
Asset Management Strategy

AMS – Electricity Distribution Network

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Asset Management Strategy – Electricity Distribution Network

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EXECUTIVE SUMMARY

This Asset Management Strategy is central to AusNet Services' processes for managing the electricity distribution assets, determining the delivery of quality services to customers and value to shareholders. It summarises the medium-term strategic actions for achieving regulatory and business performance targets, which are implemented via the programs of work shown in the five-year Asset Management Plan produced each year.

The AMS is underpinned by the regulatory and commercial imperatives of delivering efficient cost and service performance. It recognises that cost and service efficiency does not mean lowest possible cost, nor does it mean guaranteed reliability. Instead, efficiency requires the costs and benefits of all expenditure decisions to be weighed against one another. A key element in this cost benefit analysis is the consideration of risk management in relation to asset performance and network reliability.

AusNet Services' ongoing commitment to maintain ISO 55001 Asset Management accreditation ensures an auditable asset management system facilitating customer's expectations to safely maintain the quality, reliability and security of supply in an economic manner.

AusNet Services welcomes feedback from stakeholders on this document.

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1 DOCUMENT OVERVIEW

1.1 Purpose

The electricity distribution network asset management strategy (AMS) and its supporting documentation provide robust technical direction for the responsible stewardship of electricity distribution assets. AusNet Services is steward of these assets on behalf of Victoria's energy users, generators, shareholders, regulators, government and more broadly, the National Electricity Market (NEM).

The AMS has the following key functions:

- To set the framework for AusNet Services' holistic approach to management of network assets, and in so doing establish the linkages with and between the underpinning detailed strategies, processes and plans; and
- To provide important context for management strategies, by taking into account the demand for network services, the condition of network assets and expected trends into the future. It therefore also has regard to the network augmentation planning process.

As the output of a strategic assessment management process, the AMS sets out the significant Asset Management Drivers (Section 5) as well as Electricity Distribution Asset Management Objectives (Section 6) and Network Performance (Section 7) and Process and System Strategies (Section 8).

The AMS is central to AusNet Services' processes for delivery of network services to customers safely and reliably in accordance with AusNet Services' Asset Management Policy.

The AMS provides authoritative guidance for the development of asset management works programs. Further, the AMS seeks to provide contextual information for the asset strategies that will enhance the skills, resources and knowledge employed at AusNet Services, and thereby facilitate efficient network development and asset management.

The information presented in the AMS also extends to longer term expectations for technological advancement of network assets, the functionality of the network and evolution of management approaches.

1.2 Scope

This AMS covers AusNet Services' electricity distribution assets operating across Victoria, including:

- Sub-transmission and distribution lines¹, associated easements and access tracks;
- Distribution zone substations, switching stations, communication stations and depots including associated electrical plant², buildings and civil infrastructure;
- Protection, control, metering and communications equipment;
- Related functions and facilities such as spares, maintenance and test equipment; and
- Asset management processes and systems such as System Control and Data Acquisition (SCADA) and asset management information systems (including SAP and SMDs).

¹ 66kV and 22kV, 12.7kV, 11kV, 6.6kV conductors and cables

² Primarily 66kV and 22kV switchgear and transformers

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More specifically, the AMS relates to:

- All assets in the distribution area providing network services to customers are identified in the electricity distribution licence issued by the Essential Services Commission (ESC)³.

This AMS excludes the Victorian electricity transmission network and assets and infrastructure owned by:

- Embedded Generators;
- Exit customers;
- Other companies providing distribution services within Victoria; and
- Customer owned assets including Private Overhead Electric Lines (POELs).

This AMS also excludes AusNet Services' corporate processes and associated information technology systems such as business communication, human resources and financial management systems.

It does not include information on corporate offices or general business equipment such as computers and motor vehicles.

1.3 Relationship to Other Management Documents

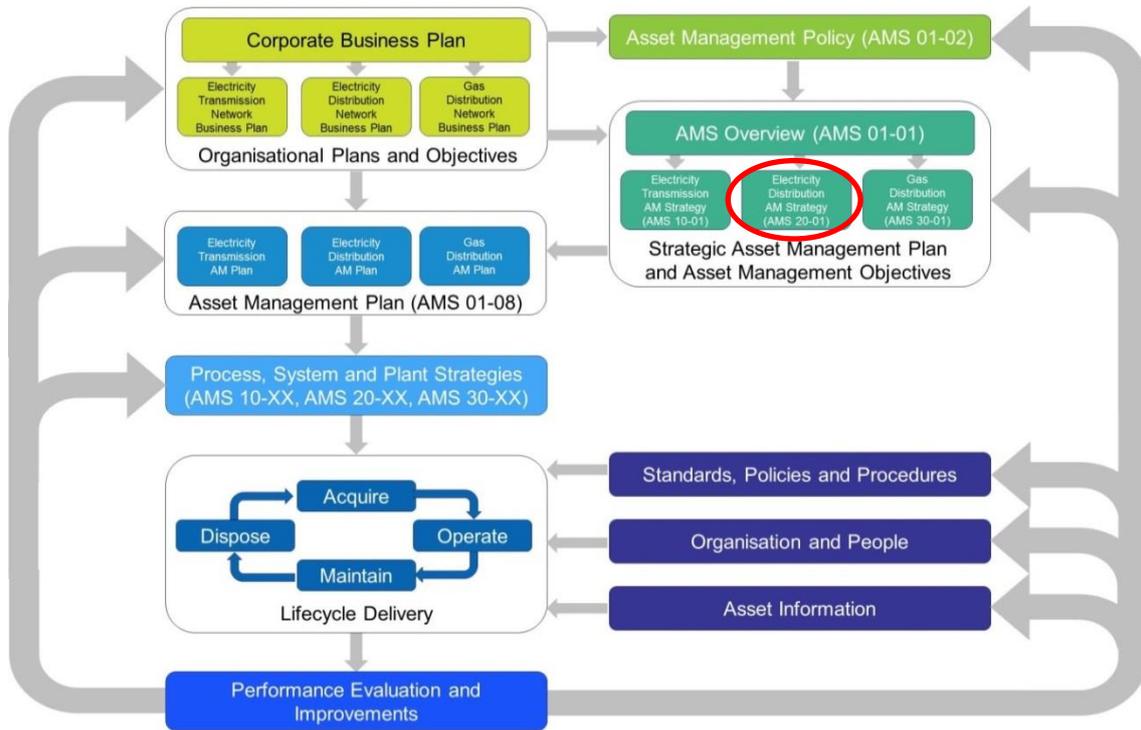
AusNet Services asset management system, including the policy, objectives and its underlying methodology, context, process, decision making criteria and certification are detailed in *AMS 01-01 Asset Management System Overview*.

This electricity distribution network asset management strategy is one of a number of asset management related documents. It provides more specific information on the issues and strategies specific to the electricity distribution network.

The suite of documents together comprises the Asset Management System as represented in Figure 1, with this document circled in red.

³ AusNet Electricity Services Distribution Licence 20080506

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The documents shown in this diagram are available on ECM

Figure 1: Asset Management System Document Interdependencies

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2 ORGANISATIONAL CONTEXT

2.1 Regulatory Framework

AusNet Services' distribution network is subject to economic and technical regulation, which is the responsibility of the Australian Energy Regulator (AER) and Energy Safe Victoria (ESV) respectively.

Economic regulation is subject to a national regulatory framework. The framework is governed by the National Electricity Law (NEL), and contained in the National Electricity Rules (Rules). The governance framework is intended to be consistent with the National Electricity Objective (NEO) set out in the NEL which states:

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

- (a) price, quality, safety, reliability and security of supply of electricity; and*
- (b) the reliability, safety and security of the national electricity system.*

The Australian Energy Markets Commission (AEMC) has responsibility for development of the Rules, and the AER is responsible for regulation of industry participants in accordance with the Rules.

The NEO guides the development of the Rules and the decisions of the AER.

The Electricity Safety Act (1998) requires AusNet Services to:

... design, construct, operate, maintain and decommission its supply network to minimise as far as practicable:

- (a) the hazards and risks to the safety of any person arising from the supply network; and*
- (b) the hazards and risks of damage to the property of any person arising from the supply network; and*
- (c) the bushfire danger arising from the supply network.*

2.1.1 Australian Energy Regulator (AER)

The AER's regulatory functions and powers are conferred upon it by the NEL and it must act in accordance with its obligations under the Rules (as must industry participants).

The AER's key responsibilities include:

- Regulating the revenues of transmission and distribution network service providers;
- Monitoring the electricity wholesale market;
- Monitoring compliance with the NEL, Rules and national electricity regulations;
- Investigating breaches or possible breaches of provisions of the NEL, Rules and national electricity regulations and instituting and conducting enforcement proceedings against relevant market participants;
- Establishing service standards for electricity transmission network service providers;
- Establishing ring-fencing guidelines for business operations with respect to regulated transmission services; and
- Exempting network service providers from registration.

Regulatory proposals (i.e. revenue applications) to the AER are assessed against, amongst other things, the operating expenditure objective and the capital expenditure objective (Clauses 6.5.6 (a) and 6.5.7 (a) of the Rules).

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Accordingly, Distribution Network Service Providers (DNSPs) are required to submit the total forecast operating expenditure and capital expenditure.

The applicable criteria for the expenditure forecasts are:

1. *meet or manage the expected demand for standard control services over that period;*
2. *comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;*
3. *maintain the quality, reliability and security of supply of standard control services; and*
4. *maintain the reliability, safety and security of the distribution system through the supply of standard control services⁴.*

2.1.2 Energy Safe Victoria

ESV is an independent Victorian statutory authority responsible for the safe generation, supply and use of electricity, gas and pipelines in Victoria.

The objectives of ESV relevant to electricity networks are to:

- Ensure the electrical safety of electrical generation, transmission and distribution systems, electrical installations and electrical equipment;
- Control the electrical safety standards of electrical work carried out by electrical workers;
- Promote awareness of energy efficiency through energy efficiency labelling of electrical equipment and energy efficiency regulation of electrical equipment;
- Promote the prevention and mitigation of bushfire danger;
- Protect underground and underwater structures from corrosion caused by stray electrical currents; and
- Maintain public and industry awareness of electrical safety requirements.

From time to time, ESV may issue directives to give effect to these objectives.

The Council of Australian Governments has initiated the development of a regulatory framework for national safety regulation of energy networks.

The *Electricity Safety Act 1998* requires AusNet Services to:

“...design, construct, operate, maintain and decommission its supply network to minimise as far as practicable:

- (a) the hazards and risks to the safety of any person arising from the supply network; and*
- (b) the hazards and risks of damage to the property of any person arising from the supply network; and*
- (c) the bushfire danger arising from the supply network”.*

The *Electricity Safety Act* also requires major electricity companies to submit to the ESV for approval, an Electricity Safety Management Scheme (ESMS) which complies with Part 10, Division 2 of the *Electricity Safety Act 1998* and *Electricity Safety (Management) Regulations 2009* in respect of safety in design, construction, operation, maintenance and decommissioning of AusNet Service’s electricity transmission network.

Further information can be found in ESMS 20-01 *Electricity Safety Management Scheme*.

⁴ AEMC – National Electricity Rules: 6 Economic Regulation of Distribution Services

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2.1.3 Codified Areas

In 2016, the *Electrical Safety (Bushfire Mitigation) Regulations 2013* were updated to introduce “electric line construction areas”, shown in red in Figure 2.

These areas have been identified as the highest risk areas of the state by the Victorian Government. They have been selected based on maximum potential bushfire impact, ease of access and egress, and terrain.

These areas are referred to as “Codified Areas” within AusNet Services.

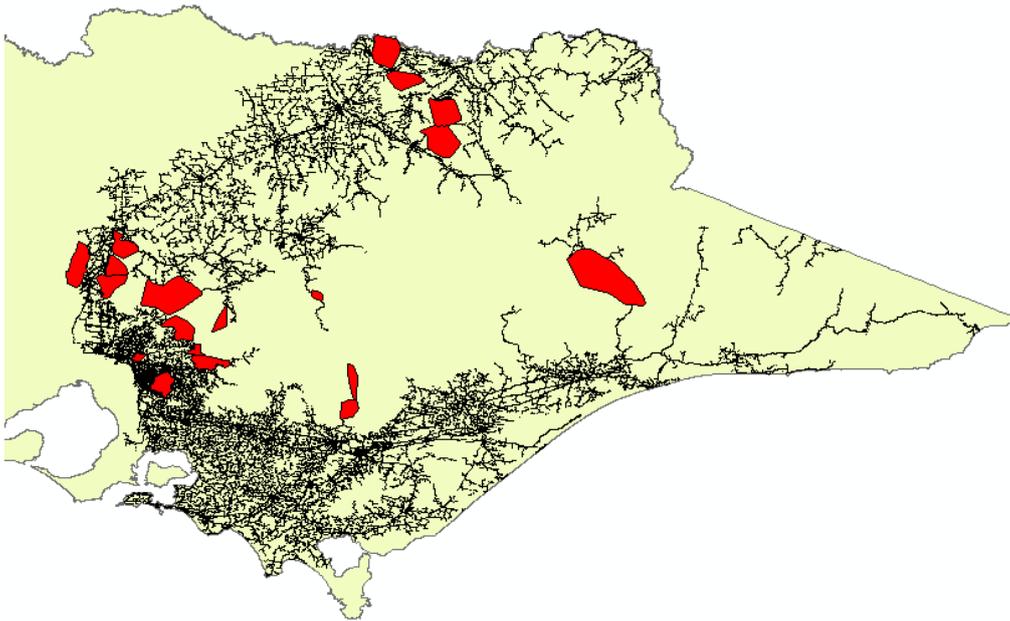


Figure 2: AusNet Services’ Codified Areas

There are 19 such areas in the AusNet Services electricity distribution network covering 21,000 poles and 1,733km of conductor.

Specific regulations apply to codified areas including financial penalties for fire ignitions and restrictions on the types of technology which can be installed within them.

They have also been targeted for capital replacement programs as part of the Powerline Bushfire Safety Program.

2.1.4 Rapid Earth Fault Current Limiters

In 2016, new bushfire mitigation regulations were introduced mandating the installation of Rapid Earth Fault Current Limiters (REFCLs) on electricity distribution networks.

REFCLs are designed to detect phase to earth faults on the network and quickly isolate them, thereby limiting the current which goes to ground and hence reducing the probability of fire ignition.

AusNet Services will meet its obligations by installing REFCLs at 22 zone substations in three tranches by 2023.

This program, being undertaken concurrently by AusNet Services and Powercor, will be the first time anywhere in the world that REFCLs have been installed for the purpose of bushfire mitigation.

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The introduction of REFCLs onto AusNet Services' network has required several programs of preparatory work to be carried out.

1. In order to operate correctly, the capacitance on different phases of a polyphase network must remain in balance. This limits the alterations to technology and construction which can be applied to REFCL protected sections of the network and constitutes an additional constraint in system design.
2. The requirement to maintain balancing affects the effective operation of AusNet Services' Distribution Feeder Automation (DFA) scheme. Additional switch upgrades are required in order to maintain switching capability.
3. Isolating transformers are required at HV customer sites where connection voltages will be impacted by REFCL operation.
4. Hardening of the network to withstand higher voltages during the operation of the REFCL during fault conditions.

2.2 Stakeholders

Table 1 summarises key stakeholders and their expectations of the service provided by AusNet Services' distribution network.

Table 1: Energy network stakeholders and expectations

Asset Owner	<ul style="list-style-type: none"> • Compliance with contract • Reliable information
Connected Parties (energy consumers, electricity generators and gas producers, other network service providers)	<ul style="list-style-type: none"> • Network access • Efficient service costs with minimum increases • No network related fire or safety issues • Reliability, uninterrupted energy supply • Efficient, well planned investment and expenditure • Proactive and responsive network planning • Reliable information and effective engagement
Community	<ul style="list-style-type: none"> • Public safety • Reliable and secure energy supply • Environmental performance within Code • Minimal traffic disruptions • Protected infrastructure • Community consultation
Employees and contractors	<ul style="list-style-type: none"> • Safe work place • Reward and recognition • Skill development
Shareholders	<ul style="list-style-type: none"> • Return on investment • Growth in investment value • Commensurate opportunities, liabilities and risks
Energy Retailers	<ul style="list-style-type: none"> • Reliable information • Efficient service costs

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Safety Regulator	<ul style="list-style-type: none"> • Compliance with Acts, Regulations and Codes • Improving safety performance • Transparent processes • Reliable information
Economic Regulator	<ul style="list-style-type: none"> • Compliance with Acts, Rules and Codes • Efficient service costs • Transparent processes • Reliable information
State and Federal Government	<ul style="list-style-type: none"> • Compliance with Acts and Regulation • Support economic development and investment • Improving safety performance • Efficient service costs
Local Government and VicRoads	<ul style="list-style-type: none"> • Coordinated infrastructure development • Coordination of works • Public land reinstatement

The performance of the distribution network is reported to the AER in accordance with the specifications established in the Regulatory Information Notice, Regulatory Accounts and Non-Financial Regulatory Accounts.

Monthly and annual reports are submitted to ESV in accordance with the Electrical Safety Performance Reporting Guidelines.

2.3 Community Expectations

To a large extent community expectations are represented in the legislative and regulatory frameworks and controls that govern the electricity supply sector. These cover various perspectives of the service locus, including safety, environmental, and in particular, the core energy supply service.

There is also a direct relationship between AusNet Services and the community. For example, AusNet Services engages in many ways with network customers, and community representatives in eastern Victoria. These relationships provide valuable insights into community expectations.

It is anticipated that the AEMC will establish increased obligations in the Rules for network operators to engage with consumers as a formal component of the revenue setting process.

As part of the 2022-2026 regulatory proposal process, AusNet Services have established a Customer Forum. The Customer Forum is a panel of five members selected to represent the preferences and perspectives of our customers in developing and negotiating the 2022-2026 regulatory proposal.

In addition to engaging with AusNet Services, the Customer Forum have been engaging with a range of stakeholders, including customers, consumer advocate and community groups, to understand their concerns, preferences and priorities.

