaging with customers and stakeholders when setting our levels of service expectations. We actively work with ESCoSA and share with them our understanding of what our customers value. This is to improve the alignment between our regulatory requirements and the levels of service our customers want.

We also actively engage with the Local Government Association of South Australia on issues such as public lighting and vegetation (tree) management. We have working relationships in State Government with Primary Industries and Regions South Australia, Department of the Premier and Cabinet, Renewal SA, and Department for Planning, Transport and Infrastructure, and the Australian Government Department of Defence.

We actively engage with and seek advice from the Urban Development Institute of Australia, Property Council of Australia, Housing Industry Association, and National Electrical and Communications Association. We have strong industry partnerships with other network companies through our involvement with Energy Networks Australia.

8.2.3 Improvement initiatives

Stakeholder engagement strategy

We have an ongoing commitment to work with our stakeholders, build on past experiences and continue to embed effective stakeholder engagement practices across the business. We continue our shift from an 'inside out' approach to an 'outside in' approach that ensures we understand, and respond appropriately to, what our stakeholders and customers value.

Our Customer Relations team is leading the development of an Engagement Strategy and model to guide our new models of engagement. The model will help identify the level of engagement required, from informing through to empowering decision making. Customer Relations will continue to actively work with the organisation to identify future opportunities for meaningful engagement and embedding the voice of the customer in our decision-making processes.

Levels of service

To develop our levels of service we recognise that we need to understand:

- current levels of service (what we provide now);
- desired levels of service (what our customers would like);
- legislative requirements (what we must do); and
- corporate and strategic goals (what our shareholders want).

Our levels of service targets aim to strike a balance between the needs of our various stakeholders.

In 2017 we defined our draft customer-facing levels of service and completed our first formal engagement with customers on levels of service. It is our goal to continue to refine and incorporate these levels of service targets throughout our asset management system to ensure our investments on the network are directly linked to the service we aim to deliver to our customers.

Assets and Work program

We have developed an Enterprise Asset Management Blueprint which outlines a multiyear Assets and Work program of change to our processes, data and systems to enable us to balance cost and asset risk in delivering the services that customers value.

A specific component of the program is to form a stronger link between the network asset and the customer. With this integration comes improved understanding of how the customer uses the network and how changes to the network affect the customer. Among other things this integration enables timely and reliable outage information to customers.

8.3 Understand network

Continuing to evolve our understanding of assets, performance and risk to inform asset management decisions

8.3.1 Background

We need to understand the assets we are managing to make effective asset management decisions. This means understanding where they are, what their capacity is, what condition they are in, how they are being used now and into the future, and the impact they are having on service and risk.

Generally, we are concerned with two aspects of our assets:

- the risk associated with physical failure; and
- the impact on service levels.

8.3.2 What this means in practice

We monitor the condition of our assets through methods like online condition monitoring and periodic inspections. We determine inspection cycles by the criticality of an asset, the bushfire risk area in which the asset is located and the level of corrosion it is exposed to. Targeted programs are also employed when an emerging risk is identified.

We use inspections to collect additional asset data to improve our understanding of our asset base. Over the last couple of years, we have been actively improving our asset knowledge by relating our work to specific assets so we can start building up a history of those assets. Previously for line assets this was done only at a feeder level rather than to a specific asset, such as a pole.

When a significant or unexpected failure does occur, we undertake a detailed equipment failure investigation, which contributes to our knowledge of asset failure modes. We continue to close the loop on failures, linking asset failures back to observed condition during cyclic inspections. This is improving our understanding of asset risk and informing our policies, strategies and practices.

A key input into our asset management plans is benchmarking. By comparing ourselves with similar organisations we can identify areas for improvement, understand what we are doing well and work collaboratively with our peers to share knowledge.

We employ predictive models to understand the investments needed to manage the risk and service from our assets. These are described in more detail in our Power Asset Management Plan.

Each year after summer we review our network demand forecasts by considering load recordings that summer, recent network changes and any new committed large loads or generation. Our forecasts consider the specific weather patterns we experienced that summer, economic factors, distributed energy take up and spatial factors. These forecasts are then compared with network capacity to identify any constraints. The results from our demand forecasting is published publicly in our Distribution Annual Planning Report each year.

We have a high voltage network model that maps geographically the connectivity of our network. This allows us to have a real-time view of our network and to manage switching operations on it. Switching is the act of changing a state of a physical switch on the network, usually to isolate parts of the network to conduct work or to restore supply. By performing electronic switching on a connected network model, we have increased visibility of the real-time state of the network, leading to more efficient supply restoration times and helping us to manage the risks our people are exposed to when performing those switching operations.

8.3.3 Improvement initiatives

Inspections

We are conducting ongoing trials with several emerging technologies towards cost-effective condition and asset assessments. Our trials cover emerging technology such as the use of autonomous drones, fixed wing aircraft, specialised condition monitoring equipment and laser scanning technology referred to as light detection and ranging (LiDAR).

