

2017 Safety Performance Report on Victorian Electricity Networks

31 October 2017

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Preface

ESV has had another busy year as we continue to improve how we regulate infrastructure safety.

Victoria does not generally prescribe through regulation the particular approach to network management; Victoria's regulatory regime places this responsibility on the major electricity companies and responsible persons (including councils for some vegetation clearance). This requires that these businesses demonstrate how assets are operated, maintained and replaced so that they remain safe and reliable and vegetation is kept clear of overhead lines.

In this regime, the major electricity companies must be able to understand the risks posed by their networks and demonstrate that all risks have been minimised as far as practicable. Businesses are required to ensure a balance of effort and cost considering not only the probability of safety risk materialising, but also the consequence. This approach recognises that businesses are best placed to make the complex trade-offs and assessment of decisions involving investment, operations and maintenance, and the management of risk. Thus, the safety outcomes expected by the Victorian community are met at the lowest cost to the community.

ESV's role is to test, challenge and expose how well the businesses are managing their networks through the assessment of Safety Cases, Electrical Safety Management Schemes and auditing and inspecting for compliance with these schemes and other regulations.

With the emphasis on safety cases during 2015-2016, ESV broadened its reach to add to its assessment of outcomes the examination of asset management practice. This approach was designed to secure assurance that the asset management practices of the businesses are sustainable over the longer term and will produce safe outcomes for the community and its workers.

ESV has spent considerable effort over the last twelve months educating and encouraging the major electricity companies to meet ESV's higher expectations. While this has entailed significant effort on behalf of all stakeholders, we believe that this will result in more transparent and robust safety outcomes.

The tools available to regulators to hold businesses accountable are many, but wherever possible regulators favour incentives for maximising performance. Enforcement and prosecution may, in some situations, be necessary. Like other regulators, ESV seeks to work with the businesses it regulates to achieve safety outcomes; however, this year finds us considering enforcement action against one of the network operators.

In January 2017, the Government announced a review of the state's electricity and gas network safety framework to ensure the effectiveness of the framework in delivering desired safety outcomes for Victorians. The review, headed by Dr Paul Grimes, is expected to release its final report later this year.

There have been many changes to the regulations underpinning the electrical networks, and ESV welcomed the opportunity the review presented to look to at the effectiveness of the overall regime and ESV as a regulator,

Over the past year there has been much discussion around what constitutes an appropriate asset regime for replacement of network assets. ESV's approach has been to work with the networks to improve monitoring that informs condition-based replacement. While we believe this provides for better safety and economic outcomes (and hence lower cost to consumers).

Last year we reported on the amendments made to the Electricity Safety (Bushfire Mitigation) Regulations that required the distribution companies to deploy covered conductor, automatic circuit reclosers and rapid earth fault current limiters in designated areas. We have been actively working with the distribution companies over the last twelve months in the deployment of these technologies. This will continue to be a specific focus of our Regulatory Assurance team until this program of works is completed in 2023.

As we head towards a summer of potentially high bushfire risk, we are reminded of the challenges posed by climate change and associated extreme weather conditions. ESV continues to work closely with government and industry to maintain the integrity of Victoria's networks, while helping facilitate the introduction of new technologies and business models into our evolving networks. ESV will ensure unashamedly that the safety of the Victorian public is not forgotten in discussions concerning our energy future.



Paul Fearon
Director of Energy Safety

Executive summary

This report addresses the financial year from July 2016 to June 2017. The previous report covered an eighteen month period so that this and subsequent reports captured an entire fire season. The report reviews the performance of the major electricity companies and analyses their performance over time, while looking for common themes and issues the industry faces.

There have been no fatalities attributable to electrical infrastructure during the twelve-month period covered by this report. The last fatality attributed to electrical infrastructure occurred in 2014 when a tree worker employed by a contractor died. No employee of a major electricity company has been killed since 2008.

Two incidents involving electricity distribution assets did result in injury:

- ▶ a crane operator received a shock and was taken to hospital for observation after making contact with a 22kV overhead powerline
- ▶ a scaffold worker sustained injuries when he contacted an 11kV powerline by extending a metallic object out from scaffold on which he was standing.

The major electricity companies are generally performing well and, while there is room for improvement, ESV has not (with one exception) observed evidence of systemic failure to operate or maintain the safety of their networks or to mitigate bushfire risk.