This stakeholder engagement is supplementary to the in-depth customer research program being undertaken by AusNet Services as part of the 2022-2026 regulatory proposal process.

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Having regard to these community perspectives AusNet Services considers that the following characteristics broadly represent the community expectations which should flow from asset management strategy:

- A safe network for the public, employees and contractors with zero explosive failures;
- Delivery of a reliable and high quality electricity supply;
- Prudent and efficient management of the network meeting regulatory commitments;
- Prompt and efficient response to service requests and network incidents;
- A secure network with protected infrastructure;
- An environmentally sustainable network with minimal environmental impact;
- Coordinated planning of network development and asset management activities in consultation with customers and the community;
- A responsive network, adapting to changing customer usage patterns and requirements;
- Most cost efficient solutions to meet the network demand; and
- Continual engagement and provision of accurate information.

2.4 Stakeholder Engagement

At a project level, AusNet Services has developed a stakeholder engagement framework for key projects (SEF 20-01). It provides a protocol for engaging with external stakeholders throughout the life cycle of a project.

2.5 Network Vision

In July 2014, AusNet Services conducted a visioning exercise⁵ for the distribution network designed to help technical staff explore a range of future energy supply scenarios.

This process took account of a range of significant factors, including community attitudes toward climate change and renewable energy sourcing, likely customer growth and energy needs, and future technology advances and applications.

For the purposes of the AMS, the conclusions from the process provide an important reference for strategy development. This is particularly so as the visioning process forecast a number of significant changes in the electricity distribution network over the next 25 years.

Key challenges arising from the process are:

- Technology advances and affordability of small scale renewable generation, energy storage, electric vehicles, metering and information and communications technology have opened a range of possibilities for future interactions between customers and the distribution network.

As a result the function and services the network will provide may change significantly.

- The degree of uncertainty for key network planning parameters including energy and demand growth has increased; therefore demand management solutions that provide responsive, short term, lower cost, flexible and mobile solutions will increasingly be considered and utilised to manage uncertainty and avoid inefficient investment.
- A significant increase in demand side solutions, including distributed generation, demand management and the resulting multi-directional energy flows and energy sharing role for the network will impact safety, network design and network operation in various ways.

⁵ Distribution Vision Summary DRAFT 06-08-14, August 2014 AusNet Services

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The implications of changing usage patterns are being considered in forward plans.

- Planning and design for network services must respond to the dynamic energy supply environment to deliver more performance at lower whole-of-life costs. The cost of network services is a current issue that will require business decision-making processes to be appropriately responsive, and therefore simplified and quickened.
- A strategic approach to workforce planning to identify the key skills required and selecting the optimum means of accessing them. Completely new skill sets may emerge particularly with regard to managing the customer relationship and commercial interactions enabled by new technology and increasing customer awareness. Forward planning should not be constrained by current paradigms.

2.6 CSIRO/ENA Electricity Network Transformation Roadmap

Australia's national science agency, CSIRO, and the peak national body representing gas distribution and electricity transmission and distribution businesses in Australia, Energy Networks Australia (ENA), partnered to develop an Electricity Network Transformation Roadmap released in April 2017.

The Roadmap was initiated recognising that:

- Australia's electricity networks are facing complex challenges that impact the economic efficiency and technical stability of the system;
- Australia's electricity system will require expenditure of almost \$1000 billion by current service providers, new entrants and customers by 2050; and
- The type and scale of benefits gained from this unprecedented investment will vary greatly depending on decisions made early in this period and particularly during the decade from 2017-2027.

The Electricity Network Transformation Roadmap provides detailed milestones and actions to guide an efficient and timely transformation over the 2017-27 decade.

These milestones and actions are an input into business plans, asset management strategies and asset management plans.

2.7 Corporate Business Plan

AusNet Services' purpose is to:

Empower communities and their energy future.

This purpose acknowledges that the nature of the energy sector will alter fundamentally over the next decade, responding to community concerns about energy prices, shifting consumer behaviour and developments in the energy environment.

The vision of AusNet Services' Energising Futures strategy is:

To create energising futures by delivering value to our customers, communities and partners.

Transitioning from our Focus 2021 strategy, Energising Futures continues to focus on growth and cost efficiency, but also brings greater attention to customer centricity, digital utility and the capabilities and culture that we will need in the future.

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Five strategic objectives have been identified to help make strategy a reality. Each of these objectives has measures to ensure we focus on the right work:

1. Growth – increase our contracted asset base by [C.I.C]
2. Cost efficiency – benchmark in the top quartile for all three regulated networks
3. Customer centricity – Customer Satisfaction Score (CSAT) above industry average and lower cost to serve
4. Digital utility – cost efficiency enabled by technology and cyber security level
5. Capabilities and culture – measured through:
 - a. Employee engagement score;
 - b. Culture score; and
 - c. Capability maturity score.

This is underpinned by AusNet Services four company values:

1. We work safely
2. We do what's right
3. We're one team
4. We deliver

2.8 Electricity Distribution Business Plan

Each year AusNet Services produces a business plan for each of the three regulated businesses.

The Electricity Distribution Business Plan is focused on the upcoming financial year and the subsequent years, but with an eye into the future, as there are expected to be major changes to the operating environment by 2040.

The business plan aligns with the strategic priorities at a corporate level.

The strategic objectives for the electricity distribution network are:

1. Build the network of the future;
2. Transform customer experience;
3. Achieve top quartile for efficiency;
4. Relentless focus on safety; and
5. Build reputation.

2.9 Safety Vision

AusNet Services' safety vision is:

Safety is a key value and our way of life at AusNet Services. We work together safely and protect and respect our community and our people. At AusNet Services, our overarching priority is the safety and wellbeing of our people.

Our safety vision is symbolised by the simple expression:



Workplace injuries have a significant impact on our business, and more importantly impact on our lives.

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When it comes to the safety of our people, contractors and visitors, zero injuries is the only acceptable target. We will not compromise on safety and we will not tolerate unsafe acts and behaviours.

It is this mindset that drives us to ensure there are no negative impacts on our families and communities as a result of our business operations.

To achieve our safety vision, our mission must be to work together to implement a common strategy with unified purpose and consistency of attitude.

Further details on how AusNet Services achieves this is contained in Section 5.1 Network Safety.

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3 AUSNET SERVICES OVERVIEW

AusNet Services is a leading energy infrastructure company operating a diversified portfolio of both gas and electricity assets throughout Victoria, helping to meet the energy needs of more than 1.3 million residential and business consumers. AusNet Services' core assets include:

- **Gas Distribution Network**

Transportation of natural gas to approximately 660,000 customers across central and western Victoria. The network spans approximately 11,000km of buried pipelines.

- **Electricity Distribution Network**

Consists of approximately 50,000km of conductors that carry electricity from the high voltage transmission grid to more than 700,000 customers across eastern Victoria.

- **Electricity Transmission Network**

Consists of approximately 13,000 high voltage towers and 6,580km of transmission lines that carry high voltage electricity from power stations to electricity distributors across Victoria.

AusNet Services is a publicly listed company listed on the Australian Securities Exchange (ASX: AST). AusNet Services' securities are 31.1% owned by Singapore Power Limited (SPI) and 19.9% by State Grid International Development Limited (SGID) with the remaining owned by ASX investors.

3.1 Distribution Network Overview

AusNet Services' electricity distribution network serves more than 700,000 Victorian households and businesses with more than 50,000 kilometres of conductor and cable. The network is located in the eastern half of Victoria primarily serving outer metro and regional customers.

In 2018, the network delivered 7,570GWh of energy and served a peak demand⁶ (at the transmission connection point) of 1,942MW⁷.

The electricity distribution network comprises a 'sub-transmission' network constructed as overhead line and operating at 66kV and a 'distribution' network of overhead lines and underground cables, which includes a range of operating voltages, including 22kV, 12.7kV, 11kV and 6.6kV, as well as 240/415V and 240/480V.

The sub-transmission network is supplied from the Extra High Voltage (500kV, 330kV, 220kV) transmission network at 11 terminal stations (connection points). It consists of 2,500 km of 66kV lines made up more than 100 individual circuits. These are predominantly configured as loops back to the terminal station to maximise reliability. The sub-transmission network supplies electricity to zone substations which transform the voltage for distribution in the surrounding area.

The 22kV distribution network is currently supplied by 57 zone and switching stations, which are strategically located close to regional load centres. Additionally, three terminal stations also supply 22kV distribution feeders. Three 22/6.6kV zone substations supply the Mount Dandenong area via three 6.6kV feeders. The Latrobe Valley power stations and mines are supplied via five dedicated zone substations operating at 11kV and 6.6kV.

⁶ Non-coincident Summated Raw System Annual Maximum Demand

⁷ AusNet Services Economic Benchmarking RIN response 2018

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A typical network configuration is illustrated in Figure 3.

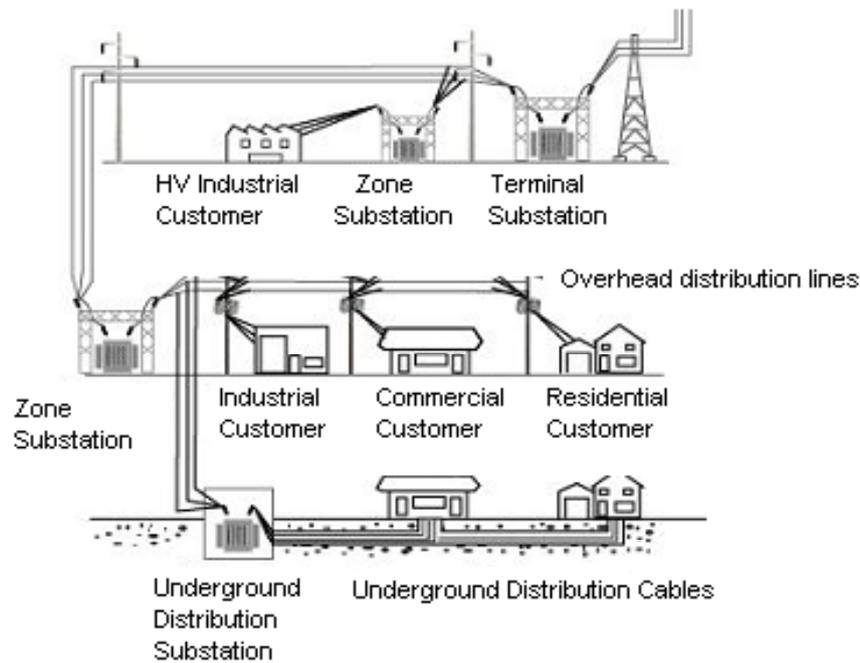


Figure 3: Typical Distribution Network Configuration

3.2 Locality and Geography

The AusNet Services’ electricity distribution network serves the fringe of the northern and eastern Melbourne metropolitan area and the eastern half of rural Victoria as shown in Figure 4.

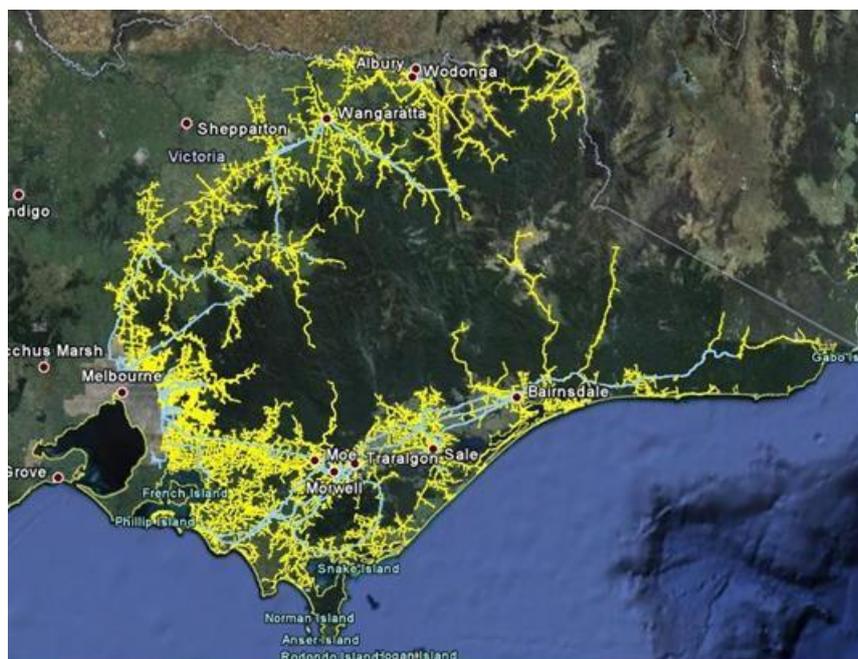


Figure 4: AusNet Services’ Supply Area

Whilst approximately one third of the customer base is urban, the majority of network line length is in rural areas.

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Much of the area is defined as Hazardous Bushfire Risk Area (HBRA), under Section 80 of the Electricity Safety Act. Assets within the HBRA are defined under the Electricity Safety (Bushfire Mitigation) Regulations as 'at risk supply networks'.

Approximately 197,000 poles are located in HBRA. AusNet Services' distribution network also contains Melbourne's fastest developing northern and south eastern urban growth corridors.

3.3 Asset Summary

Table 2 summarises the volumes, of major assets in the network as reported to the AER.

Table 2: Distribution Network Assets⁸

#	Asset Type	Description	Number
1	Connection Points	Terminal Stations (66kV Connection Point) ⁹	11
2	Connection Points	Terminal Stations (22kV Connection Point) ⁹	3
3	Connection Points	Zone Substations (66/22kV) ⁹	52
4	Connection Points	Substations (22/6.6kV) ⁹	3
5	Connection Points	Zone Substations (Single Customer) ⁹	9
6	Connection Points	Switching Station ⁹	1
7	Transformers	Zone Substations Transformers	155
8	Transformers	Distribution Transformers (Pole Mounted)	56,720
9	Transformers	Distribution Transformers (Kiosk, Ground Outdoor or Indoor Chamber Mounted)	4,649
10	Circuit Breakers	High Voltage (>22kV)	254
11	Circuit Breakers	Medium Voltage (≤22kV)	2,190
12	Feeders	Number of 22kV feeders ⁹	345
13	Feeders	Number of 6.6kV feeders ⁹	3
14	Conductors	Overhead (Low Voltage <1kV) (km)	6,625
15	Conductors	Overhead (SWER) (km)	6,466
16	Conductors	Overhead (Medium Voltage 11 and 22kV) (km)	22,613
17	Conductors	Overhead (High Voltage 66kV) (km)	2,504
18	Conductors	Underground (Low Voltage <1kV) (km)	4,583
19	Conductors	Underground (Medium Voltage 11 and 22kV) (km)	2,314
20	Conductors	Underground (High Voltage 66kV) (km)	11
21	Conductors	Service Lines (number of services)	209,409
22	Poles	Wood Poles	185,588
23	Poles	Concrete Poles	126,010
24 a	Poles	Steel Poles (excluding public lighting poles)	404
24 b	Poles	Public Lighting Poles ¹⁰	90,467
25	Poles	Crossarms	405,074

⁸ AusNet Services Regulatory Information Notice – Category Analysis 2018

⁹ AusNet Services Distribution Annual Planning Report 2019-2023

¹⁰ AusNet Services Regulatory Information Notice – Economic Benchmarking 2018

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#	Asset Type	Description	Number
26	Communications	Optical fibre – ADSS, OPGW (km) ¹¹	680
27 a	Communications	Point to point radio links – zone substations	23
27 b	Communications	Point to point radio links - AMI	63
28	Communications	WiMAX base stations	85
29	Communications	TRIO base stations	19
30	Communications	Network Nodes (SDH, WDM and PDH)	244
31	Communications	Routers and Switches	164
32	Communications	Telephone exchanges	6

¹¹ Sourced from Communication team

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4 ASSET MANAGEMENT SYSTEM

AusNet Services maintains an Asset Management System compliant with ISO 55001, the international standard for Asset Management. Adoption of this standard enables AusNet Services to achieve its objectives through effective and efficient management of its assets.

Compliance with ISO 55001 requires the demonstration of robust and transparent asset management policies, processes, procedures, practices and a sustainable performance framework. Accreditation is recognised as an indicator of best practice in asset management.

AMS 01-01 Asset Management System Overview provides an overview of the asset management system.

A key component of the asset management system is the Asset Management Policy (refer Appendix A), which acknowledges the company's purpose and directs the content and implementation of AMSs, objectives and plans for the energy delivery networks.

This Policy sets the foundation for all asset management decisions and has been formally endorsed and communicated throughout the business.

The Asset Management Policy summarises AusNet Services' fundamental asset management principles and from this overarching asset management objectives have been developed to support the successful delivery of AusNet Services' purpose.

The overarching asset management objectives for AusNet Services' energy networks are:

- Comply with legal and contractual obligations;
- Maintain safety;
- Be future ready;
- Maintain network performance at the least sustainable cost; and
- Meet customer needs

The objectives are supported by network specific objectives. The electricity distribution network asset management objectives are detailed in Section 6 Electricity Distribution Asset Management Objectives of this strategy.

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5 ASSET MANAGEMENT DRIVERS

The following sections discuss the significant drivers for future network investment to achieve customer, regulatory and shareholder expectations. AusNet Services is accountable for responding to these drivers in accordance with legislative and other regulatory instruments.

5.1 Network Safety

Stakeholders and AusNet Services alike have high network safety expectations. Safety is one of the factors to be balanced in pursuance of the National Electricity Objective and network management is subject to the requirements of Victorian Safety Legislation.

The Safety Legislation requires network businesses to lodge an Electricity Safety Management Scheme (ESMS) and annual Bushfire Mitigation and Vegetation Management Plans with ESV. In particular, the strategies contained in these regulatory commitments address the risks of electric shock and wildfire ignition associated with failures of distribution network assets.

Managing safety risks in accordance with the requirements of the Electricity Safety Act is consistent with the objectives of the National Electricity Rules. ESV has accepted AusNet Services' ESMS and its annual Bushfire Mitigation Plan.