We need to extend our capability to collect timely data by considering other methods of collection: field crew, customers and new technology.

We are continuing our journey of transitioning to condition based inspections. This includes further development of our inspection tools to support information capture directly against our assets for more field based activities beyond the already implemented functionality for line inspections. We are expanding the tools to cover vegetation management audits, pre-bushfire patrols, substation inspections, bulk lights, DC batteries and thermographic inspections. Further enhancements are also being deployed to support work valuing and work visibility.

Asset data collection

Testing and commissioning procedures are developed to ensure that new assets are safe and ready to connect to the network. Updating the information systems is an ongoing task in life cycle asset management. A critical stage in the life cycle is when the asset is commissioned on the network. This is the point at which all the relevant systems are updated with as much available data as possible.

Maintenance and refurbishment activities allow asset condition data to be collected at other stages of the asset life cycle.

Evolution of risk-based approach

Our understanding of network risk has evolved over the years. Twenty years ago, we would replace assets when they failed, with little to no proactive replacements. Fifteen years ago, we introduced a time-based priority system with asset inspectors using their judgement to determine how quickly we needed to rectify defects. Ten years ago, we introduced a maintenance risk value score that considered additional factors such the bushfire risk area of an asset in assessing the priority of defects.

In 2012 we increased our inspection efforts and introduced inspection cycles based on asset criticality, bushfire risk and corrosion zones.

In 2014 we took our first step towards a condition based approach as we modelled network risk using a condition based risk management (CBRM) model. In 2017 we expanded the number of assets we modelled in CBRM and started operationalising our learnings from the CBRM methodology by capturing more condition data and additional environmental factors during inspections. These inputs are now being used to determine the value of addressing defects, considering more refined risk reductions and benefits such as improved customer experience.

Today we are focused on delivering the most value from our resources through improving how we make decisions throughout our end-to-end processes. This has allowed us to prudently manage our network risk and service.

Our next focus is on refining our understanding of how assets fail through further failure mode analysis and integration with robust statistical models.

We need to know more about our assets to maintain a view of our asset risk, by improving our data collection on high priority assets, why assets fail, and manufacturer and design details. We are extending our ability to efficiently capture asset condition using technology and investing in predictive analytics to ensure we focus expenditure on the highest value work.

Customer demand forecast system

Spatial demand forecasts help us to understand the service performance of our network now and into the future. We use the data from the network monitoring devices we have in order to understand the impact of new customer technologies on the flow and quality of electricity.

We are making improvements to our customer demand forecasting tool and methods to be more closely aligned with AEMO methodology. Additionally, the tool will be more robust, scalable and well-functioning than current solutions. This will ensure we continue to meet our customer demand and regulatory obligations.

Low voltage network model

We are expanding our network model to include the low voltage network, in recognition of the visibility of that network becoming increasingly important as customers continue to take up distributed energy resources directly connected to that network. Operational management of the low voltage network is becoming a key part of our role in this energy transition.

8.4 Balance cost and service

Treating expenditure on the network as an investment in levels of service, risk and productivity

8.4.1 Background

Our levels of service targets are a balance between the performance we are required to meet by law, what our customers value (now and into the future), what our shareholders expect, and what we can safely and cost effectively deliver. Our ageing asset base means that investment is increasingly required to maintain service levels.

However, the role of the network is changing. Our assets generally have an expected life of 20–80 years and over that time significant changes could be seen in how the network is used. Our risk appetite statement signals our Board's appetite to operate existing assets within the full range of their specification based on a risk-based approach. The Board also has an increasing appetite to invest in technology, systems, processes and shorter life assets to improve our efficiency.

Our reference groups and key stakeholders continue to iterate the need to manage network cost and support the changing role of the network. However, they have also indicated that they expect us to continue to make prudent investments in the network so as not to leave a heavily deteriorated asset base for future generations.

8.4.2 What this means in practice

To achieve this balance, we invest in systems and processes that help us understand the impact of our maintenance, asset refurbishment and replacement, customer connection and capacity programs on network risk and service levels.

We use a life cycle asset management approach to maximise the useful life and minimise the costs of acquisition, use, maintenance and disposal of network assets. Figure 31 shows the typical asset life-cycle process.

Asset planning

The first decision we make in the asset life cycle is whether we need to create the asset in the first place.

The three primary drivers for new assets are:

- capacity upgrades driven by forecasted increases in customer load and generation (indirect customer demand);
- new and altering customer connections in response to customer requests for connection (direct customer demand); and
- replacement of existing assets that are inadequate, have failed or are posing significant risk.

For larger projects we complete a detailed cost benefit analysis. Capacity and replacement projects above $5 million are subject to a regulatory investment test, which includes calling for proposals for non-network solutions to address constraints where feasible. However, for smaller pieces of work a lower effort approach is adopted.