Powercor reported exceptionally high levels of noncompliant vegetation in the spring of 2016. The vegetation cutting rate did not assure ESV that all vegetation would be clear of lines before the relevant municipalities were declared by the CFA. Powercor determined that it was being overly conservative when reporting noncompliances and substantially reduced the number reported; ESV both challenged this performance and enhanced its inspection programme (for all MECs) to validate the state of the vegetation; ESV found a significant number of noncompliant spans. ESV has formally investigated this matter and is, at the time of writing, considering appropriate enforcement action.

On 1 May 2016 the Victorian Government amended the Electricity Safety (Bushfire Mitigation) Regulations. The amendments required the distribution businesses to reduce the bushfire risk presented by the lines emanating from 45 zone substations — AusNet Services Distribution (22), Powercor (22) and Jemena (1). This is to be achieved by:

- ▶ deploying appropriate technology to contain the energy released should a conductor contact earth
- ▶ covering or undergrounding substantially replaced electric lines in specified areas
- ▶ installing automatic circuit reclosers on each single wire earth return (SWER) line.

The delivery of these requirements is challenging and will run until May 2023. ESV has recruited the engineering resource necessary to effectively regulate these activities.

The government gazetted the F-factor Scheme Order in December 2016. This order establishes a new incentive mechanism that encourages the distribution businesses to target works to reduce those fire ignitions that present the greatest risk of harm to the community. ESV is charged with validating the fire start reports the distribution businesses provide to the Australian Energy Regulator (AER).

We have continued our assessment of the detailed safety cases we required the major electricity companies to develop last year. We require them to clearly articulate how they identify the safety risks associated with their operations and other activities. The safety cases also need to explain how the companies manage, in some detail, their operations and assets to reduce these risks to an acceptable level. As I explained last year, we require each company to provide a safety case in advance of submitting its Electricity Safety Management Scheme (ESMS) for approval. ESV has accepted Safety Cases from the majority of the businesses, and the ESMS assessments are progressing well. The one exception is the Jemena safety case; Jemena continues to struggle to articulate its management of safety risk clearly and concisely.

ESV has further developed its near real-time fire-start and bushfire preparedness reporting mechanism to provide greater detail and transparency of the businesses' preparedness to the Minister each week during the fire season.

ESV has worked hard to develop clarity and understanding of the risks it manages and the controls that are in place to prevent undesirable events occurring (for example, bushfire ignition). This work means ESV is becoming better placed to target its regulatory focus to better effect by using risk to inform its regulatory activity.

We are pleased to note that our incident reporting portal OSIRIS and our data analysis platform Conduit have both been adopted by the NSW Independent Pricing and Regulatory Tribunal (IPART). ESV has also engaged with the Country Fire Authority (CFA) and the Melbourne Metropolitan Fire Brigade (MFB) to improve data sharing with these organisations.

In general, the incidents in the 2016-2017 period were in line with the historical data for the period January 2010 to June 2016. More specifically:

- ▶ the monthly incidents were around the historical average in the winter and spring months
- ▶ the monthly incidents were below the historical average in the summer and autumn months
- ▶ seasonal variability was reduced in 2016-2017

The number of ground fires was below the historic average and the number of ground fires in December, January and February were respectively 45 per cent, 48 per cent and 38 per cent lower than the previous year.

Of the 446 fires reported, 56 per cent did not escape the equipment, and of the remainder:

- ▶ 21 per cent were smaller than 10 m²
- ▶ 15 per cent were between 10 m² and 1000 m²
- ▶ 7 per cent were between 1000 m² and 10 hectares.

Three fires exceeded 10 hectares; they were all in the Powercor area and were all outside the control of the distribution business.

Public interaction with electricity assets fall into three main areas:

- ▶ vehicles impacting electrical assets
- ▶ encroachment and contact with underground electrical assets
- ▶ all other encroachment and contact events, including theft, vandalism, unauthorised access to electric assets and breach of the No Go Zone.

The last of these categories was the most common event placing members of the public at risk last year. These events have been increasing since 2014-2015. Section 4.2 of this report provides further insight into these interactions.

ESV is increasing its focus on education and consultation with municipal councils. It is clear that councils have fewer resources and a lesser capability to manage vegetation near power lines (for which they are responsible in some areas). ESV is actively engaging with and helping councils understand both their responsibilities and how best to discharge them.

In the last report, we commented on ESV's analysis of fire starts across the State and how it demonstrated a strong correlation between fire events and weather conditions. We also noted that, to substantially reduce the risks of any particular fire start from electricity leading to catastrophic bushfire, a substantial change of approach is required to affect a change large enough to disrupt this correlation and reduce fire starts over the longer term. We anticipate that the deployment of the technology resulting from the amended Electricity Safety (Bushfire Mitigation) Regulations has the potential to cause such a change.