The Electricity Safety Act (section 83B or Part 10) requires AusNet Services to minimise safety risks '*as far as practicable*'.

The *Electricity Safety Act 1998 (Victoria), Part 1 – Preliminaries, Section 3 Definitions* states:

'practicable', in section 83B or Part 10, means practicable having regard to –

- (a) severity of the hazard or risk in question;*
- (b) state of knowledge about the hazard or risk and any ways of removing or mitigating the hazard or risk;*
- (c) availability and suitability of ways to remove or mitigate the hazard or risk; and*
- (d) cost of removing or mitigating the hazard or risk.*

In practice, this means that the costs associated with managing safety risks shall not be grossly disproportionate to the benefits.

5.2 Bushfire F-Factor Scheme

An "F-Factor" scheme provides an incentive to Distribution Businesses to reduce the number of asset failures causing fire ignitions.

In the scheme, difference weights are applied to fires based on:

- the location of ignition (geography multiplier); and
- the prevailing fire danger rating in the relevant fire district in which the ignition occurred at the time the ignition occurred (time multiplier).

This combination of geography and time are used to calculate the ignition risk unit (IRU) with \$15,000 allocated to each IRU under/over the target.

Table 3 gives the IRU targets as published in the Victoria Government Gazette 22 December 2016.

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Table 3: IRU Targets

Measure	FY2016/ 2017	FY2017/ 2018	FY2018/ 2019	FY2019/ 2020	FY2020/ 2021	FY2021/ 2022
F-Factor – IRU Target	247.7	247.7	247.7	221.1 (Note 1)	221.1 (Note 1)	221.1 (Note 1)

Notes:

- The IRU targets for relevant financial years after the 2019/2020 financial year may be published by the Minister by notice in the Victoria Government Gazette. If the Minister does not publish the IRU target for a relevant financial year, the IRU target for that financial year is the same as the IRU target for the 2019/2020 financial year.

5.3 Reliability Expectations

5.3.1 Service Target Performance Incentive Scheme (STPIS)

The Service Target Performance Incentive Scheme (STPIS) is the principal regulatory control for maintaining and improving network reliability. The scheme seeks to ensure that the incentives are sufficient to offset any financial incentives the distributor may have to reduce costs at the expense of service levels, also having regard to customer's willingness to pay for improved performance.

AusNet Services' network reliability targets for the regulatory control period are established by the AER. As per Clause S6.1.3(4) of the NER, AusNet Services' targets for 2020 are shown in Table 4.

The incentive scheme rates are calculated as per Clause 3.2 of the STPIS.

Table 4: 2020 Reliability Targets¹²

Performance Targets	Urban Feeder	Rural Short Feeder	Rural Long Feeder
USAIDI (average minutes)	80.26	186.23	231.50
USAIFI (average interruptions)	1.08	2.26	2.79
MAIFI (average interruptions)	2.79	5.80	11.35
Telephone answering parameter (per cent)	80.33		

Notes:

- USAIDI (Unplanned System Average Interruption Duration Index, or the average minutes a customer is off supply each year as a result of unplanned outages).
- USAIFI (Unplanned System Average Interruption Frequency Index, or the average number of times a customer is off supply each year as a result of unplanned outages).
- MAIFI (Momentary Average Interruption Frequency Index or the average number of times a customer is off supply for less than 1 minute each year).
- Call centre performance (the percentage of fault calls progressing to an operator that are answered within 30 seconds).

The incentive has delivered highly material economic impacts and ensures a critical focus on network reliability. The incentive scheme impacts are accordingly a key input into the development of asset strategies and the economic evaluation of investment options.

¹² Source: AusNet Services distribution determination final decision, Attachment 11, p 11-9

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Features of the STPIS include:

- Symmetrical penalties and rewards;
- Measured primarily on the basis of performance deviation from target;
- Targets are set prior to each regulatory control period based on historic performance with adjustments for planned improvements;
- Incentive rates based on customers willingness to pay as represented by Value of Customer Reliability (VCR);
- Exclusions based on statistical outliers from long run performance;
- Removal of accumulation or roll forward of incentives; and
- An S-Bank facility to smooth pricing impacts on customers.

5.3.2 Guaranteed Service Level (GSL)

The STPIS also incorporates a Guaranteed Service Level (GSL) scheme, which provides an incentive for distributors to improve service to customers receiving poor service and recognises by way of payment those customers who have received poor service.

Features include:

- Funding included in determination;
- Parameters, threshold and payments based on jurisdictional arrangements;
- Uncapped liabilities; and
- S-Factor exclusion methodology applies.

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Table 5: GSL Supply Restoration and Low Reliability Payments 2016 to 2020

Measure	Condition	Amount
Duration	Where the customer experiences more than 20 hours of unplanned sustained interruptions per year; or	C.I.C
	Where the customer experiences more than 30 hours of unplanned sustained interruptions per year; or	
	Where the customer experiences more than 60 hours of unplanned sustained interruptions per year;	
	Where the customer is supplied by an urban feeder and experiences an unplanned sustained interruption of more than 12 hours, and 20 hours or less of unplanned sustained interruptions in that year	
	Where the customer is supplied by a rural feeder and experiences an unplanned sustained interruption of more than 18 hours, and 20 hours or less of unplanned sustained interruptions in that year	
Number of Sustained Outages	Where the customer experiences more than 8 unplanned sustained interruptions per year; or	C.I.C
	Where the customer experiences more than 12 unplanned sustained interruptions per year; or	
	Where the customer experiences more than 24 unplanned sustained interruptions per year	
Number of Momentary Outages	Where the customer experiences more than 24 momentary interruptions per year; or	C.I.C
	Where the customer experiences more than 36 momentary interruptions per year.	

5.3.3 Value of Customer Reliability (VCR)

The Value of Customer Reliability (VCR) represents, in dollar terms, the willingness of customers to pay for a reliable supply of electricity.

The values currently used were set by AEMO in 2014 and are indexed to CPI.

The values produced are used as a proxy in this way, and can be applied for use in revenue regulation, planning and operational purposes in the National Electricity Market.

In response to a Rule Change proposal from the Council of Australian Governments (COAG), the AEMC amended the NER to give the AER responsibility of determining the values different customers place on having a reliable supply. This rule change became effective on 5 July 2018.

The AER must publish their first VCR by 31 December 2019. The AER is currently conducting a review into VCR.

5.4 Rapid Earth Fault Current Limiters (REFCLs)

The 2009 Victorian Bushfire Royal Commission (VBRC) provided a range of recommendations relating to distribution networks, which are addressed within the Bushfire Mitigation Plan. Recommendations that required further investigation and analysis due to technical complexities were addressed by the Powerlines Bushfire Safety Taskforce (PBST) and their recommendations subsequently accepted by the Victorian Government. Recommendations 28 and 29 were implemented through changes to the Electricity Safety

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(Bushfire Mitigation) Regulations 2003. Outcomes of the PBST are defined in *AMS 20-13 Enhanced Network Safety Strategy*.

Recommendation 27 of the VBRC called for new technology that delivered greatly reduced bushfire risk, being applied to all overhead conductors (SWER and 22kV powerlines) in high bushfire risk areas.

The Government subsequently introduced Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016 that require each polyphase line originating from selected zone substations to have specific capacity to reduce voltage and therefore limit the potential for fire ignition.

This has resulted in the introduction of the REFCL program. The REFCL program aims to install REFCLs in three tranches as shown in Figure 5. Each zone sub-station has been allocated a point score which is used in determining how many sites are to be included in each tranche.

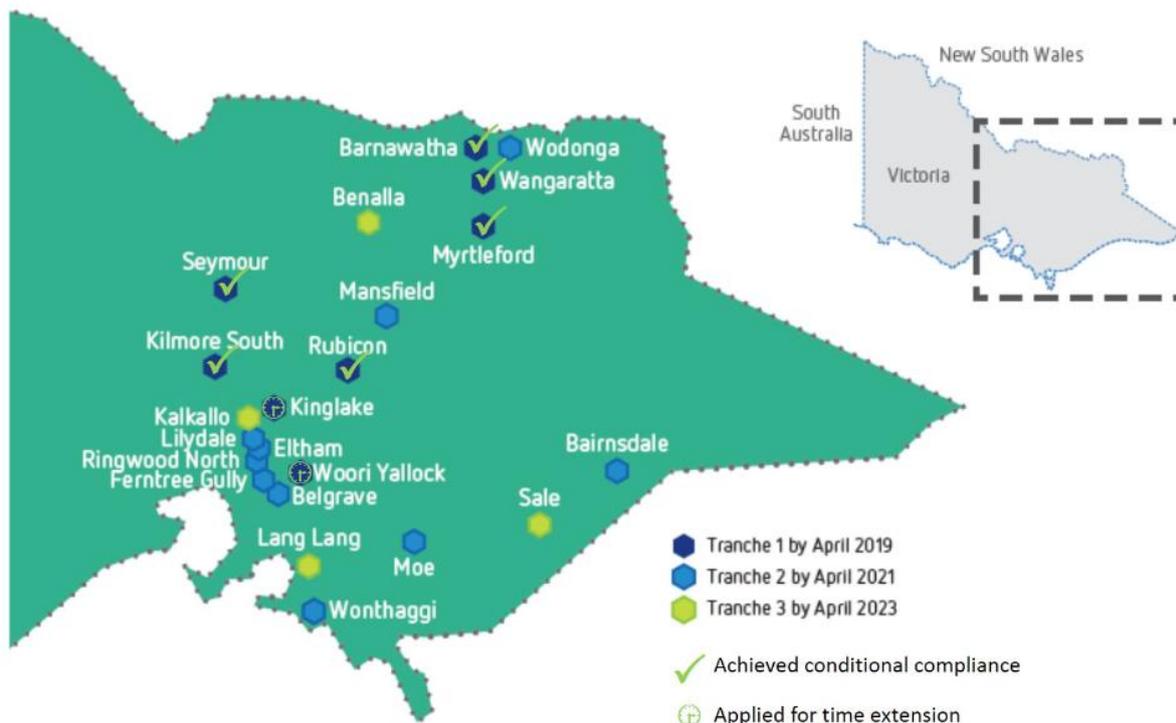


Figure 5: REFCL delivery timetable

5.5 Customers

At AusNet Services, our vision is to create Energising Futures by delivering value to our customers, communities and partners. This can only be achieved if we better understand customer preferences and behaviour, so that we can respond with service offerings that customers value.

As part of the preparation of AusNet Services 2022-2026 electricity distribution submission, AusNet Services has undertaken its most extensive customer research program to date, in terms of breadth and depth. First and foremost, this research was aimed at gauging what customers value and expect in terms of services and service levels. We then explored their views on network investment and trade-offs between reliability and safety outcomes and operating costs.

The research program was also designed to inform the Customer Forum, appointed for the 2022-2026 EDPR, of salient customer views. In a ground-breaking customer engagement trial, AusNet Services appointed a Customer Forum, responsible for representing business and residential customers in negotiating our plans for the electricity distribution network over

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the 2022-2026 regulatory period. In negotiating with us, the Customer Forum relied heavily on the research output to develop appropriate responses to our customers' views.

Electricity price, in terms of both affordability and value for money, remains a key concern for all customers. Around two thirds of customers felt that electricity prices had increased in the past two years, and provided poor value for money. Given the environment of low trust amongst the community in the energy industry, with very low understanding of the supply chain and awareness AusNet Services, it is clear that as a business, we need to continue our focus on reducing costs where possible through more efficient work practices and adopting new technology.

Our research indicated that customers viewed the provision of a reliable, continuous supply as the most important service provided by AusNet Services. This priority was closely linked to their personal values of trust, honesty and family. Anecdotally, although cost and price of energy was a consistent topic of conversation, there was no feedback that suggested customers were prepared to accept lower levels of reliability. Instead, research suggested that nobody wanted to pay more, nobody wanted more blackouts and most preferred to reduce their electricity use to avoid scenarios of increased prices or increased outages.

Based on quantitative research, annual blackouts were considered acceptable by a majority of customers, whereas more frequent outages of every 4-6 months were only considered acceptable by less than a third of customers. It is clear that outages cause real pain for our business customers, both large and small to medium sized. In a survey of small-to-medium businesses, a reliable energy supply and energy costs were listed amongst top three key issues or challenges facing business.

Consistent with a more general trend seen in society, customers both residential and small business, are also feeling a loss of control when it comes to electricity issues. A majority of customers are already trying to reduce their electricity use, but are unaware of how else to improve their situation. This issue of control was highlighted in overwhelming feedback from customers that they would be very unhappy if their solar exports were limited, and a preference for voluntary rather than automated demand response programs.

Awareness of new energy technologies has grown across all customer groups. Interest in solar continues to be strong, with around two thirds of non-solar residential and small business customers interested in installing solar. Around half of residential and small business customers surveyed were interested in purchasing a battery. Customers generally felt that the costs associated with upgrades to the network to allow more solar connections should be shared by all because solar is in everyone's interest.

The desire for more and better information across all customer groups was consistent theme. In addition to information related to outages, customers want proactive, simple and unbiased information and advice from AusNet Services.

The business is currently in the process of embedding continuous customer engagement and research as part of its business-as-usual activities. Integral to this is responding to the insights from research on an on-going basis.

In this regard, the business has responded to the findings from the customer engagement research undertaken as part of the current regulatory review process in the following ways:

- Identified improvements in our business processes and practices that can be implemented immediately without any additional cost impact on customers;
- Developed a short-list of initiatives that can be implemented over the next two years, which would improve customer outcomes;
- Identified opportunities to respond to customer feedback in our network investment plans proposed for the five year period 2022 to 2026, which directly impact services and service levels for customers.

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5.6 Network Demand and Utilisation

Ongoing network augmentation investment and significant expansion of the network in targeted urban growth corridors has managed strong demand growth over many years. The forecast demand growth rate has significantly declined in recent years due to weaker economic conditions, consumer response to critical demand tariffs, appliance energy efficiency, building thermal efficiency, rooftop solar generation (photovoltaic arrays) and the impact of increases in the cost of electricity.

The majority of new customers are connected via underground reticulation in residential estates located in the south eastern and northern growth corridors of metropolitan Melbourne.

The expected growth in photovoltaic (PV) arrays is expected to continue.

Technological advances in PV arrays are continuously increasing in efficiency and installation cost effectiveness although generation is ultimately offset by reduced capacity over time due to wear-out.

In addition, exposure from risk of inadequate maintenance of solar panels and other embedded generation (EG) mechanisms needs to be carefully managed to avoid an inadvertent loss of generation during peak demand periods.

High asset utilisation is fundamentally a desirable characteristic as it represents more efficient use of available capacity.

However, this must be balanced against key risks:

- Accelerated deterioration of electrical insulation caused by elevated operating temperatures;
- Reliability of service affected by complex operating procedures to re-distribute peak loadings, de-energise equipment and maintain supply security during periods of high demand or network faults;
- The need to establish sophisticated, case specific, contingency plans to minimise customer load-at-risk;
- A heightened reliance on frequent and sophisticated condition monitoring and maintenance to ensure loading conditions are not impacting design parameters or causing rapid deterioration of the plant; and
- Reduced flexibility to access equipment for maintenance, repair or switching.

The risks have associated commercial risks for AusNet Services which must also be considered, such as:

- Compromised network reliability performance and subsequent Service Target Performance Incentive Scheme (STPIS) revenue penalties;
- Increased operating and capital cost associated with reduced flexibility to access network assets for maintenance; and
- Requirement for increased strategic spares, particularly high cost items such as transformers, to mitigate the risks of plant failure.

More detailed information on utilisation and its impacts is contained in *AMS 20-12 Augmentation*.

5.7 Quality of Supply Requirements

AMS 20-15 Quality of Supply describes the challenges faced and the initiatives taken by AusNet Services to manage supply quality to the requirements of the Electricity Distribution Code.

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Over recent regulatory control periods, the importance of power quality has been recognised by regulators and Distribution Businesses have responded through the installation of monitoring equipment at zone substations and at feeder extremities.

Power quality is measured by several means including:

- Power quality meters installed at zone substations and
- Power quality meters installed at the extremity of one distribution feeder emanating from each zone substation,
- Temporary installation of sophisticated power quality meters to investigate specific issues, and
- AusNet Services Advanced Metering Infrastructure (AMI) meters have the capability to measure steady state voltages at the customers' point of connections in 5 minute intervals.

Analysis of power quality data from zone substations and feeder extremities when combined with the customer AMI data and monitoring of customer complaints indicates that portions of the distribution network have power quality issues.

These include:

- Steady state voltage variations;
- Voltage sags and swells;
- Negative sequence voltages outside the requirements of the Distribution Code;
- Harmonic distortion.

Investigations of the few complaints received about voltage harmonics or voltage flicker have revealed these issues were generated by equipment in customers' installations. These were resolved by the installation of mitigating equipment by the customers concerned.

5.7.1 Steady State Voltage Variations

Maintaining steady state voltages within the Distribution Code limits is a challenging task due to increased penetration of solar PV generations.

A national power quality survey has reported that the steady state voltages are more close to the upper limit of the allowable voltage range.

Analysis of customer voltages obtained from the AMI meter data indicates that the steady state voltages of some customers are outside the code requirements.

5.7.2 Voltage Sags and Swells

Voltage sags and swells are short duration deviations from steady state voltage levels. Voltage sags and swells can affect the operation of customers' equipment – dimmed lights are common.

Industrial customers can experience plant failure due to their protection systems operating incorrectly and causing financial loss to customers.

In extreme cases, voltage sags can damage equipment.

5.7.3 Negative Sequence Voltages Outside the Requirements of the Distribution Code

Some parts of the network also experience negative sequence voltage that is outside the Distribution Code limits. Mainly three phase customers are experiencing the negative sequence issue and it can cause equipment malfunctioning or damage.

The main causes for negative sequence voltage deterioration are load unbalance and network asymmetry in the sub-transmission network.

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5.7.4 Harmonic Distortion

Another emerging power quality issue is the harmonic distortion caused by modern household equipment such as Compact Fluorescent Lamps.