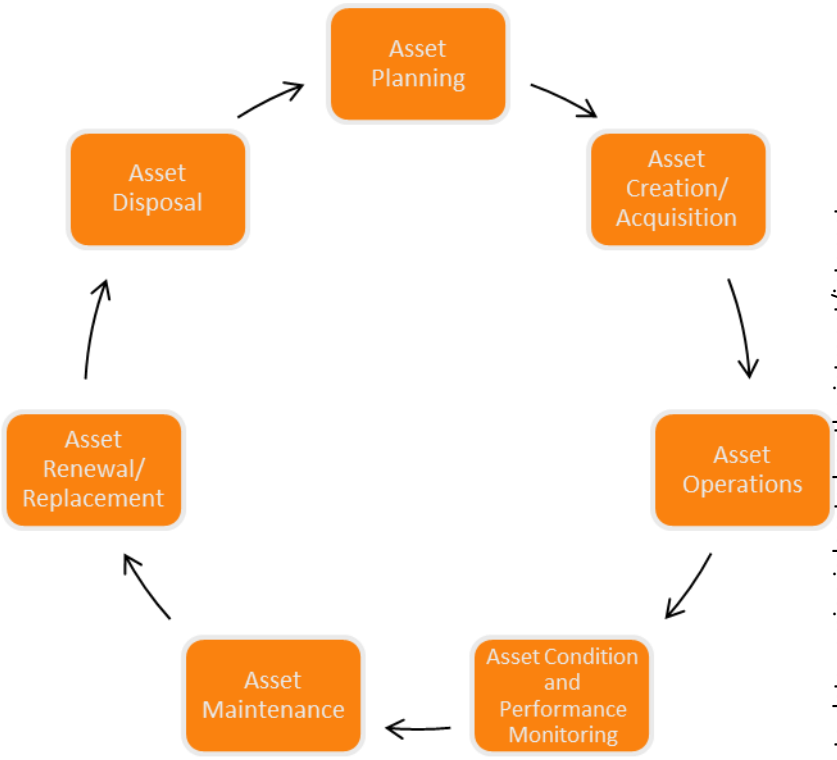


Figure 31 Typical asset life-cycle stages

Building on our network risk forecasting methodologies we determine an 'actionable' work value for small to medium size jobs to help us make day-to-day decisions. Work value is the measure of the benefit of undertaking work on the asset. It is the combination of how much risk we reduce and other benefits from undertaking the work. This work value is used to ensure effective investment decisions on smaller projects where a detailed cost benefit analysis is not warranted.

Safety is considered at every phase in the plant life cycle, from design to disposal. However, the earliest stages of the design process (during conceptual and planning phases) are the best places to design out hazards, incorporate risk control measures and design in efficiencies. This means thinking in advance about potential hazards and possible design solutions as the plant is manufactured, transported, installed, commissioned, used, maintained, repaired, de-commissioned, dismantled, disposed of or recycled.

Asset creation and renewal/replacement

In the lead up to creating an asset in response to an identified need in the asset planning phase, we consider what the right asset is to install.

Where possible and prudent to do so, we have a bias towards repairing or refurbishing assets to extend their service lives. In addition to 'patching' in service assets we redeploy refurbished transformers, switching cubicles and circuit breakers. Our active refurbishment programs have allowed us to extend the life of our assets and reduce the investment required to maintain risk and service levels.

Where we do decide to install a new asset, we consider the future requirements for that asset. For instance, new switchgear is installed with remote monitoring capabilities to help us get visibility of energy flows on our network. We also consider non-network solutions where prudent to do so.

Asset operation

Once assets exist we use them to safely transport electricity throughout the network to and from our customers. A key factor is the mitigation of bushfire risk. We have a systematic focus on prevention of fire starts from the network operations leading up to the start of the Country Fire Service declared fire danger season and safe operation of the network during the fire danger season. Operational activities to mitigate the risk of bushfire are outlined in the SA Power Networks Bushfire Risk Management Manual. Each year before the fire danger period, SA Power Networks implements preventive measures and prepares contingency plans to reduce the risk of bushfire start.

Additional typical operational activities undertaken on the network include:

- real time operation of the network through remote switching and monitoring of the network status and system load using the SCADA system;
- effective switching to allow work on assets with minimal disruption while ensuring the safety of staff, contractors and the public; and
- monitoring and clearance of vegetation growing near assets.

Condition and performance monitoring

Comprehensive asset inspection and condition monitoring programs are undertaken across line and substation assets to identify signs of asset deterioration. The assessment techniques used include visual inspections, thermography, partial discharge tests and other diagnostic techniques to determine the condition of the assets.

The inspection and condition monitoring programs happen on a cyclic basis in line with the corrosion zone an asset is in (ie how quickly it is likely to deteriorate), the bushfire risk zone an asset is in (ie how big the consequence of a failure is likely to be) and/or the criticality of the assets (ie how many customers are supplied by the asset).

The frequency of inspection cycles across the network continues to be optimised.

We also actively monitor network reliability and performance to identify — and thus address — emerging trends.