5.8 Network Support Services

Network Support Services refer to the suite of non-network solutions and demand management techniques available for procurement by AusNet Services to manage risk and improve the performance of the distribution network.

Such services can include embedded generation, embedded storage, tariff strategies and customer demand response.

5.8.1 Distributed Energy Resources (DER)

Distributed Energy Resources (DER) traditionally refers to embedded generation (EG) that is distributed throughout the electricity network and connected at low voltages.

Typically, solar PV, small wind generators and co-generation (heat and electricity) systems are deployed for local supply by homeowners and businesses for various reasons including in response to government incentives. Also included is the proposed strategy for Electric Vehicles as this is not only a charging load but also, potentially, a source of generation into the network.

In addition to supplying the local load, embedded generation (EG) has the potential to defer peak demand and shift load to another time.

Demand Management (DM) services can use EG or load curtailment to control the peak demand.

5.8.2 Demand Side Management

AusNet Services provides network support in the most efficient manner available. Where network support, by EG or demand management is the least cost, most efficient strategic option, AusNet Services will respond accordingly.

AusNet Services also recognises the intent of the AER for transparency in network planning and augmentation as defined under the new rules for RIT-D.

RIT-D requires DNSPs to consider and assess all credible options before they choose the best investment option to meet their customer's needs. The application guidelines set out guidance on how to assess these options and the circumstances in which businesses are required to consider and quantify market benefits when undertaking a RIT-D¹³.

5.8.3 Deferral of Augmentation

Many new energy supply technologies connect directly into the distribution network, either as dedicated export connections or via a regular electricity supply connection, as is the case for household installed photovoltaic arrays.

The resulting multi-directional energy flows and energy sharing role for the network will impact safety, network design and network operation in various ways, and need to be addressed in forward planning to facilitate accommodation. Some aspects requiring consideration are quality of supply implications on the distribution network, network support implications, metering arrangements and safe operating arrangements.

¹³ Regulatory investment test for distribution (RIT-D) and application guidelines (<http://www.aer.gov.au/node/19146>)

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The provision of network support in the form of EG or the use of demand reduction during the relatively short periods of high network demand, has the ability to manage short term peak demand effectively.

Medium term deferral of augmentation can also be effective with the use of larger EG facilities and demand side participation (DSP).

5.9 Asset Information

AusNet Services' main asset management information systems are:

- SAP Enterprise Asset Management – Asset data information system;
- SAP Enterprise Resource Planning – Task, project and program information system for managing physical change in the network;
- SAP Work Manager – Field mobility solution;
- Spatial Data Management Electricity (SDMe) – Geospatial asset location and network modelling;
- Enablon – Incident, Risk, Compliance and Audit Management
- LatLonGo – Geospatial navigation system for viewing tasks, projects and programs in each network;
- Distribution Outage Management System (DOMS) - real time network configuration and status management system;
- PowerOn Fusion – Electricity distribution supply outage management system;
- Objective – Engineering drawing record management system;
- Enterprise Content Management (ECM) – Written document management system;
- Protection and Control Setting Information System (PAC SIS) – Protection relay settings; and
- Ratings Database Repository (RADAR) – Plant and equipment ratings.

The progressive development of asset management information systems is coordinated by the Enterprise Asset Management program within the Business Systems Asset Management Strategy.

The key drivers of improvement in information systems are:

- Improving data quality for informed operation and strategic decision making;
- Increasing costs of supporting disparate, customised, non-interfaced systems;
- High risks associated with reliance on the 'local knowledge' of a mature-aged workforce;
- Repeatable, transparent and auditable processes to assure compliance to regulatory and safety obligations; and
- Replacement of obsolete legacy systems.

5.10 Asset Condition

The deterioration of network assets over time may affect worker and public safety, the environment and network performance and impact on the organisation achieving its objectives.

Asset condition is a measure of the health of an asset and is a key parameter in determining the remaining useful life and can be used to predict how long it will be before an asset needs to be repaired, refurbished or replaced.

Asset condition is also an indicator of how well an asset is able to perform its designed function.

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Health indices provide an estimate of asset condition help to provide an indicator for increasing volumes of replacement work that will occur due to deteriorating condition and serviceability.

In forecasting expenditure requirements, a sound understanding of the failure rates and replacement rates of deteriorating assets is necessary to ensure future replacement plans are consistent with sustained service performance.

Effective condition monitoring, analysis and management are essential. Accordingly condition modelling and recognition of the advanced service age of many assets is a key consideration in the AMS.

Further information on condition monitoring can be found in *AMS 20-21 Condition Monitoring*.

5.11 Sustainability

5.11.1 Carbon Footprint

Line losses represent almost the entire carbon footprint of the distribution network.

Whilst these losses are classified as Scope 2 emissions under the National Greenhouse and Energy Reporting Scheme (NGERS) classification, and therefore do not require the purchase of permits, AusNet Services' strategy is to propose efficient network augmentation in the form of distribution feeder re-conductoring and pole-top capacitor installation based upon the forecast cost of losses to customers.

In addition, AusNet Services includes both electrical and environmental (i.e. SF₆) costs in economic analysis of project options to ensure efficient network augmentation and asset renewal projects are proposed.

5.11.2 Emissions Management

Climate change (both in terms of the physical effects and government policies) and funding pressures are likely to continue to influence energy sector direction over the next five years. The precise impacts remain uncertain, with ongoing global research and debate about near-term climate effects and evolving national and international climate policy.

The Government have retained the Clean Energy Regulator and the NGERS as part of the administration of the Emissions Reduction Fund.

5.12 Compliance with Environmental Obligations

The regulatory instruments (including the NER and Distribution License) require AusNet Services to comply with all applicable regulatory obligations or requirements associated with the provision of network services.

Environmental compliance, including the implementation of sustainable practices, is therefore a key objective for the AMS.

As part of its environmental system, AusNet Services continues to mitigate risks associated with asbestos containing materials, oil contaminations, CCA treated poles, greenhouse gas emissions and noise in order to address community and customer expectations. Electrical loss reduction and the capability of the electricity distribution network to interconnect distributed generation are emerging expenditure drivers.

AusNet Services utilises the Customer Management System and the People and Safety System to record and monitor operational compliance with key environmental obligations.

5.13 People and Culture

The nature of the energy sector will change fundamentally over the next decade, responding to community expectations of safety and reliability, climatic change and emerging

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technologies. The systems, processes, tools and the appropriate employee skills set used to deliver distribution services will need to adapt to the changing operating environment as it continually evolves.

More immediately, the industry faces skill shortages through retirement of an aging workforce. The retirement profile, together with a projected increase in network expenditures, is driving the increasing demand for knowledge-management, skills-transfer, training and recruitment.

Retaining and developing AusNet Services' people will be critical to the successful implementation of the wide range of asset management initiatives. Programs must be designed to promote behaviours and activities consistent with AusNet Services' core values.

5.14 Heightened Focus on Security

Commonwealth and state governments have imposed legal responsibility¹⁴ on both the owners and operators of critical infrastructure (such as gas and electricity installations) to take all necessary preventative security measures to ensure continuity of supply.

Legislation has been enacted to counteract the threat of terrorism or sabotage to critical infrastructure.

The five main security threats to the electricity distribution network are:

1. Safety – of untrained persons in the vicinity of energy-containing equipment;
2. Malicious – motivated by revenge, fame, association or challenge;
3. Criminal – profit driven; includes theft, fraud, sabotage or extortion;
4. Terrorism – threat or use of force to influence government or public through fear or intimidation¹⁵; and
5. Accidents or natural disasters that breach secure perimeters and/or cause security protections to fail.

Industry standards for security have also been established to reduce the risk of injury to children, or asset damage caused by vandals, following unauthorised access.

In addition, AusNet Services has sophisticated policies and procedures which provide clear instruction on the prevention of, and response to and recovery from security events. These internal standards reflect the advice and recommendations contained in various other agency and association documents providing guidance.

These instruments reflect the increasing priority of physical security as a critical component of asset management.

These include:

- SPIRACS
- AusNet Services' Information Security Policy
- Victorian Emergency Management Manual
- Emergency Management Act 1986 (VIC)
- Terrorism (Community Protection) Act 2003
- AusNet Services' Tactical Security Plans

¹⁴ Victorian Terrorism (Community Protection) Act 2003

¹⁵ A 'terrorist act' is an act or threat intended to advance a political, ideological or religious cause by coercing or intimidating an Australian or foreign government or the public; causing serious harm to people or property, creating a serious risk of health and safety to the public, disrupting trade, critical infrastructure or electronic systems - Criminal Code Act 1995 [Commonwealth]

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- Victoria Police Precinct Mapping of AusNet Services' assets.
- ISO 31000:2009 Risk Management-Principles and Guidelines
- HB436-2004 Risk Management Guidelines
- HB167-2006 Security Risk Management
- Australian Government Department of Industry Tourism and Resources: Electricity Systems – Risk Context Statement, March 2007 (Electricity Systems Risk Context Statement (2007))
- Australian Government's (ASIO) Business Security Report July 2006 – Electricity
- Department of Infrastructure Risk Context Statement for Energy
- Critical Infrastructure Emergency Risk Management Assurance Handbook
- Victorian Framework for Critical Infrastructure Protection from Terrorism
- AusNet Services' Network Contingency Plans

5.15 Advances in Technology

The nature of the energy sector will change fundamentally over the next decade, responding to community expectations of safety and reliability, climatic change and emerging technologies. Advances in technology are facilitating new electricity generation and storage techniques and more efficient small-scale embedded generation solutions, and in the future, the introduction of electric vehicles.

Integration of these new technologies presents new challenges for the distribution network.

5.15.1 Innovation

Innovation is required to modernise the electricity distribution network and develop the most effective solutions for network challenges. It will explore the most economical way of maintaining reliability and safety of the network in the future. AusNet Services' aims to keep innovation research focussed on resolving most urgent and important network problems and involve Victorian educational and research institutions.

It is intended to commercialise, wherever possible, the key technologies developed in order to ensure a cost effective supply of the new product or services for the benefit of AusNet Services and other DNSPs. AusNet Services' innovation and research program can be classified into three main categories including Advanced condition monitoring, Network intelligence using smart analytics and Investigating emerging technologies. A number of innovative solutions from these key areas are currently being researched or trialled on the network.

5.15.2 New Technology Adoption

Innovation, Research and Development (IRD) is required to modernise existing electricity distribution network and develop most effective and cost efficient solutions for real network challenges. This one time investment will explore the most economical way of maintaining reliability and safety of the grid in the future.

The IRD program includes identifying and conducting trials using leading edge technologies already developed elsewhere as well as to conduct research and development (R&D) if a suitable solution does not exist.

It is our aim to keep the R&D program focussed on resolving most urgent and important network problems and involve Victorian educational and research institutions thus leveraging other research funds available from Australian research council or through co-operative research centres.

It is intended to commercialise the key technologies developed in order to ensure a cost effective supply of the new product or services for the benefit of all DNSPs.

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AusNet Services' current innovation and research program has produced a number of important milestones for the grid especially in terms of developing technologies which will help avoid failures using advanced condition monitoring (CM) and inspection techniques.

However, the current program is very much limited to few initiatives and requires a step change in order to take advantage of the introduction of the advanced technologies at a faster pace than ever before.

Advances in technology are providing a broader range of economic solutions to network constraints. The information flow from AMI smart meters, advanced asset inspection and condition monitoring technologies, demand management, EG and smart network initiatives such as network automation are areas where stakeholders expect the energy service sector to exploit new technology.

In addition, and to a large extent as a result of energy efficiency and emissions management policy, technological advances are facilitating new generation and more efficient small-scale EG solutions, and in the future, the prospect of electric motor vehicles. Technology also provides for these end user solutions to interact, in an interdependent manner, with the electric network and its operation.

AusNet Services as the DNSP recognises that accommodation of these technologies needs to be carefully managed. AusNet Services' facilitates customer's expectations to safely maintain the quality, reliability and security of supply in an economic manner by ensuring the network is not adversely affected.

5.15.3 Secondary systems

The dominant trend in secondary systems is toward the application of digital technology devices and systems with in-built intelligence and integrated functionality. These digital technology platforms add value by:

- Increasing functionality, reliability and availability through the use of microprocessors, solid-state devices, digital technology and optic fibre-based communication systems
- Lowering per function costs whilst increasing performance capability
- Embedding intelligent diagnostic software that optimises operation and improves asset management
- Rationalising equipment via functional integration and multiple signal processing capability
- Providing remote management facilities for network elements based on real-time data communications

5.16 Approval of Capital and Operational Expenditure Forecasts

AusNet Services' capital and operational expenditure requirements are determined by the AER in accordance with the criteria set out in Chapter 6 of the NER.

Clause 6.5.7 of the NER requires the distributor's pricing proposal for the regulatory control period to include a total forecast of capital expenditure which it considers is required in order to achieve the following defined capital expenditure objectives:

- Meet or manage the expected demand for standard control services over that period;
- Comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;
- Maintain the quality, reliability and security of supply of standard control services;
- Maintain the reliability, safety and security of the distribution system through the supply of standard control services.

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The AER must accept the forecast if it is satisfied that the total of the expenditure for the regulatory control period reasonably reflects the following criteria:

- The efficient costs of achieving the capital expenditure objectives;
- The costs are prudent and required to achieve the capital expenditure objectives; and
- A realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.

Operational expenditure is treated in the same way, with consistently defined operational expenditure objectives. It is therefore necessary for AusNet Services' strategies and plans to satisfactorily demonstrate that its expenditure forecasts both achieve the objectives and satisfy the criteria.

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6 ELECTRICITY DISTRIBUTION ASSET MANAGEMENT OBJECTIVES

Electricity Distribution Asset Management Objectives have been developed to guide the development of asset strategies to support the successful delivery of the organisation’s strategic objectives.

These Electricity Distribution Asset Management Objectives are aligned to and supplement the overarching Asset Management Objectives¹⁶ and the Electricity Distribution Strategic Objectives¹⁷.

The Electricity Distribution Asset Management Objectives are:

1. Maintain long-term network reliability
2. Reduce risks in highest bushfire risk areas
3. Prepare for changing network usage
4. Improve efficiency of network investments
5. Achieve top quartile operational efficiency
6. Implement REFCLs within prescribed timeframes

Figure 6 shows the relationship between the AusNet Services Strategic Objectives, the Electricity Distribution Strategic Objectives, the overarching Asset Management Objectives and the Electricity Distribution Asset Management Objectives.



Figure 6: Alignment of Objectives

¹⁶ AMS 01-01 Asset Management System - Overview

¹⁷ Electricity Distribution Business Plan FY20

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7 NETWORK PERFORMANCE

7.1 Safety

AusNet Services' safety framework is discussed in Section 8.3 Health and Safety Management. The company's approach to enhancing network safety is to establish strategies to continuously reduce safety risks to *as far as practicable*.

Within this approach AusNet Services' aspiration is to economically achieve a 20% reduction in serious incidents through each regulatory control period.

Safety performance is discussed in *AMS 20-13 Enhanced Network Safety*.

AusNet Services' Electricity Safety Management Scheme (ESMS) and the Bushfire Mitigation Plan facilitate monitoring and quantification of network safety risks and implementation of remediation programs.

From a public safety perspective, network safety risks are generally caused by an asset failure that results in the escape of electrical energy with potential consequences of electric shock or fire.

Figure 7 and Figure 8 show the number of network related electric shock incidents and the breakdown of network related electric shock incidents by cause.

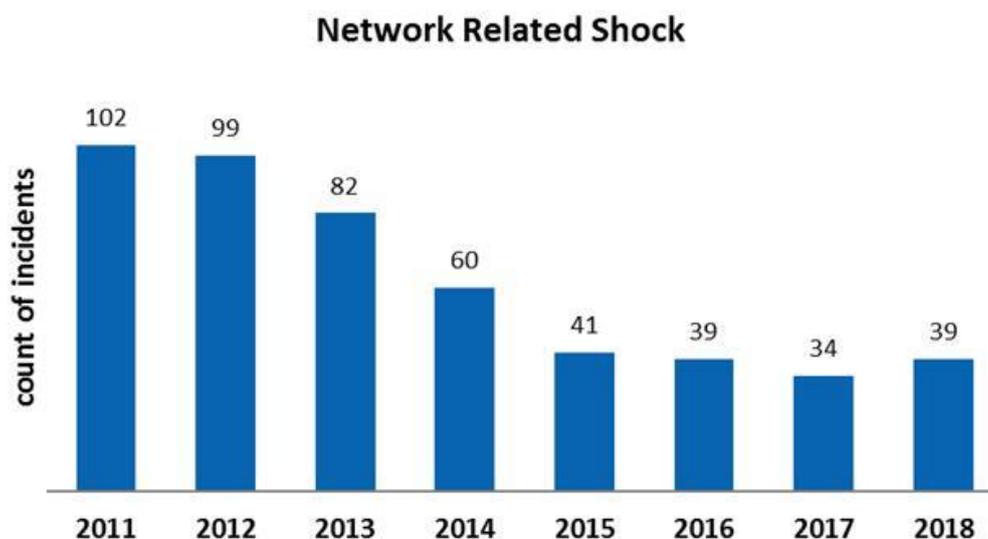


Figure 7: Number of Network Related Shock Incidents

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Network Related Electric Shock by Cause

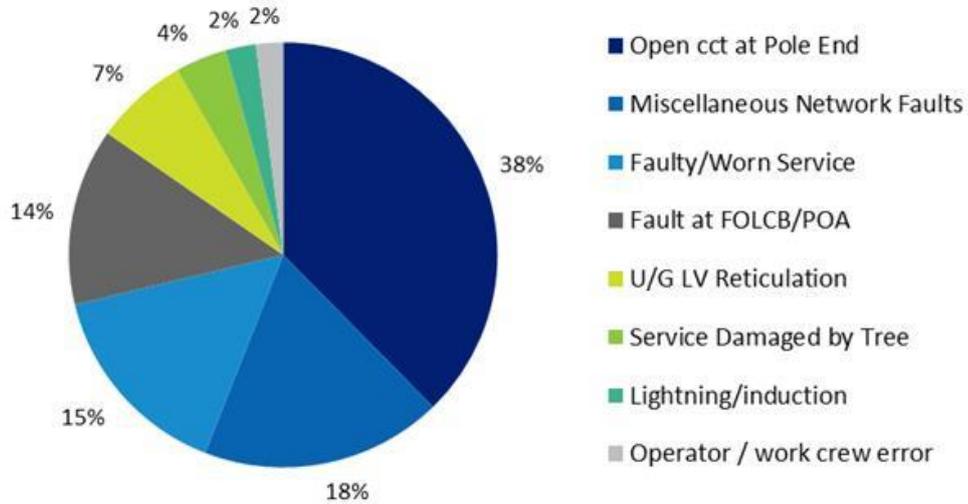


Figure 8: Network Related Electric Shock by Cause

Figure 9 shows the number of fire start incident for both non-ground (asset) fires and ground fires.

Network Fire Starts

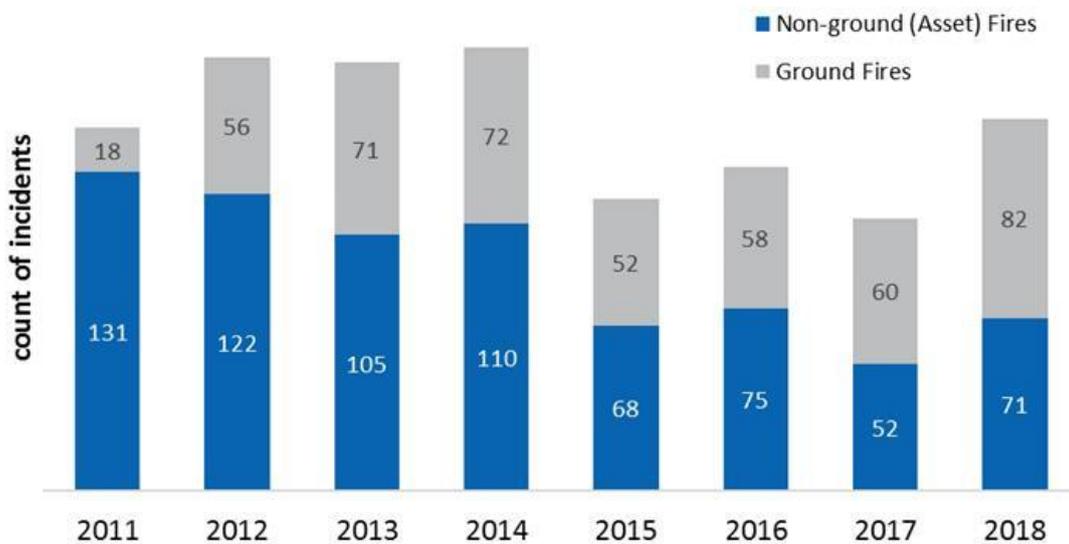


Figure 9: Number of Fire Start Incidents

Figure 10 and Figure 11 show the causes of asset fires and ground fires, respectively.

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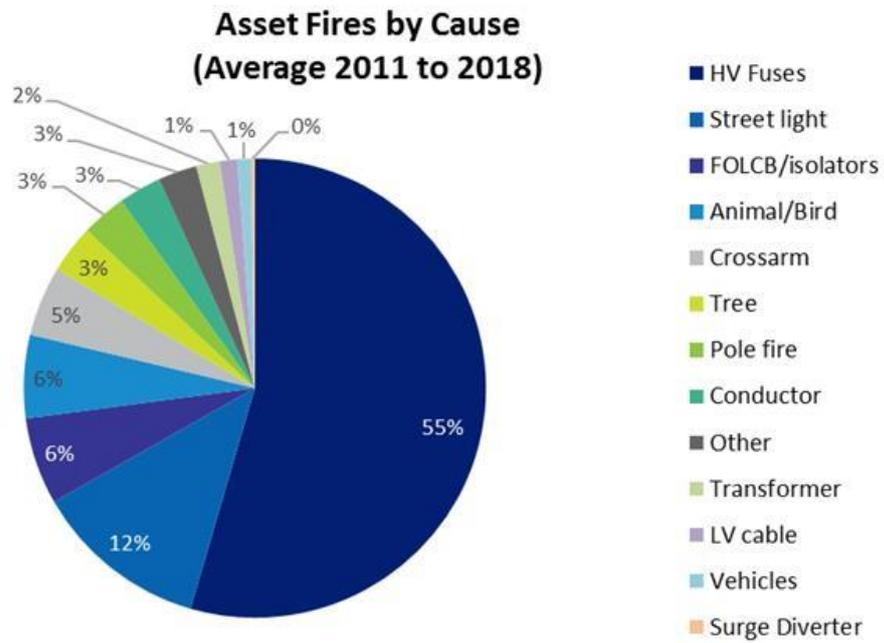


Figure 10: Causes of Asset Fires

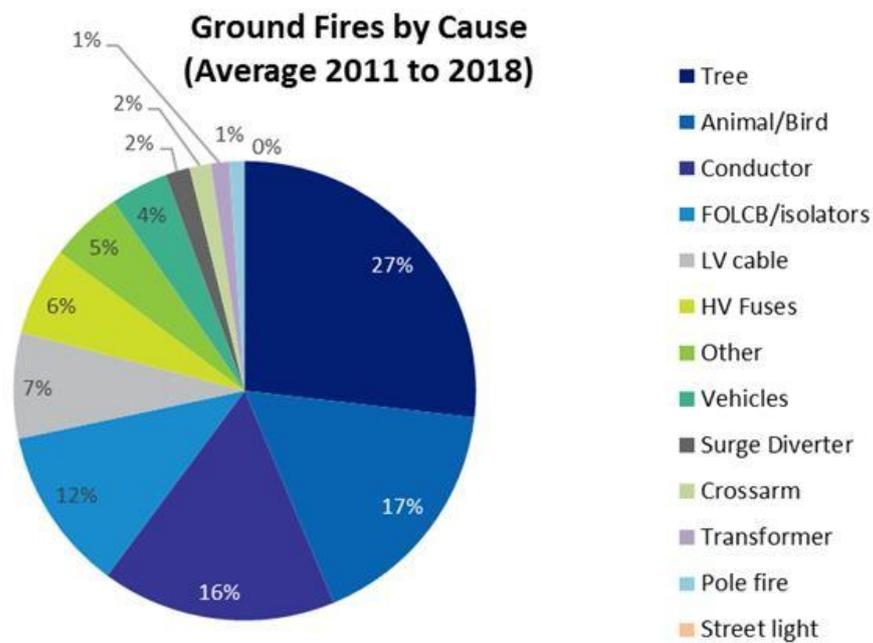


Figure 11: Causes of Ground Fires

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AMS 20-13 Enhanced Network Safety Strategy also includes details of:

- Non-asset failures such as vegetation, which are also being addressed through AusNet Services’ Vegetation Management Plan;
- No Go Zone breaches, which continue to be addressed through co-operation with ESV and WorkSafe Victoria in the communication and education of safety hazards to targeted stakeholder groups when working near overhead powerlines; and
- Occupational health and safety risks associated with asbestos, working at heights and explosive failures.

7.2 Capacity

AMS 20-12 Augmentation contains the analysis of the growth in customers supplied and associated peak demand, the impact of demand growth on asset utilisation and load-at-risk. It also summarises the planning standards and forecast work necessary to meet customer expectations for capacity, quality, reliability and security of electricity supplies.

7.2.1 Network Utilisation

Network utilisation at zone substation level is calculated as total non-coincident peak demand in MVA divided by total installed nameplate capacity in MVA. Utilisation peaked at 78.5% in 2009 primarily due to the very hot summer of 2008/09.

The period from 2019 to 2020 is forecast to grow from 1915MVA to 2020MVA, with utilisation estimated to increase from 63.7% in 2019 to 66.6% in 2020.

Figure 12 presents the historical zone substation utilisation for AusNet Services’ distribution network since 2003, along with the 2020 forecast utilisation, under 50% POE conditions.

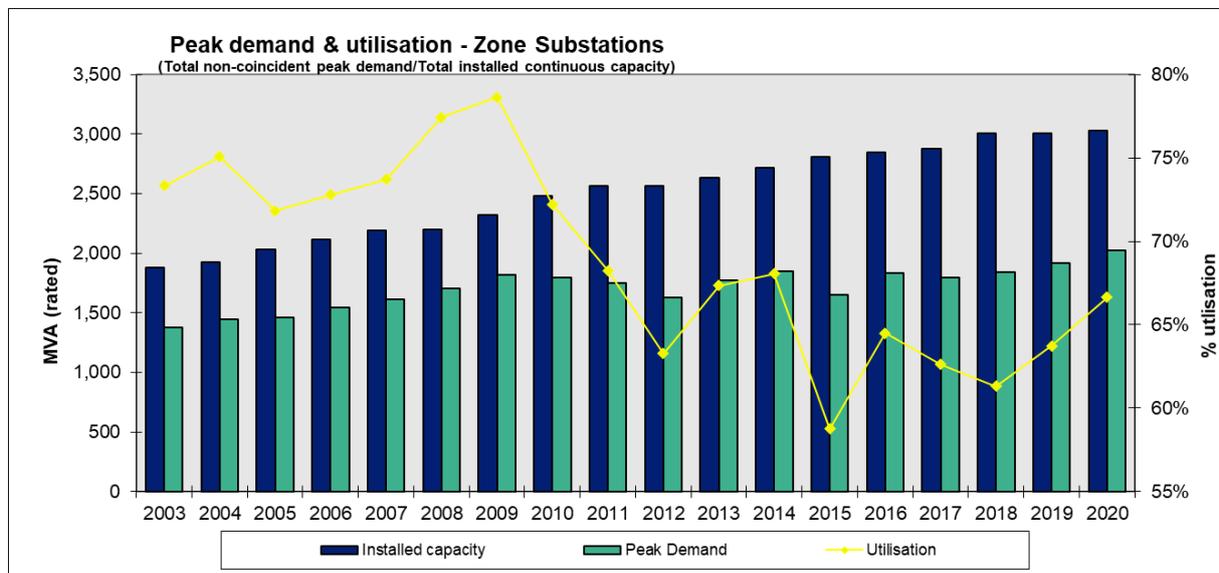


Figure 12: Peak Demand, Capacity and Utilisation

More detailed information on load growth forecasts are provided in AMS 20-12 Augmentation.

Ongoing network augmentation investment and significant expansion of the network in targeted urban growth corridors has managed the strong growth demand and new customer connections.

Overall zone substation peak demand utilisation has softened from the peak of 79% in 2009 to 63.7% in 2019 and is forecast to increase in a similar trend from previous years to 66.6% in 2020. The installation of additional capacity at zone substations, in combination with

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consumer response to the critical peak demand tariff, improvements in appliance efficiency and building thermal efficiency and consumer installations of solar photovoltaic (PV) arrays have driven this reduction in utilisation.

The distribution network provides connection for a substantial volume of embedded generation (EG) (small units, close to load, 3kW-5MW) as shown in Figure 13.

Solar PV and wind generation has increased significantly from 41MW in 2000 to 715MW in 2019. The increase in wind generation in 2015 is attributable to the Bald Hills windfarm, which is connected to the sub transmission system. There has been rapid growth in small scale (<30 kW) Solar PV connections, driven by lower technology costs and government rebates, resulting in an increase of 276MW of installed capacity from 2015 to 2019. Over 541MW of residential solar PV is currently connected to the LV network, and provides more than half of the embedded generation capacity within the network.

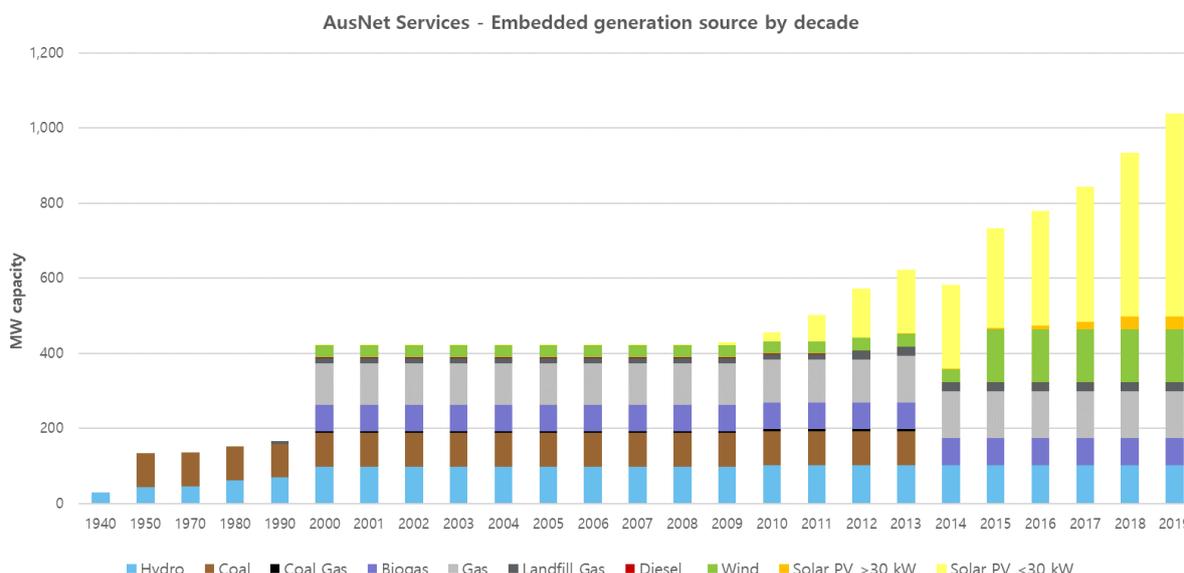


Figure 13: Distribution network embedded generation

7.2.2 Load at Risk

The load at risk at zone substation level (load through the 66/22kV transformers which is above the firm (N-1 rating) of the transformers) provides a high-level view of the supply risk carried in the distribution network.

Load at risk is expected to remain steady from 2018/19 to 2019/20, as illustrated in Figure 14, and will not reach the 2011/12 peak which was inconsistent with sound risk management and became a driver for significant investments.

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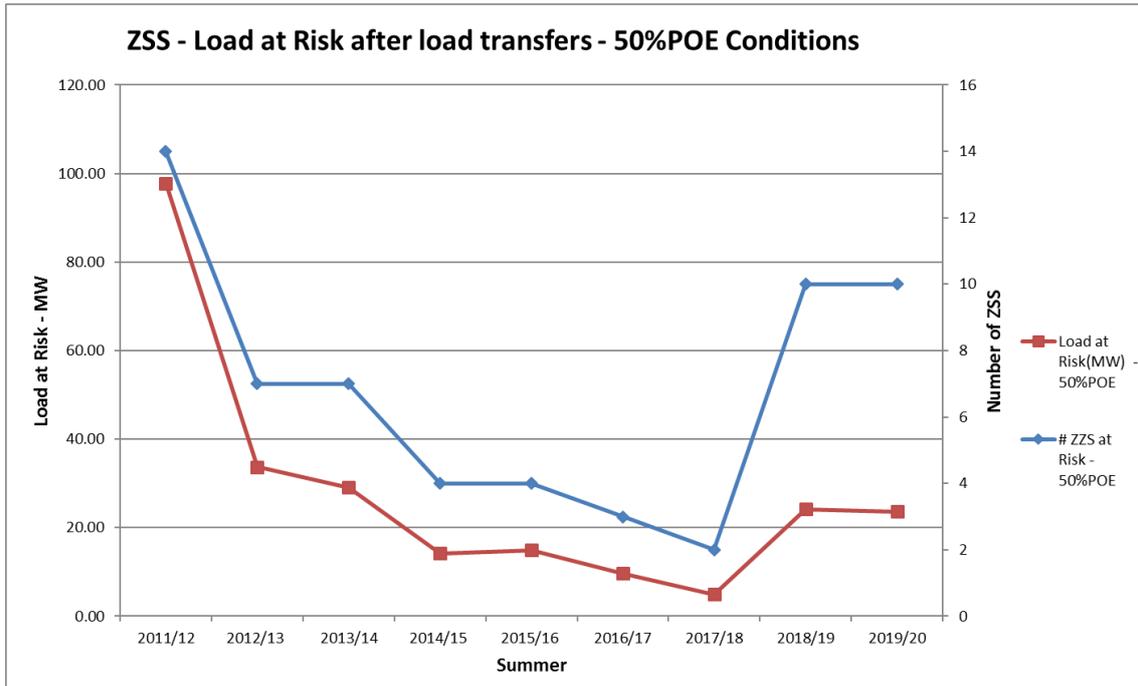


Figure 14: Load at Risk after load transfers

7.3 Reliability

Evidence suggests that when abnormal events are appropriately excluded, AusNet Services' underlying reliability performance remains relatively constant as shown in Figure 15 and Figure 16.

This aligns with customers strongly expressed preference to maintain current reliability levels.