Disposal

When an above-ground asset reaches the end of its life, it is removed with components salvaged for reuse where possible and the remainder disposed for scrap value or to landfill. Below-ground assets are typically left in the ground unless they can easily be removed (eg cables in conduits) or if there are environmental considerations that require the decommissioned asset to be removed.

8.4.3 Improvement initiatives

In addition to the initiatives described below, improvements we are making throughout the asset life cycle include understanding our customers and assets better as described in Sections 8.2 and 8.3, and investing in our asset management system as described in Section 8.8.

Asset operation

Historically we have isolated our asset operational data from our asset management practices. We are moving towards integrating this data to improve our ability to manage the network and reliability for our customers.

Feeder automation

The Fault Location, Isolation and Supply Restoration application within Advanced Distribution Management System allows smart devices on selected feeders within the distribution network to perform self-healing functions after a protection lockout. The system uses information from SCADA field devices (reclosers, circuit breakers, load break switches and switching cubicles) and the network model in the system to automatically locate and isolate the faulted line section before restoring supply to all healthy sections — all in less than 60 seconds.

To date 98 feeders have been automated. The next top 20 poorly performing metro feeders identified lie predominately around the Happy Valley, Norwood and Salisbury areas. An expansion strategy in progress will also roll out automation to many customers across the state within the next 10 years.

Further equipment development currently underway will support further expansion with promised simplified commissioning, improved performance, increased longevity and reduced costs.

8.5 Enable energy transition

Transforming our network and services to meet customers' changing energy needs

8.5.1 Background

An increasing number of small and large embedded generators, traders, virtual power plants, communities and individuals continue to seek access to the network to trade energy.

Where the capacity of the network to accept exported energy is limited, we could help our customers release more value from their investments by:

- upgrading the network to add export capacity;
- improving access to existing capacity by managing export limits dynamically as constraints arise;
- deploying active voltage control to free up additional capacity on the network; and
- utilising customer distributed energy resources to provide network stability and support.

Widespread upgrading of the network will drive increases in network cost. Thus, we are considering combinations of the other responses to effectively release value and enable a safe, secure, reliable and fair energy platform for all customers.

8.5.2 What this means in practice

Our Future Network Strategy sets out the roadmap for managing the transition from a centralised energy system to one increasingly defined by the actions of many distributed energy resources.

Our initial focus is on managing our low voltage network better, which is where most of the distributed energy resources are connected. To do this we are developing a network-wide view of the 'hosting capacity' of our network (ie capacity to accommodate customer-connected solar PV and other distributed energy resources before we hit thermal or voltage constraints) and modelling the cost of various strategies to increase this hosting capacity.

We are also developing a roadmap to implement the 'distribution system operator' capabilities we will need to manage the network as more and more customer-side resources come online and begin to be controlled as virtual power plants (Strategies 2 and 3 of Future Network Strategy).

8.5.3 Improvement initiatives

Pilots and trials

In addition to modelling network impacts we have undertaken several pilots and trials.

- In 2017 we undertook a battery trial in Salisbury to understand how customers are likely to want to use these systems and the possible impacts of this on the network.
- We have installed two stand-alone (off-grid) power systems for rural customers, in lieu of grid connections, with a third soon to be completed, to build our understanding of the technologies, costs and benefits of off-grid systems.
- We are partners in Simple Energy's South Australian Virtual Power Plant pilot project, which is developing models for integration of virtual power plants and the network, and the role of the network in future market models.
- We are scoping out a potential microgrid trial to inform network design and operation under very high distributed energy penetration.

Static measures

We are pursuing static measures to increase hosting capacity by:

- updating our connection standards to mandate AS4777 Volt-VAr and Volt-Watt response modes for all new inverters;
- proposing new seasonal time-of-use network tariffs designed to encourage load to shift to times of peak solar export; and
- exploring the potential to shift hot water controlled load to the daytime.

Low voltage network visibility

We have begun a program to roll out low voltage transformer monitors to targeted areas of the network, and are engaging with the new contestable metering market to seek to procure access to voltage data from retailer-owned smart meters.

8.6 Improve resilience

Addressing deteriorating reliability performance of our network during major event days

8.6.1 Background

Our network spans a vast distance and is exposed to increasingly severe and frequent weather events. The consequent extended interruptions when our assets are damaged by those events has clearly been felt by our customers. During our engagement sessions in 2017 reliability emerged as their highest priority. Customers supported hardening the network against major storms in priority areas and ensuring acceptable levels of reliability for all customers.

Performance incentive schemes exclude major storm event interruptions and therefore there is little financial incentive for SA Power Networks to invest in mitigating them.

8.6.2 What this means in practice

The Resilience Program aims to address deteriorating reliability during major event days. The program's scope is to harden the most vulnerable sections of the distribution network against storms and lightning to reduce the impact on customers on those days.

The program uses a combination of strategies including:

- re-insulating vulnerable sections of overhead lines to minimise the possibility of insulator failures due to lightning;
- altering network asset configuration/standards to minimise the chance of vegetation outages from outside the prescribed clearance zone;
- installing mid-line switches to reduce the number of customers subject to storm related interruptions; and
- underground sections of the overhead network that is repeatedly damaged during storms.

The Resilience Program is different from managing underlying network reliability as it is focused on improving the performance of vulnerable parts of our network during major storms, and thus reliability to our worst served customers.

8.6.3 Improvement initiatives

2020–2025 Resilience Program

The Bureau of Meteorology report, *Climate extremes analysis update for South Australian Power Network operations*, predicts future increases in severe weather events which are likely to further affect network performance. The hardening program will therefore need to continue through to 2025.

The recommended option is to continue to invest funds in the 2020–2025 regulatory period to harden the network against the effects of storms and lightning. That will address the deteriorating reliability performance and manage customer service during major event days.

The overall 2020–2025 hardening program expenditure proposal is in line with 2015–2020 hardening expenditure allowances and customer expectations. Customers have expressed a preparedness to invest only a little more for hardening of the network in priority areas.

The Resilience Program will reduce the extent of customer interruptions and of significantly rebuilding the network.

8.7 Empower our people

Enabling better decisions through making information widely available and empowering our people

8.7.1 Background

Our corporate strategy recognises the need for ongoing integration and streamlining of our activities throughout the organisation. Empowering our people with the right tools and information means they can make decisions and improve customer experience.

8.7.2 What this means in practice

We are moving from a centralised model for making asset management decisions to empowering people throughout the process to make these decisions, armed with the right tools and information. An example is how we pull opportunistic work. In the past, only the highest priority work was requested to be completed. Now all known issues and potential work is shown to the field during scoping through a mapping tool so they can pull this into a planned job. For instance, while we are building assets to connect a new customer we can complete minor maintenance tasks in the area.

We recognise that a new range of employee attributes are required to shape our business to meet existing and future needs. Our aspiration through our people, assets, systems and data is to continue to develop our business to ensure that:

- our culture is one where safety is everyone's top priority, all the time;
- our people create and embrace change and drive improved performance;
- leaders look outwards for best practice;
- we meet future challenges by developing new and improved capabilities through ongoing training and recruitment;
- we have a culture of innovation and continuous improvement;
- we empower our people to make decisions throughout the delivery process;
- our investments are focused on delivering value; and
- an agile mindset is embedded in the organisation.

8.7.3 Improvement initiatives

Scheduling and mobility

We have begun a transition from decentralised field processes to centralised job ready and field management that improves scheduling capabilities. This improves our field work delivery through better and more agile schedules, supporting work information to field crew and access to additional information while in the field.

From a field perspective, we are empowering our field crew with the authority and information to make decisions in the field, enabling them to progress components of work (eg clear debris or engage a customer) or select alternative nearby work, and improving our ability to deliver to plans and satisfy customer expectations.

Worker safety

We foster a culture of relentless focus on safety throughout the organisation. This includes encouraging our employees to speak up by promoting trust, openness and learning. Our focus is on managing fatal risks. We have an extensive safety training program, including training on human factors. Our leaders are responsible for role modelling safety and coaching staff.

We have a safety management system with procedures and processes to ensure hazard identification, risk assessment, and adequate and regularly monitored controls are in place to undertake the day-to-day activities of operating and maintaining the network. We seek to improve our safety capabilities by automating manual safety procedures and introducing tools that improve worker spatial awareness, provide real time expert support and increase worker competency. Our goal is to achieve safety in all we do, including keeping our communities safe.

8.8 Invest in our systems and processes

Gaining efficiencies through investing in our systems and work delivery processes

8.8.1 Background

Our Board has signalled their appetite to invest in technology, processes and shorter life assets to deliver the capabilities we need to be a leader in delivering energy services that customers value. Our customers have indicated that they'd like to see more non-network solutions considered and for us to use technology to effectively manage network cost. We are also seeing accelerating technology development.

We consider four key investment areas:

- **data**: asset data and data governance;
- **processes**: end-to-end work delivery process improvements;
- **systems**: supporting IT systems and pilots and trials of new technology offerings; and
- **people**: empowering our people to make informed decisions.

8.8.2 What this means in practice

We have addressed the key investment areas through our Digital Strategy and supporting programs.

Digital Strategy

Our Digital Strategy identifies how we are establishing technical foundations that support long-term delivery of our energy services. The strategy is an enabler to all other business strategies including the Asset Management strategy. Given our dynamic operating environment, the pace of technical change, innovation and customer expectations, the strategy considers:

- solid IT foundations — systems and data are current, secure and reliable;
- achieving new regulatory requirements — enabling the 5-minute rule and regulatory reporting;
- creating a better customer experience — by capturing and incorporating the voice of the customer into our work, providing new communication channels and quality information;
- enabling energy transition — through data analysis, process and platform support; and

- enabling Asset and Work Management — a program improving our asset management and work capabilities.