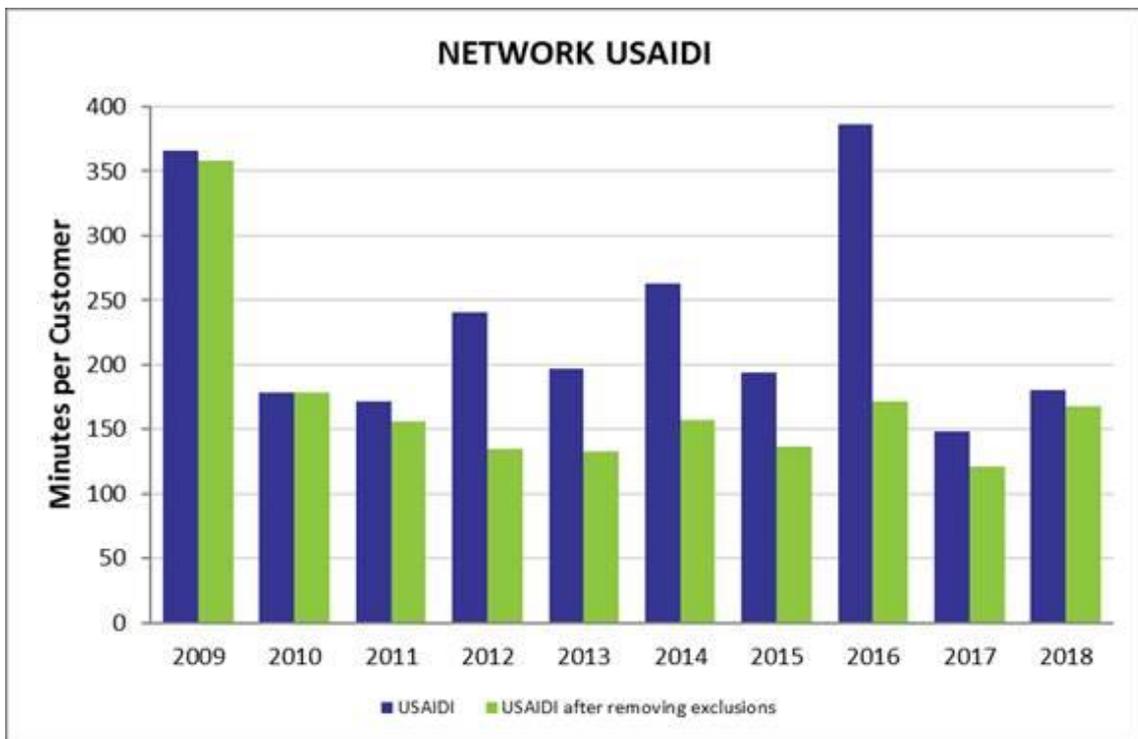


Figure 15: Unplanned SAIDI Performance

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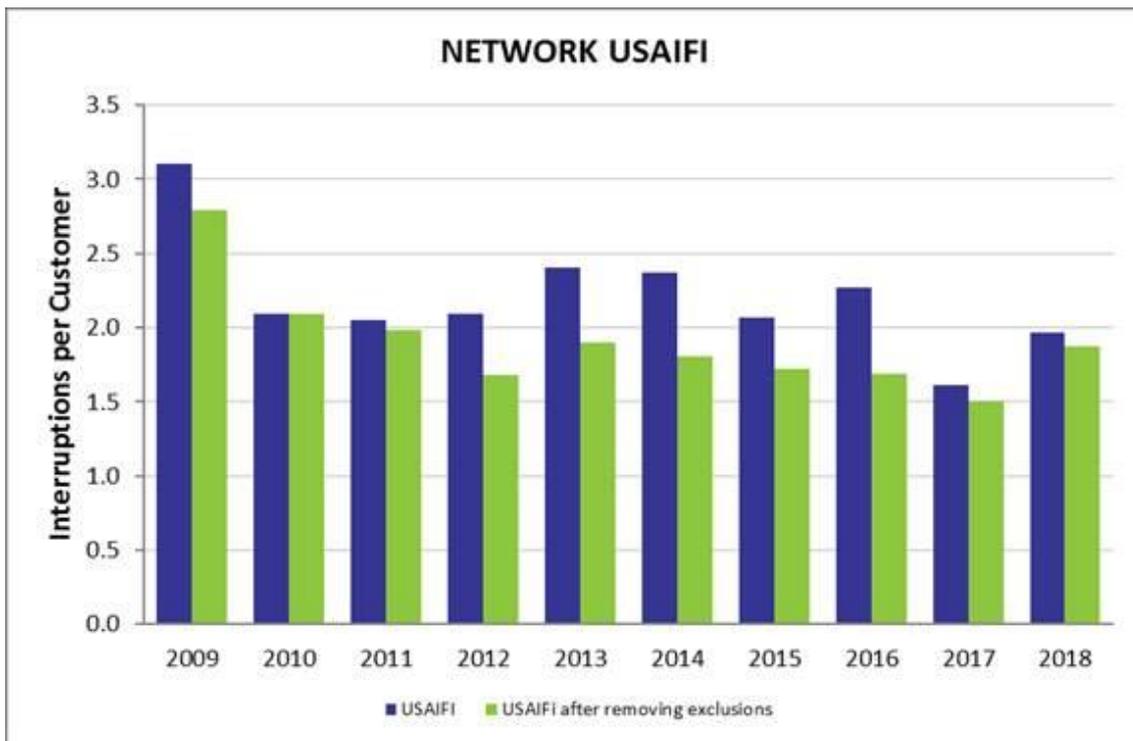


Figure 16: Unplanned SAIFI Performance

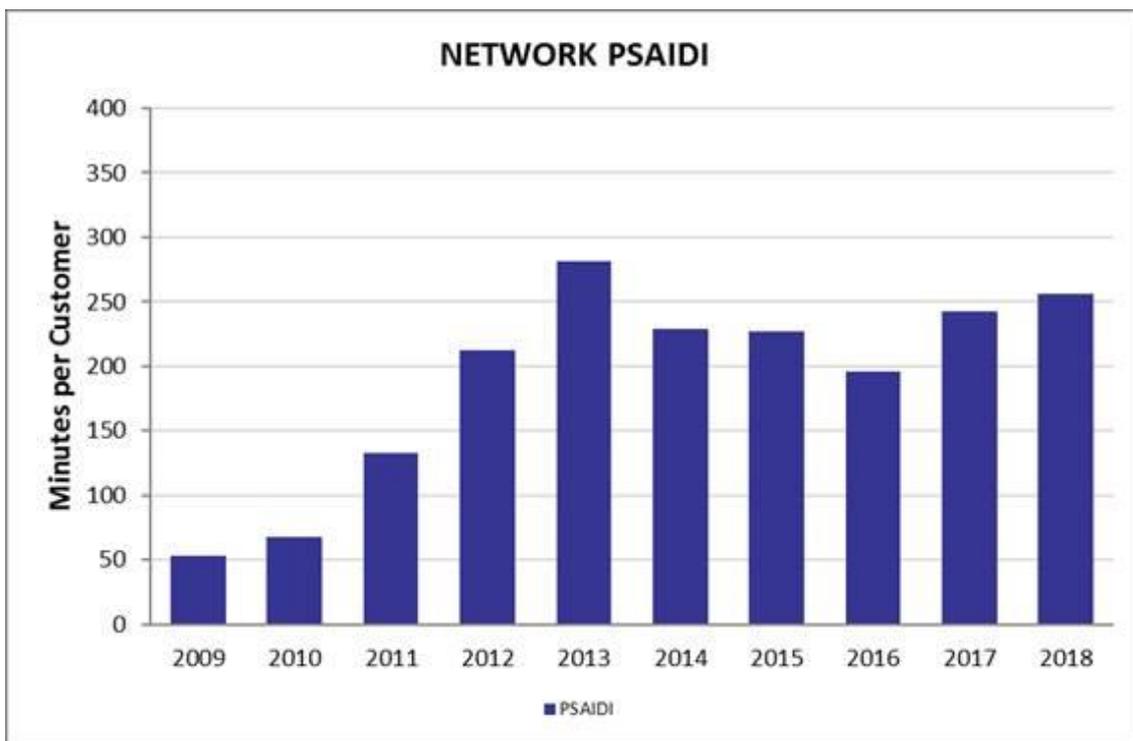


Figure 17: Planned SAIDI Performance

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8 PROCESS AND SYSTEM STRATEGIES

This section covers the major processes and systems required to manage the distribution network for the achievement of the desired outcomes.

In April 2014 the electricity distribution asset management practices were certified to *ISO 55001 Asset Management – Management Systems: Requirements* following transition from the superseded British Standard Institute's Publically Available Specification *PAS 55-1:2008 Asset Management*.

The asset management system was recertified in September 2017, with the auditors finding:

AusNet Services continues to operate a sophisticated and mature asset management system. As a result of focus on continuous improvements, there are increases in maturity across many of the ISO 55001 clauses.

There are two areas where improvements have not occurred, where maturity has declined, however, the issues related to these can easily be addressed within BAU activity.

Overall, AusNet Services is exceeding the requirements as defined by ISO 55001:2014.

8.1 Risk Management

AusNet Services operates a corporate Risk Management Framework¹⁸ based on *AS/NZS ISO 31000 Risk management – Guidelines*. The framework is a blue print to manage risk consistently across AusNet Services.

Risks are rated and prioritised under the following categories:

- Health and Safety (Employee and Public);
- Environment and Community;
- Reputation;
- Customers;
- Regulation, Legal and Compliance;
- Management Impact and People; and
- Financial Impact.

By adopting common metrics across the broad range of business risks and investment portfolios, AusNet Services can more effectively manage business risks and optimise network outcomes and objectives.

AusNet Services uses a range of techniques to identify and assess risk and thus determine the maintenance and replacement requirements for each asset class.

The various techniques are applied depending on the asset type and the asset data available. The range of resulting risk assessments and replacement forecasts are compared, contrasted and brought together using engineering judgement to inform the management of risk and development of maintenance programs and replacement forecasts.

Key strategies for the management of business and asset risks include:

- Integration of the risk management process into all processes used to make significant decisions and to deal with changes;
- Key controls are identified and allocated to nominated control owners for periodic verification that they are adequate, effective and cannot be cost effectively improved;

¹⁸ RM 10-01 Risk Management Policy and Framework, 2018, AusNet Services.

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- Conduct analysis after any significant incident, event, change or decision to learn from both successes and failures. This will include the use of root cause analysis;
- Maintenance of Emergency Operations Management Plans, the Mutual Aid Plan and Disaster Recovery Plans through AusNet Services' Integrated Response and Contingency System, SPIRACS¹⁹;
- Maintain standardised asset design, installation, operation and maintenance procedures;
- Establish contingency and risk mitigation plans where network risks have been identified as unacceptable;
- Utilise economic net benefit modelling and program prioritisation techniques;
- Manage risks 'as far as practicable';
- Determine asset criticality and/or risk scores for key equipment;
- Develop and implement risk based maintenance plans for key equipment; and
- Enhance risk based replacement and refurbishment programs.

Further information can be found in *RM 10-01 Risk Management Policy and Framework* and *AMS 01-09 Asset Risk Assessment Overview*.

8.2 Electricity Safety Management System (ESMS)

AusNet Services maintains an accepted Electricity Safety Management Scheme (ESMS) as required under the *Electricity Safety Act 1998*, in compliance with the *Electricity Safety (Management) Regulations 2009* and *AS 5577 Electricity Network Safety Management Systems*.

The ESMS forms an outcome based regulatory framework against which ESV maintain regular audits to monitor AusNet Services' compliance.

AusNet Services' Electricity Safety Management Scheme (ESMS) applies a full life cycle asset management philosophy for the management of its electricity distribution network. This management philosophy supports a continuous improvement approach toward the development and maintenance of preventative strategies designed to network safety risk.

In summary, the scheme contains information on:

- Executive officers responsible for the network;
- A description of the location, extent and scope of the scheme;
- A formal safety assessment including methodology, hazards identified and measures to reduce those hazards;
- A description of the management scheme including content, responsibilities, formal policy, technical standards applied and an asset management plan detailing the change management process;
- A system authorising access to the network and preventing access by unauthorised persons;
- Emergency preparedness plans;
- Monitoring, auditing and reviewing processes;
- Key Performance Indicators;
- Incident reporting and investigation processes;
- Competence and training;

¹⁹ 30-4006 AusNet Services' Integrated Response and Contingency System

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- Record keeping; and
- Reporting procedures for serious incidents.

Further details can be found in *ESMS 20-01 Safety Management System (Electricity Distribution)*.

8.3 Health and Safety Management

As explained in Section 2.9 Safety Vision, the AusNet Services safety vision is symbolised by the simple expression missionZero.

The AusNet Services' health and safety management system complies with the Occupational Health and Safety Act 2004 and is certified to the requirements of AS/NZS 4801 Occupational Health and Safety Management Systems by enabling a framework to manage health and safety across our business.

The primary aim of the health and safety management system is to establish an integrated, sustained and systematic approach to safety management in all areas of our activities.

Safety is a core value at AusNet Services.

Our missionZero HSEQ strategy will be achieved through:

- strong safety leadership;
- safe behaviour;
- safe work environment; and
- safety systems and measurement.

These missionZERO strategic elements are shown in Figure 18. Each of these elements feeds off the others to create awareness, continuous improvement and our goal of missionZero.

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Figure 18: Mission Zero Strategic Elements

We rely on our leaders to set clear behavioural expectations and reinforce the reasons why it is important to work safely. In turn, our people must always have safety “front of mind” and apply safe behavioural decision making guided by our HSEQ management systems (policy, procedures, guidance materials, training and audit program).

Our HSEQ Plan FY20 will continue our journey to ZERO supported by a safety strategy with four key components:

1. Safety leadership
2. Safe behaviour
3. Safe work environment
4. Systems and measurement

To ensure we energise our approach to the above four components of the strategy the following thinking will be used in the development of initiatives:

- Empowering – placing people at the centre of the solution.
- Positive – looking at the health of the safety system as a whole, look for positive outcomes and learning, not only negatives.
- Ethically Responsible – safety will be a matter of integrity, not bureaucracy.

Continuous improvement in HSEQ performance requires a commitment to improving line management accountability for safety and environment. Our leaders take responsibility for the safety of our people.

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The AusNet Services' HSEQ plan has been developed in consultation with the executive and forms the basis of the AusNet Services' vision and applies to all AusNet Services' operations.

8.4 Bushfire Mitigation

AusNet Services has a comprehensive and mature Bushfire Mitigation Plan (BFM Plan) in place that forms part of the ESMS.

AusNet Services submits an annual BFM Plan to ESV for acceptance. The BFM Plan seeks to mitigate wild fire ignition risks from network assets to levels as low as reasonably practicable. *BFM 21-79 Bushfire Mitigation Manual* and associated procedures contain a suite of policies, strategies, processes and systems to mitigate bushfire risk.

BFM strategies include:

- Monitoring and reporting systems:
 - Fire reporting, investigation and analysis procedures;
 - Management reporting systems and key performance indicators; and
 - Work management and prioritisation systems;
- Management:
 - Management committee with broad representation;
 - Auditing and compliance processes and systems; and
 - Monitoring of annual bushfire mitigation programs;
- Communication:
 - Annual advice to customers and stakeholders of their obligations;
 - Preparation of annual BFM Strategic Plan for employees and public;
 - Advertising of bushfire risks and programs in print and electronic media; and
 - Involvement of external and internal stakeholders in annual audit/review program.

8.5 Environmental Management

AusNet Services maintains a certified ISO14001 HSEQ Management System that applies to its networks.

The HSEQ management system is the principal tool through which AusNet Services identifies environmental risks, develops and implements solutions and monitors success in controlling such risks.

The HSEQ Management System drives the integration of policies, procedures and objectives pertinent to vegetation management, bushfire mitigation and environmental management to the AusNet Services HSEQ policy and environmental objectives.

In accordance with the core values of AusNet Services' Environmental Policy, the following programs have been identified as key environmental outcomes to be achieved:

- Manage oil spill risk;
- Manage asbestos risk;
- Manage noise abatement at zone substations;
- Minimise release greenhouse gases to the atmosphere;
- Manage arsenic risk; and
- Manage vegetation risk.

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Success of the above outcomes can be reflected in achievement of AusNet Services' corporate target of zero environmental compliance notices.

Strategies to achieve this include:

- Management of oil discharge:
 - Bunding of all plant >1000 litres
 - Bunding of plant <1000 litres where environmental risk evident
 - Regular inspection and maintenance of plant
 - Remote monitoring and alarm of selected bunded installations
 - Reporting and monitoring of oil spills
 - Maintenance of oil clean-up and mitigation procedures and training
 - Investigation into the use of biodegradable vegetable oils for transformer insulation
- Management of asbestos containing materials:
 - Enhancement of the asbestos register
 - Planned removal of asbestos, particularly during zone substation augmentation
 - Removal of friable asbestos containing materials
 - Maintenance of asbestos handling procedures and training
- Management of noise abatement:
 - Monitor noise levels of 'noisy' zone substations
 - Selection of plant with low noise characteristics
 - Maintain existing land buffers around stations
- Greenhouse gas reduction:
 - Introduction of energy efficient public lighting options for customers
 - Replacement of >80W MV public lighting with high pressure sodium (HPS)
 - Trial of energy efficient technologies (public lighting)
 - Monitor and implement where practicable, alternatives to and minimisation of atmospheric release of SF₆
- Management of arsenic:
 - Seek alternatives to copper chrome arsenic (CCA) treated timbers
 - Maintain procedures and training for handling and disposal of CCA materials
- Vegetation management:
 - Compliance with regulations, codes and guidelines, including annual submission of a Vegetation Management Plan to the ESV for approval
 - Maintenance of vegetation management systems and training
 - Participation and consultation with community forums and stakeholders groups
 - Establishment of sustainable vegetation practices within easements
 - Communication to stakeholders of suitable vegetation species within easements.

8.6 Condition Monitoring

The purpose of condition monitoring is to detect early stages of asset degradation before poor condition becomes a significant risk to the safety of personnel, the environment, the asset itself and network reliability.

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Condition monitoring is also an essential component of sound asset management which allows AusNet Services to evaluate, quantify and manage a variety of asset failure risks impinging on compliance, performance and safety through economic maintenance and renewal programs.

Condition monitoring includes a range of technologies (visual inspections, off-line testing, discrete and continuous online and non-invasive scanning techniques) which are constantly developing, more accurate and less disruptive asset condition evaluations.

Annual substation scans including portable radio frequency scans among others are currently occurring as planned activities.

There is an on-going development in the area to achieve earlier warnings at least cost. AusNet Services will benefit in collaborating efforts for such development and also supporting trials of emerging technologies.

Efforts will also be made to monitor those assets which do not have adequate CM regimes available currently i.e., underground cables.

New condition monitoring systems such as automated image processing using high resolution smart aerial image processing (SAIP) for ASCR (aluminium conductor steel reinforced) conductor condition assessment and continuous partial discharge (PD) monitoring of substations have potential to change the paradigm for reliability, safety and operating expenses.