Processes

We are focused on reviewing and improving business processes that affect the delivery of cost effective services to customers. With the increase in maintenance work due to the ageing network, better processes are a foundation for systems improvements that enable us to minimise network costs. The processes include capital portfolio management, workflow excellence, design and estimating.

We have begun to develop a capital portfolio management process to improve the visibility of the capital program and resources, and enable us to make prudent investments in the network. The process will then be automated and integrated with our financial management system.

The Workflow Excellence program will improve the delivery of quality work through improvements in work preparation, standardisation of work processes, procedures and data such as labour hours. This improvement is the foundation for improvements in our estimating and scheduling system.

The Design process aims to standardise designs and associated estimates as a foundation for improvements in the Design Management System.

Systems

A key operational system is our Advanced Distribution Management System, which contains our high voltage network model and in the future, will contain our low voltage network model.

In additional to this key operational system, we developed our Enterprise Asset Management Blueprint which outlines a multi-year Asset and Work ICT program of change to our processes, data and systems to enable us to deliver the services that customers value balancing cost and asset risk.

The blueprint is a key component of our Assets and Work ICT Program, a long running (10–15 year) program initiated in 2011.

The program is implementing end-to-end capabilities and efficiencies in the asset life cycle, enabling us to deliver the increasing workload and complexity with our existing workforce. The program helps us understand our assets, balance cost and service, empower our staff and invest in our systems and processes with the customer outcome in mind.

The program implementation approach is based on the concept of Pilot, Foundation and Extend. To date the program has focused on piloting capability and building foundational initiatives to underpin regulatory reporting requirements and the efficiency improvements needed to manage our asset life cycle information and deliver more of the right work. Some foundational activities commenced or trialled include:

- asset data improvement projects covering governance, cleansing and alignment of asset data across our core systems;
- collection of asset data and condition data to inform our risk assessments;
- new or improved mobile capability through integrated solutions;
- interim risk quantification solutions to better understand asset risk and impact;
- development of a work valuing tool and visibility map for planned work;
- upgrading of our foundation Scheduling and Mobility system;
- definition of an intelligent design management system to consolidate design systems and centralise drawing repositories; and
- assessment of the suitability of applications to cloud migration.

8.8.3 Improvement initiatives

Outage management system upgrade

During 2019-2020 we will implement and align our Outage Management System (OMS) into our ADMS environment to simplify the integration and enable the consolidation of the planned and unplanned scheduling of work to improve our efficiency and reduce the impact on our customers.

Assets and Work Program

Figure 32 Assets and Work Program key themes

Our Assets and Work Program (the Program) improves existing capabilities and introduces new initiatives over a 5–10 year period with a focus on five initiatives that reflect the asset management life cycle. The Program will be supported by the following two enabling initiatives:

- Worker Safety – fatigue risk management - putting safety first for workers and the community;
- Geographic Information System (GIS) Consolidation - reduce duplication through one consistent GIS for asset location data.

Asset Data Optimisation — 'collect the data'

Asset Data Optimisation delivers business capability by extending and optimising the way we collect and store asset data. We need the right data to understand our assets so that we can make effective asset management decisions. It extends our foundational asset data work that collected attributes for our most critical assets by extending data capture and management capabilities to further asset classes, collecting appropriate asset attributes and reducing the time to collect information about the condition of those assets.

The initiative will:

- Extend our asset structures with additional appropriate asset attributes, governance, standards and expand the way we collect and process asset data;
- Establish a data management capability to accept asset condition data provided by customers;
- Optimise collection of asset condition data by extending data collection capabilities to our mobility-enabled field crew;
- Pilot technology-based data collection that provides the capabilities to handle various data types, volumes and analysis methods.

Portfolio Planning Management – 'manage the work'

This initiative extends on our foundational portfolio planning management capability and enables longer term asset investment planning, integration of financial information and work completion. We will implement a portfolio planning system that integrates with our financial system, other project systems and other core systems to enable long term forecasting and improve budgeting and resource planning. This will provide long term grouping of work on the distribution network and long lead-time procurement.

Asset Investment Optimisation – 'select the work'

Asset Investment Optimisation extends the piloting and foundation work in risk quantification and Value and Visibility of work capabilities already completed. This will help us establish a sustainable method of analysing, evaluating and prioritising the asset maintenance and replacement work we undertake to maintain the distribution network and enable us to balance the cost of doing this with providing the services our customers value.

Work Lifecycle Standardisation – 'plan the work'

Central to the Program is continuing to standardise data and consolidate and integrate processes and systems to ensure we can effectively deliver work. This initiative extends planning and work data ensuring standardisation and end-to-end process improvement and data management. The initiative includes the extended use of compatible units (CUs) and Building Information Model (BIM) methodologies to improve end-to-end delivery and standardisation. This will help to provide process efficiencies that will offset the increased volumes of work from our changing work mix.