High level strategies for condition monitoring are:

- Ensure integration with the ISO 55001 certified Asset Management System
- Adapt Condition Monitoring (CM) points, integrate with current business process and ensure input to the Enterprise Resource Planning (ERP) System
- Consider usability of smart sensors and associated asset data gathering systems.

For further information refer to *AMS 20-21 Condition Monitoring*.

8.7 Inspection and Maintenance

8.7.1 High-volume, low-value assets in public places

The low replacement cost for high-volume, low-value assets means maintenance, repair or refurbishment is rarely an economic option for this type of asset (a notable exception being poles where pole reinforcement, or staking, may be used to extend the life of a pole prior to replacement).

Thus, the majority of high volume, low-value assets are managed using inspection programs to trigger condition-based replacements.

Public safety, bushfire ignition and supply interruption consequences coupled with deterministic serviceability criteria are used to establish the business rules governing asset inspection intervals and refurbishment and replacement criteria.

Monte Carlo simulation techniques using purpose built software, such as Availability Work Bench, are valuable in optimising inspection intervals based on risk.

The inspection schedules and deterministic serviceability criteria appropriate to poles, cross arms, insulators and similar assets located in public places, or on easements in private property, are documented in *30-4111 Asset Inspection Manual*.

8.7.2 Low-volume, high-value assets in zone substations

The replacement cost for low-volume, high-value assets means that maintenance, repair and refurbishment become viable economic options in the management of this type asset.

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The following asset have reliability-centred and duty-cycle based inspection and maintenance programs:

- Three-phase automatic circuit reclosers;
- Line voltage regulators;
- Air-break medium-voltage switches; and
- Plant and equipment in zone substations.

These assets are subject to a combination of reliability-centred and duty-cycle based inspection and maintenance schedules driven by a combination of manufacturer recommendations, industry experience and failure rates.

The co-location of assets is an important factor in the optimisation of inspection cycles in zone substations. Maintenance schedules are optimised using asset condition and performance data.

Monte Carlo simulation techniques using purpose built software, such as Availability Work Bench, are becoming valuable in optimising inspection, maintenance.

8.7.3 Inspection and maintenance strategies

Inspection and maintenance strategies include:

- Maintain asset recording, condition and performance monitoring systems and processes;
- Selectively increase condition monitoring and diagnostic tests to predict the need, extent and timing of maintenance;
- Where practicable, create new assets with built-in condition monitoring and self-testing facilities;
- Automate the analysis of key asset condition and performance data;
- Monitor and adjust inspection and maintenance cycles to suit performance and condition requirements of network assets;
- Selectively refurbish or replace plant and equipment that is maintenance intensive;
- Enhance the use of criticality assessment in prioritising the maintenance effort;
- Integrated works management system for work scheduling and planning;
- Integrate portable data application devices in asset inspection and maintenance processes;
- Use benchmarking to identify opportunities to enhance asset maintenance practices; and
- Ensure appropriate stocks of spare parts are held at strategic locations.

8.8 Repair, Refurbishment and Replacement

8.8.1 High-volume, low-value assets in public places

Condition-based replacement triggered by inspection programs is the fundamental strategy used to manage the majority of high-volume, low-value assets.

The business rules governing refurbishment or replacement to generate a continuous, prioritised refurbishment and replacement program are documented in *30-4111 Asset Inspection Manual* and are used in the electronic asset management system (SAP).

Refurbishment and replacement forecasts for high-volume, low-value assets commence with identification of the homogenous cohorts within each asset class.

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The service age profile, condition profile and historic replacement rate are established for each cohort from asset management records.

Failure rates and associated consequences are established from outage management records.

End-of-life is modelled for each cohort based on the service age profile and failure/replacement rate. Models are calibrated by back-casting prior to use in forecasting future replacement volumes.

Failure Mode Effect Criticality Analysis (FMECA) is used to quantify failure modes and consequences which form the inputs to Monte Carlo simulation models for high-volume low-value assets.

Cost optimised Monte Carlo simulation models are used to quantify the most economic inspection and replacement strategies for each asset from the generic, replace-on-failure or replace-on-condition or replace-on-time strategies.

The relevant refurbishment or replacement strategy for each asset class is documented in the detailed plant strategies which underpin this document.

In addition to condition-based replacement programs, from time to time there may be compliance-based replacement programs, triggered by things such as the outcomes of the ESV directives from Powerline Bushfire Safety Taskforce (PBST) and Victorian Bushfire Royal Commission (VBRC) recommendations.

These compliance-based programs are detailed in *AMS 20-13 Enhanced Network Safety Strategy*.

8.8.2 Low-volume, high-value assets in zone substations

The fundamental principle underpinning the management of low-volume, high-value assets, located in zone substations, is the stabilisation of failure risk. Fleet-risk models are used to quantify the risks associated with low-volume high-value assets such as power transformers and circuit breakers.

Probabilities of failure are determined for each asset based on its assessed condition. Condition assessments draw on individual maintenance and failure records as well as fleet averages for similar equipment in other locations. The fleet-risk model aggregates the probabilities of failure for sub-fleets and the overall fleet of assets. This model is calibrated to the prevailing fleet failure rate.

Consequences of failure are calculated from the costs of repair, safety impact, environmental damage, collateral damage and supply interruption consequences for each individual asset. Calibration is achieved by comparison to recent events in the AusNet Services' network or in similar networks throughout Australia.

The calibrated fleet-risk model facilitates scenario analysis by which refurbishment and replacement plans which stabilize the fleet failure risks are optimised.

Individual items or asset classes identified for replacement are subject to business case development and approval.

Replacement activities associated with zone substation primary and secondary works are often integrated with augmentation works which have defined delivery schedules.

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8.8.3 Repair, refurbishment and replacement strategies

Strategies to ensure the timely and cost effective replacement or refurbishment of assets that ensure a safe and reliable supply of electricity to customers include:

- Undertake periodic reviews of asset condition, technical lives and management strategies;
- Undertake detailed modelling of asset classes to predict future replacements;
- Optimise asset replacement or refurbishment program through integration with asset augmentation programs and/or asset configuration;
- Develop detailed replacement plans for the next 10 years;
- Apply discounted cash flow techniques to quantitative criteria;
- Apply life cycle costing principles to economic analysis;
- Perform economic evaluations that are consistent with the relevant regulatory tests for all major asset renewal projects;
- Avoid asset replacement workload peaks through a combination of asset life extension programs and pre-emptive replacement programs;
- Asset replacement program to maintain zero BFM Index during declared fire season;
- Standardise plant and materials utilised in asset replacement and include training, operating, maintenance and replacement procedures;
- Ensure appropriate stocks of spare equipment are held at strategic locations; and
- Where practicable, new assets have built-in condition monitoring and self testing facilities.

The relevant refurbishment or replacement strategy for each asset class is documented in the detailed plant strategies which underpin this document.

8.9 Asset Management Information Systems

Key development strategies for the asset information systems include:

- Extend the electronic collection of data via mobile computing devices and automatic links between SAP and SCADA.
- Progressively implement the Enterprise Asset Management program to form a single authoritative asset and inventory register incorporating works management, and logistics management which includes:
- Consolidation of asset data from disparate systems within SAP system.
- De-commission disparate systems.
- Have common processes across the business for the same functions across the asset life cycle.
- As necessary, establish links from SAP system to other systems to facilitate automatic updates.
- Establish web browser architecture to facilitate remote access by authorised stakeholders to view information and reports.
- Implement a flexible reporting capability that caters for routine and ad hoc requests from stakeholders.
- Ensure that there are appropriate data security and data recovery plans in place.
- Leverage and extend GISConnect to display asset data which provides a net business benefit spatially.
- Remediate data quality issues to support critical business processes and reports.

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To support this, the Information Management (IM) Platform and Asset Risk Modelling (ARM) Use Case program has been created to develop the platform necessary to provide the asset data required to manage assets effectively and efficiently.

Figure 19 provides an overview of the Information Management (IM) Platform and Asset Risk Modelling (ARM) Use Case program.

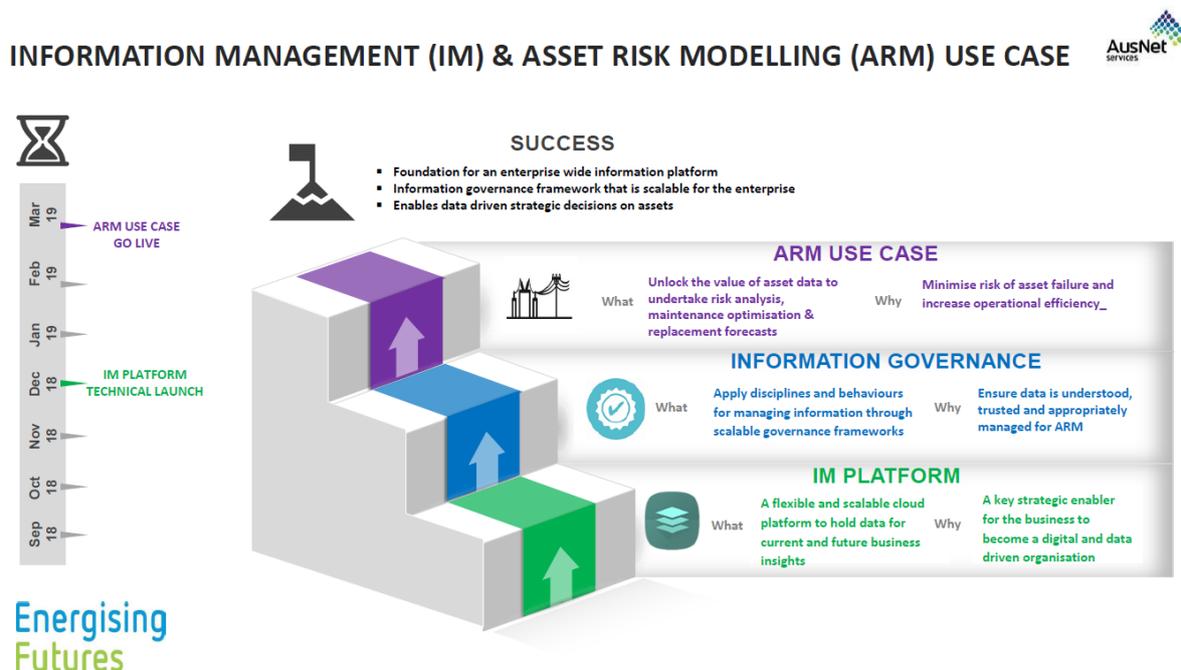


Figure 19: Information Management (IM) and Asset Risk Modelling (ARM) Use Case

8.10 Network Planning

AusNet Services’ planning for the sub-transmission network and distribution network is summarised in the *Distribution Annual Planning Report*, which is published on an annual basis and is also available on the AusNet Services’ website.

This report is prepared and published in accordance with regulatory requirements set out in the Electricity Distribution Code (administered by the Essential Services Commission of Victoria) and the requirements of clause 5.13.2 of the National Electricity Rules (the Rules).

The distribution network planning process provides transparency and facilitate regular opportunities for stakeholders to contribute to the cost effective augmentation of the electricity distribution network via either network or non-network solutions.

As part of its 2016-2020 electricity distribution determination, the AER incentivised DNSPs to explore non-network solutions through the demand management incentive scheme (DMIA)²⁰.

Further, the National Electricity Rules require DNSPs to consult with interested parties on the possible options, including but not limited to demand side options, generation options and market network service options to address projected network limitations.

Further information on network planning can be found in *AMS 20-16 Distribution Network Planning Standards and Guidelines*.

²⁰ [AER - Demand Management Incentive Scheme for Victoria](#)

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8.11 Economic Assessment of Projects and Programs

AusNet Services is focused on delivering optimal distribution network performance at efficient cost. Except in the case where outputs are mandated, this requires an explicit cost benefit analysis to be undertaken in order to ensure that capital expenditure is allocated most efficiently.

The process ensures that initiatives having the highest merit, assessed through cost/benefit analysis are given funding priority.

Projects and programs are selected for inclusion in budgetary provisions via application of high level cost/benefit comparison between initiatives. The projects and programs arise from planning studies and analysis conducted in developing asset management strategies.

Business cases are developed for individual projects and programs to ensure they are economically efficient via a net present value (NPV) analysis and this process also includes a detailed options analysis against identified alternative solutions.

In doing this, AusNet Services assesses the incremental costs of delivering an incremental change in network performance to customers, relative to the incremental benefits from the delivery of that enhanced network performance.

The AMS therefore ensures that all decisions to augment, replace or maintain network assets are justified on economic grounds. The benefits are a function of the explicit customer value proposition, or proxy via the adoption of minimum performance standards which are stipulated in legislation or other statutory or regulatory instruments.

The various drivers that are brought to bear when undertaking AusNet Services' Cost Benefit Analysis are summarised in Figure 20. An assessment of these drivers, both individually and collectively, are fundamental to the cost benefit analysis that underpins AusNet Services' approach to managing its network.

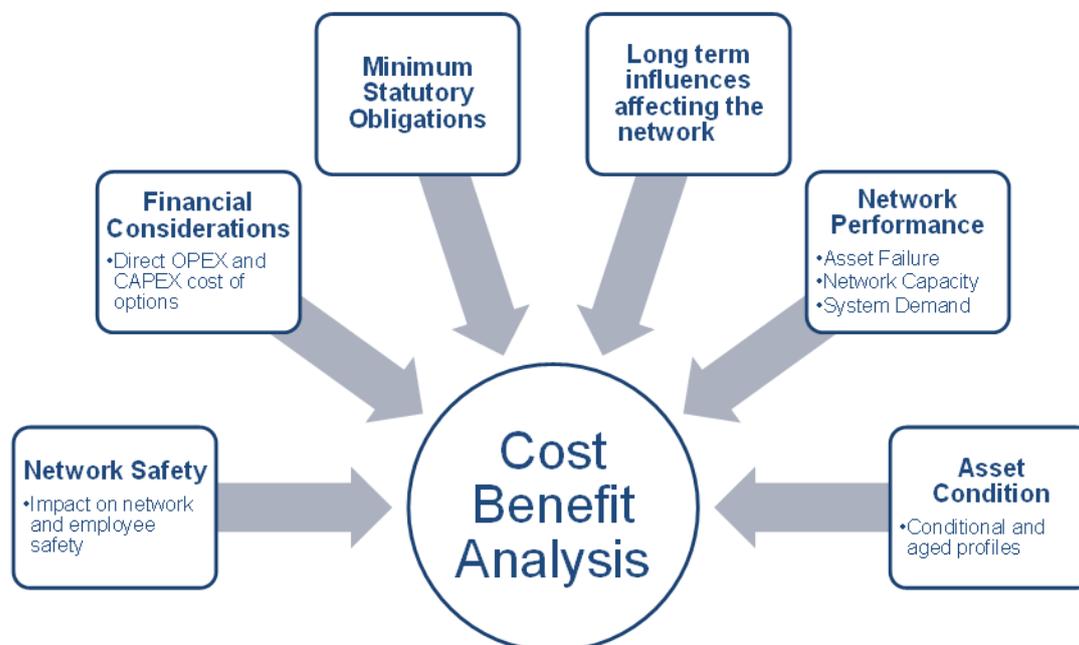


Figure 20: Cost Benefit Analysis Drivers

Final approval of programs/projects requires authorisation in accordance with AusNet Services' *Delegation of Authority Policy 10-1016*.

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8.12 Reliability

AusNet Services reliability goal is to maintain the reliability of electricity supplies to existing customers and provide reliable supplies to new customers in a safe, secure and economically efficient manner.

Key strategies in managing reliability include:

- Monthly reporting of reliability performance;
- Asset inspection and maintenance programs;
- Vegetation management program;
- Zone substation refurbishment projects;
- Targeted asset replacement programs; and
- Economic assessment process for projects and programs.

8.13 Quality of Supply

8.13.1 Steady State Voltage

Key strategies in managing steady state voltages include:

- Use AMI data to identify customers who are receiving steady-state voltage outside Code requirements due to the LV network and continue the ongoing Supply Improvement Program to reduce the number of customers experiencing voltage issues.
- Use AMI data and information from automatic circuit reclosers to identify SWER systems where steady-state voltage is out of code and continue the ongoing program of investment to reduce the number of SWER customers experiencing voltage issues.
- Use AMI data to identify sites where the distribution transformer taps or the phase connection could be changed to reduce the number of customers experiencing voltage issues.
- Utilise AMI data based plant utilisation factor (PUF) methodology to improve the detection of overloaded distribution transformers and ensure that expenditure is correctly targeted at distribution transformers that are actually overloaded and that overloaded transformers are detected before they lead to power quality issues. Continue the ongoing Distribution Transformer Upgrade Program to reduce the number of customers experiencing voltage issues.

8.13.2 Voltage Sags and Swells

Key strategies in managing voltage sags and swells include:

- Assessing the value of installing Neutral Earth Resistors (NERs) at zone substations that are planned to be rebuilt and do not currently have an NER installed. Proceed with the installation of an NER as part of the rebuild project where it is determined to be economic.
- Assess the impact of Ground Fault Neutralisers (GFNs) on transient voltage variations where the GFNs are being installed to mitigate bushfire risk. Consider whether the installation of GFNs can be justified to reduce the impact of transient voltage variations.
- Consider the protection implications arising from Bus-Tie Open Schemes.
- Influence equipment manufacturers to build sufficient voltage sag immunity into their products so that the equipment can ride through common power disturbances.

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8.13.3 Negative Sequence Voltage

Key strategies in managing negative sequence voltages is:

- To undertake rectification work where a customer is adversely affected by negative sequence voltages and rectification can be carried out economically.

8.13.4 Harmonics

Key strategies in managing harmonics voltage include:

- Feeder load balance.
- Transposition of 66kV lines.
- Respond to customer complaints on a case by case basis and, where necessary and economic, undertake corrective works.
- Consider undertaking a regular review of harmonics at zone substations.

8.14 Network Support Services

Network Support Services refer to the suite of non-network solutions and Demand Management (DM) techniques available for procurement by AusNet Services to manage the level of energy at risk on the network. Such services can include embedded generation, embedded storage and customer demand response.

Network support may be deployed to defer capital expenditure projects, reduce energy at risk levels or respond to network contingencies.

As set out in *AMS 20-35 Network Support Services*, AusNet Services evaluates the efficiency of non-network solutions alongside network augmentation solutions when considering its response to forecast constraints.

For larger capacity-driven requirements, this process is formalised by the Regulatory Investment Test for Distribution (RIT-D). AusNet Services also maintains a register of demand side suppliers and has published a Demand Side Engagement Strategy to ensure that the range of market offers for network support services are taken into account in the network planning process.

Over an extended period, AusNet Services has managed capacity constraints in the electricity distribution network by contracting permanent generators such as at Bairnsdale, deploying a fleet of containerised, mobile generators in Euroa, and hiring smaller generators for Nagambie and Phillip Island. In 2012 AusNet Services established a five-year Network Support Agreement to defer augmentation at Traralgon zone substation with an embedded generation service provider. AusNet Services has also employed temporary installations using smaller capacity diesel fuelled generators to mitigate the impact of planned network outages on customers.

In recent years, AusNet Services has procured the fleet of mobile diesel generators, has engaged large customers to provide demand response under network support agreements and has completed trials into the use of battery storage to provide network support at both grid-scale and behind the meter.

Increasing requirements for more economic and efficient solutions to manage short term constraints have emphasised the importance of non-network solutions and demand management to provide Network Support Services.

Successful use of Network Support Services relies on matching the network performance requirement with the technical performance capabilities and economics of the different types of services.

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These services cover demand-side response and installation of non-network solutions, and comprise:

- Commercial and Industrial Customer Demand Management;
- Embedded Generation (EG);
- Battery storage; and
- Residential Customer Demand Management (or Demand Response).

Network support services are usually applied in one of three main situations to help reduce the risk of customer supply interruption or avoid overloading network assets:

- Planned support to avoid forecast overload of feeder thermal ratings;
- Planned support to avoid forecast overload of zone substation N-1 ratings; and
- Unplanned emergency response to network contingency events.

AusNet Services has identified residential demand response as a key area in which to develop future network support capability. The introduction of advanced metering technology and availability of third-party aggregation services have opened up the prospect of addressing residential peak demand at-source.

Potential measures include:

- Tariff-based measures;
- Critical peak-demand rebates;
- Demand Response Enabled Device (DRED) controls;
- Demand limiting via smart meters;
- Embedded generation.

AusNet Services intends to engage further in this area of residential demand response.

Other technologies that have been identified as potential future options for network support include thermal storage in building cooling systems, high-efficiency cooling systems such as ground-source heat pumps and fuel cells that could offer network support generation with lower emissions of greenhouse gasses and noise compared to diesel generation.

8.15 Infrastructure Security

AMS 20-14 Infrastructure Security focuses on security enhancements for more than 50 zone substations, 2500 ground-mounted kiosks, voltage regulators, substations and indoor substations forming part of AusNet Services' electricity distribution network.

The Infrastructure Security Risk Assessment Tool (ISRAT) is used to assess physical security risks and control measures in AusNet Services' installations. *AMS 20-14 Infrastructure Security* is informed by more than 50 individual assessments of major sites, and 20 generic assessments for the multiplicity of less significant installations. These assessments are enhanced by a representative sample of physical inspections by qualified and competent Security Risk Management practitioners that validate the ISRAT findings.

AusNet Services' physical security control measures are founded on the following principles:

- Consistent risk identification and quantification;
- Defence in depth – increasing the number and sophistication of control measures commensurate with the degree of intrusion risk;
- Deterrence – measures including signage, lighting, site attendance, law enforcement awareness training (leading to patrol attendance) and more to deflect would-be intruders towards other targets;

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- Delay – measures including locks, fences, barbed wire and lighting to increase the time and effort required to successfully intrude;
- Response – Mobile Patrol and Security guarding measures to promptly and appropriately deal with intruders and associated consequences; and
- Contingency planning – measures to promptly recover service and minimise societal impact.

SPIRACS is AusNet Services’ Integrated Response and Contingency System and contains detailed instructions to inform and instruct a person tasked with managing security at any impacted sites to do so competently and comprehensively.

AusNet Services’ Corporate Security Policy details an organisation wide approach to security preparedness and, amongst other things, provides a detailed framework for the application and administration of access control protocols dictating staff access to sites.

8.16 Program Delivery

AusNet Services has implemented a Project Governance Framework – Stage Gate Process that sets out the process for managing programs and projects from conception, through the planning, business case approval, release, delivery and close out phases.

The Project Governance Framework – Stage Gate Process is shown in Figure 21. The Project Governance Framework is supported by detailed work instruction documentation and an internal resourcing model.

Program delivery is further supported by the formation of strategic alliances with external companies that provide design services, installation services and maintenance services.

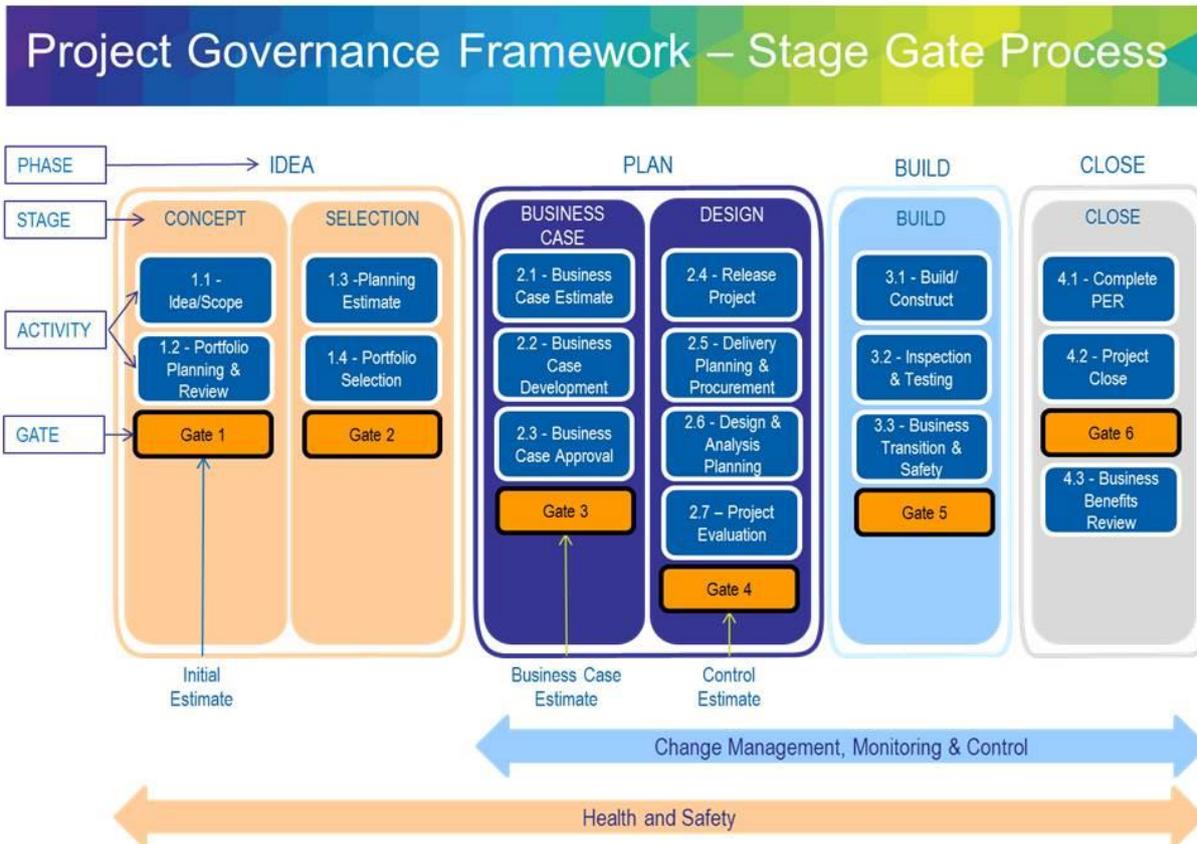


Figure 21: Project Governance Framework – Stage Gate Process

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The Program Delivery group provides management and resources to deliver the AusNet Services maintenance and capital works programs relating to network assets.

Strategic alliances have been formed with companies that provide design services, installation services and maintenance services. Contract arrangements are performance based with benchmarking of costs and standards to ensure that quality and value is maintained throughout the contract.

Strategies for program delivery and optimisation are:

- Maintain key internal resources within the Program Delivery area to ensure that strategic works and program control services can be sustained;
- Assess the synergies between the transmission and electricity distribution businesses with respect to resource planning by considering the common and similar skill areas;
- Plan maintenance and capital works to ensure the efficient use of resources, the maximisation of network availability and the reduction of risks to supply security;
- Provide program management resources on a functional basis, covering project control, estimation, engineering standards and field technical services;
- Use unified systems which link the core project activities of planning, estimation and costing. Use the Constructability, Operability and Maintainability review process to test and confirm the appropriateness of technical decision making at key stages in the development and execution of major network augmentation, refurbishment and replacement projects;
- Conduct internal Post Implementation Reviews of all projects, with key projects undergoing these reviews by independent, external consultants;
- Use the zone substation design guide and the pre-qualified design service providers to ensure that engineering and quality standards are maintained;
- Maintain construction resources within AusNet Services to ensure that key strategic projects can be delivered to the required schedule; and
- Control and supervise all site works through the field service areas to ensure safety, network security and quality of workmanship.

8.17 Operations Management

The operation of the overall system and of individual assets is a key part of asset management to ensure that system performance targets are achieved, the integrity of the assets is not compromised, and safety and environmental requirements are met.

Current sites have different information sent back and in differing formats together with overlap in responsibilities for systems and processes that add to the complexity of managing the distribution network.

An over-riding principle is to ensure that operational staff have access to systems that can provide them with relevant information in a format that assists them to make timely and accurate decisions.

The following strategies will provide improved operation of the network:

- Implement key SCADA system improvements including:
 - Continue to develop enhanced selective and automatic load-shedding systems to better protect and respond to energy and network; and
 - Increasing numbers and levels of intelligent functionality of distribution feeder automation schemes;
- Implement Distribution Management systems that provide real time monitoring, management and optimisation tools such that network components can be more

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effectively monitored for stress levels and fault activity to empower better predictive actions;

- Maintain and enhance plant operating thresholds and schedules to assist network controllers;
- Outage management system to be integrated with asset management systems and geographic information systems (GIS);
- Field personnel equipped with personal digital assistant (PDA);
- Continue to optimise the timing of the planned outages of assets using the maintenance management and network management systems;
- Continue to develop the interactive voice response (IVR) system linked to outage management system (OMS) to provide better information for customers when incidents occur;
- Continue to enhance and develop the direct contacting of customers during fault activity;
- Regular review of all current operational procedures to ensure they remain relevant with the introduction of new technologies; and
- Continue to enhance and ensure that the back-up Network Operations Centre and back up Data Management Centre are regularly tested.

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APPENDIX A SCHEDULE OF REVISIONS

Issue	Description
1	Creation
2	2006 Update and editorial
3	2007 Update and editorial
4	2008 Update and editorial
5	2009 Editorial and addition of detailed plant strategy summary
6	Update following review by Harding Katz
7	Updates and editorial
8	Section 7 editorial
9	Update pole expected lives
10	New AM Policy and formal approval by GGM NSD
11	Incorporate 'STEM'. Update reliability targets
12	Revision and editorial
13	Restructure, review and update
14	Align network strategies, review and update
15	Review strategies, reliability quality and demand. Align network objectives
16	2016 Update and editorial
17	2017 Update and edits
17.1	Minor edits, Objectives updated
18	2018 update.
19	<p>Minor spelling and grammatical changes. General formatting changes and re-ordering for consistency</p> <p>Section 2.7 Updated with Energising Futures</p> <p>Section 2.8 new business plan</p> <p>Section 3.1 demand figures updated</p> <p>Section 3.3 volume figures updated</p> <p>Section 4 revised and policy moved to appendix</p> <p>Figure 7 updated</p> <p>Section 6 reworded with no change to objectives</p> <p>Figure 8 updated</p> <p>Section 7 performance charts updated</p> <p>Section 7.2 revised</p> <p>Section 8.1 updated to include maintenance.</p> <p>Section 8.3 updated with HSEQ Plan FY20</p> <p>Section 8.10 details of planning standards removed</p> <p>Section 8.14 updated to align with AMS20-35</p> <p>Appendix Schedule of Revisions added</p>

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APPENDIX B ASSET MANAGEMENT POLICY

Empower communities and their energy future

This policy directs the content and implementation of asset management strategies, objectives and plans for AusNet Services' energy delivery networks. It provides employees, contractors, suppliers and delegates with guiding principles to underpin asset management decisions.

Our approach to Asset Management is centred around our objective to create a leading, modern energy company that will operate its networks in the top quartile of efficiency benchmarks with the aim to care for customers, enable their choices and strive to make their energy more affordable.

To achieve this we will:

- Minimise risks to the safety of any person and their property "as far as practicable".
- Place customers at the centre of our decisions to support their evolving needs and the changing energy landscape.
- Engage with our customers and stakeholders to understand and integrate their requirements in asset management decisions.
- Comply with legislation, regulation, relevant Standards and industry codes and actively contribute to the development of amendments that will benefit our customers and stakeholders.
- Use a risk-based approach to manage the energy networks and balance the environmental, economic, and social needs of today without sacrificing the interests of future generations.
- Use innovation, information and technology to facilitate a whole of life cycle approach to asset management to deliver value to our customers, communities and partners.
- Continually develop the skills of our people to ensure asset management activities are performed efficiently and effectively.
- Align and continuously improve our asset management processes and capabilities in accordance with certification to ISO 55001 Asset Management.

A handwritten signature in black ink.

Nino Ficca
Managing Director
5 April 2019

We work safely | We do what's right | We're one team | We deliver

Asset Management Strategy – Electricity Distribution Network

APPENDIX C PLANT STRATEGY DOCUMENTS

Table 6 lists the various plant strategies for electricity distribution assets.

Table 6: Plant Strategies

Document Number	Asset Class
AMS 20-52	Conductor
AMS 20-53	Zone Substation Capacitor Banks
AMS 20-54	Circuit Breakers
AMS 20-55	Civil Infrastructure Sites
AMS 20-56	Indoor Switchboards
AMS 20-57	Crossarms
AMS 20-58	Distribution Transformers
AMS 20-59	Electrical Earths
AMS 20-60	MV Switches and ACRs
AMS 20-61	MV Switches, Disconnectors and Earth Switches
AMS 20-62	HV Switches, Disconnectors and Earth Switches
AMS 20-63	Instrument Transformers
AMS 20-64	Sub Transmission Towers and Insulators
AMS 20-65	Insulated Cable Systems
AMS 20-66	Insulators – High and Medium Voltage
AMS 20-67	Line Surge Arresters
AMS 20-68	Line Voltage Regulators
AMS 20-69	Pole Top Capacitors
AMS 20-70	Poles
AMS 20-71	Power Transformers and Station Voltage Regulators
AMS 20-72	Protection and Control Systems
AMS 20-73	Public Lighting
AMS 20-76	Service Cables
AMS 20-77	Surge Arresters in Zone Substations
AMS 20-79	Neutral Earthing Devices
AMS 20-81	Communication Sites

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APPENDIX D ACRONYMS

ACR	Automatic Circuit Recloser
AEMC	Australian Energy Markets Commission
AER	Australian Energy Regulator
AMI	Advanced Metering Infrastructure
AMS	Asset Management Strategy
ASCR	Aluminium Conductor Steel Reinforced
BFM	Bushfire Management
C&I	Commercial and Industrial
CCA	Copper Chrome Arsenic
CM	Condition Monitoring
DER	Distributed Energy Resources
DFA	Distribution Feeder Automation
DM	Demand Management
DMIA	Demand Management Incentive Scheme
DNSP	Distribution Network Service Provider
DOMS	Distribution Outage Management System
DSP	Demand Side Participation
ECM	Enterprise Content Management
EG	Embedded Generation
ENA	Energy Networks Australia
ERP	Enterprise Resource Planning
ESC	Essential Services Commission
ESMS	Electricity Safety Management Scheme
ESV	Energy Safe Victoria
FMECA	Failure Mode Effect Criticality Analysis
GFN	Ground Fault Neutraliser
GIS	Geographic Information Systems
GSL	Guaranteed Service Level
HBRA	Hazardous Bushfire Risk Area
HSEQ	Health, Safety, Environment and Quality
HV	High Voltage
IRD	Innovation, Research and Development
ISRAT	Infrastructure Security Risk Assessment Tool
IVR	Interactive Voice Response
LV	Low Voltage

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MAIFI	Momentary Average Interruption Frequency Index
MV	Medium Voltage
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NER	Neutral Earthing Resistor
NGERS	National Greenhouse and Energy Reporting Scheme
NPV	Net Present Value
OMS	Outage Management System
PAC SIS	Protection and Control Setting Information System
PBST	Powerline Bushfire Safety Taskforce
PCB	Polychlorinated biphenyls
PD	Partial Discharge
PDA	Personal Digital Assistant
POEL	Private Overhead Electric Lines
PQ	Power Quality
PUF	Plant Utilisation Factor
PV	Photovoltaic
RADAR	Ratings Database Repository
REFCL	Rapid Earth Fault Current Limiter
RIT-D	Regulatory Investment Test - Distribution
SAIP	Smart Aerial Image Processing
SAMP	Strategic Asset Management Plan
SAP	AusNet Services electronic asset management system
SCADA	Supervisory Control and Data Acquisition
SDMe	Spatial Data Management Electricity
SPIRACS	AusNet Services' Integrated Response and Contingency System
STPIS	Service Target Performance Incentive Scheme
SWER	Single Wire Earth Return
USAIDI	Unplanned System Average Interruption Duration Index
USAIFI	Unplanned System Average Interruption Frequency Index
VBRC	Victorian Bushfire Royal Commission
VCR	Value of Customer Reliability