Service Delivery Optimisation – 'do the work'

Extending the scheduling and mobility foundation work already completed will enable integration and selective automation of using value when scheduling and bundling work for the field. We will also implement field document management and electronic job folder capabilities and automate many manual procedures. This will empower our workforce by giving them the right access and making workflows and all other necessary information available in the field. The initiative will provide real-time capture of work progress which will improve customer interactions through status updates.

9 Summary of asset management programs

Table 5 lists the capital programs, and Table 6 the operational programs, for asset management from 2018 to 2030.

9.1 Capital programs

Table 5: Capital program 2018–2030

Program	Forecast expenditure (2018–30, $m)	Description	Respond Strategy
Asset renewal/replacement — Distribution	1,257	• Replacement or refurbishment (life extension) of assets • Largest expenditure category due to ageing asset base • Expenditure based on prudent risk management and forecasted using a variety of methodology • For detailed replacement expenditure discussion see Power Asset Management Plan	
Asset renewal/replacement — Substations	365		
Asset renewal/replacement — Telecommunications	100		
Customer connections	1,180	• Connection works between the customer and the distribution network, extension of the network to the customer's location and any network augmentation required within two years of the customer's connection to ensure sufficient capacity • Forecast is net of customer contributions toward connections	
Capacity upgrade	427	• Network upgrades to cater for new or growing demand • Based on forecast generation/load through a network asset exceeding the rating of that asset • No customer contribution is derived for this expenditure	 
Safety	336	• Targeted capital works programs to ensure that the electrical distribution network is operated in a safe manner for customers, SA Power Networks employees and contractors • Includes capital elements of bushfire risk management and targeted programs to replace	

Program	Forecast expenditure (2018–30, $m)	Description	Respond Strategy
		existing assets or install new assets where other controls are not adequately mitigating safety risk	
Reliability and resilience 	184	• Driven by the need to meet regulated supply reliability and customer service standards, meet customer service expectations, and maximise business performance • Reliability expenditure is generally based on strategic planning and historic values focused on maintaining regulated service standards • The performance degradation is due to the increasing number of customers, increasing age profile of the assets and increasing intensity of weather events	
Network control 	158	• Covers activities required by the organisation to operate and report on the network performance, eg outage management system; the budget category covers specific major projects	 
Power Line Environment Committee projects 	150	• Mandated program under the *Electricity Act 1996* and regulations to underground overhead mains, generally on main roads, as determined and agreed with the Power Line Environment Committee • All projects have a third of their costs covered by the relevant local council	

Program	Forecast expenditure (2018–30, $m)	Description	Respond Strategy
Environmental	28	• Targeted environmental management activities at sites with high environmental risk factors, such as oil containment • Aimed at meeting our requirements under the *Environment Protection Act 1993* and other environmental Acts	
Strategic	24	• Substation condition monitoring equipment • Line inspection monitoring equipment	

9.2 Operational programs

Table 6: Operational programs 2018–2030

Program	Forecast Expenditure (2018-30, $m)	Description	Respond Strategy
Substation Maintenance	134	• Maintenance program covers network assets within substations (including the perimeter fence), our two mobile substations, line assets, telecommunication assets and all other secondary system assets • Maintenance activities aim to meet SRMTMP obligations as required under the Electricity Act and regulations. The defective forecast is based on historic values and CBRM modelling; preventive maintenance is based on manufacturers' recommendations, industry standards or SA Power Networks experience	
Network Telecommunications Maintenance	97		
Line Maintenance	173		
Other Maintenance 	215		

Program	Forecast Expenditure (2018-30, $m)	Description	Respond Strategy
Vegetation Management 	576	• Clearing of trees and other vegetation near powerlines to mitigate bushfire risk, maintain reliability, ensure community safety and to meet the requirements of the Electricity Act and regulations	
Supply Restoration 	456	• Unplanned supply restoration works in response day-to-day outages on the network and after major events like storms	
Inspections 	214	• Cyclic asset inspections program to collect information on asset defects and asset condition • Inspection program also collects various other asset data including asset type, environmental conditions and asset location • Inspection cycles are set to improve our understanding of network risk and to capture asset degradation before failure	
Asset Restoration 	173	• Work that is required to restore the full functionality of an asset, but does not prevent supply being restored	
Other 	215	• Other operational activities include regulatory compliance, systems support and asset management operational costs	

9.3 Financial summary

Figure 33 and Figure 34 show, respectively, capital and operational expenditure forecasts.

9.3.1 Capital expenditure forecast

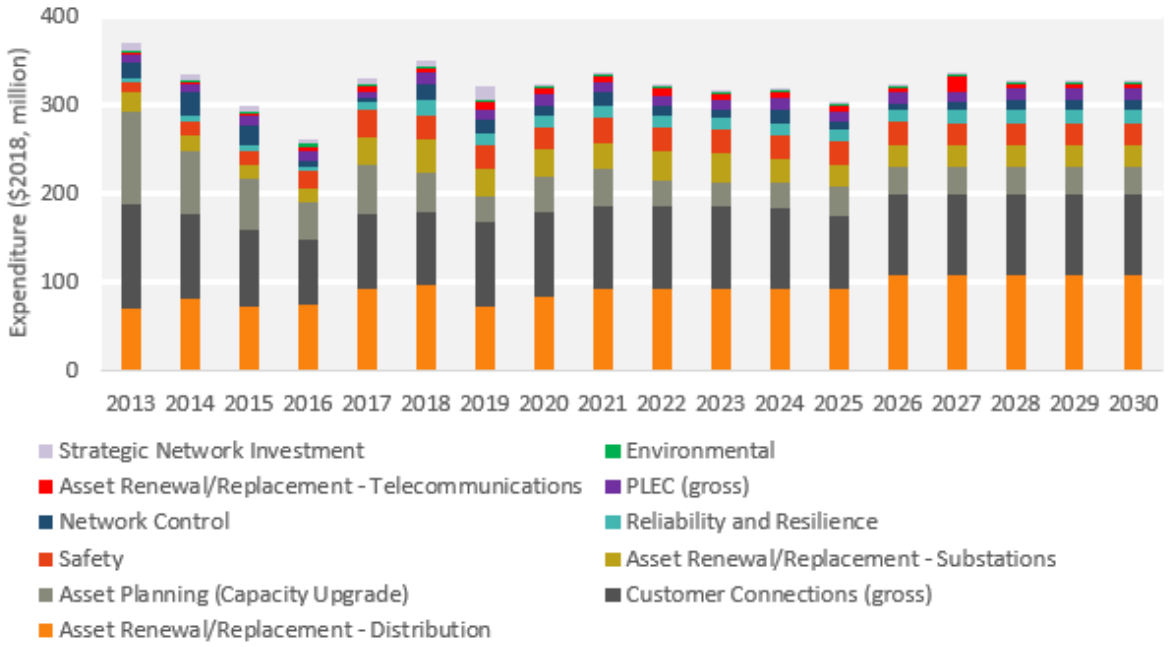


Figure 33: Capital expenditure actuals and forecast 2013–2030 ($2018)

9.3.2 Operational expenditure forecast

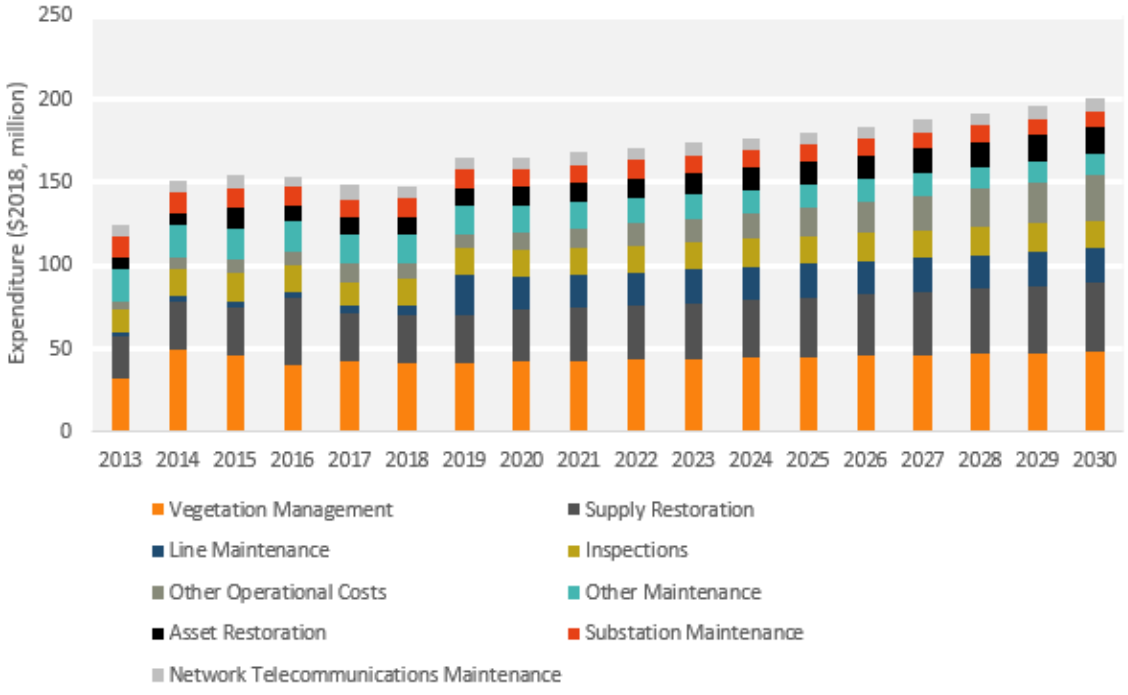


Figure 34: Operating expenditure actuals and forecasts 2013–2030 (nd forecasts 2013–2030 ($2018)