Ian Burgwin
General Manager
Electrical Safety and Technical Regulation

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1 INTRODUCTION

On 10 August 2005, Energy Safe Victoria (ESV) was established by the *Energy Safe Victoria Act 2005*. ESV is responsible for the safety and technical regulation of electricity, gas and pipelines in Victoria. ESV's Annual Report is tabled in Parliament each year by the Minister. The Annual Report outlines how ESV has discharged its responsibilities under the relevant Acts and regulations that it administers.

ESV is committed to the safe, efficient supply and use of electricity and gas. This is the seventh year that ESV has reported on the safety performance of the Victorian electricity distribution businesses and the sixth year it has reported on the safety performance of the Victorian electricity transmission businesses. This report informs stakeholders, the community, government and industry of how well these businesses are meeting their safety obligations.

This report also provides transparency of ESV's role in regulating the safety of electricity supply in Victoria and focuses on the key safety indicators reported by each major electricity company:

- ▶ incidents on the electricity network
- ▶ progress of directions placed on each distribution company to meet the recommendations of the 2009 Victorian Bushfires Royal Commission
- ▶ operation of each company's Electricity Safety Management Scheme
- ▶ results of audits and inspections of the major electricity companies, including those to assess the readiness of these companies for the bushfire season.

1.1 Aim

The aim of the report is to inform the community, government and industry of how the major electricity companies have performed when delivering their electricity network safety obligations.

This report covers the 2016-2017 financial year (FY1617), being the 12-month period from 1 July 2016 to 30 June 2017.

1.2 Objective

The objective is to analyse the broad range of safety-related information that ESV acquired during the 2016-2017 financial year to highlight areas of good and bad performance, identify common themes and trends, draw conclusions and make appropriate recommendations.

1.3 Scope

The report assesses data supplied by each major electricity company and examines the safety performance of each major electricity company for 2016-2017 financial year. Some longer-term trends are also discussed.

2 REGULATORY CONTEXT

The *Electricity Safety Act 1998* (the Act) vests ESV with the statutory objective of ensuring electrical safety across Victoria. The responsibility for the safety of Victoria's electricity transmission and distribution networks lies with two groups defined in the Act that ESV regulates — the major electricity companies and responsible persons. These groups and the regulatory context for ESV's powers are described below.

2.1 Major electricity companies

2.1.1 Description

Major electricity companies comprise both licenced electricity transmission companies and licenced electricity distribution businesses.

Statistics on the major electricity companies are provided in Table 1.

While generally similar in engineering terms, the major electricity companies have evolved differently as various engineering solutions have been adopted in line with the different environments affecting their operations. These differences include geography, topography, customer base and operating environment; all of which have the potential to influence safety performance. As such, care must be taken when comparing the performance of the individual major electricity companies; direct comparisons often may not be possible.

2.1.2 Regulatory requirements

The safety performance of the major electricity companies is measured in the context of compliance with the Act as underpinned by subordinate regulations that include:

- ▶ Electrical Safety (Management) Regulations 2009

These establish the requirement for each major electricity company to submit an Electricity Safety Management Scheme (ESMS) to ESV every five years for acceptance. ESV regularly audits each major electricity company for compliance with its ESMS.

In 2015, ESV introduced the requirement to submit a Safety Case as a precursor to preparation of an ESMS.

- ▶ Electricity Safety (Bushfire Mitigation) Regulations 2013

These establish the requirement for each major electricity company to submit a Bushfire Mitigation Plan (BMP) to ESV every five years for acceptance. ESV regularly audits each major electricity company for compliance with its BMP.

- ▶ Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016

The Amendment Regulations placed additional bushfire mitigation requirements on the major electricity companies. These requirements are discussed in more detail in Sections 3.1.1 and 5.2.2.

- ▶ Electricity Safety (Electric Lines Clearance) Regulations 2015

These establish the requirement for each major electricity company to submit an Electric Line Clearance Management Plan (ELCMP) to ESV each year for acceptance. ESV regularly audits and inspects each major electricity company for compliance with its ELCMP.

As the primary operators of Victoria's electricity networks, this report predominantly focuses on the performance of the major electricity companies.

Table 1 Electricity network statistics

Transmission companies	
AusNet Services	
Voltages:	500kV AC and 220kV AC transmission across Victoria ¹ 66kV AC sub-transmission across Victoria 330kV AC on interconnector to New South Wales 275kV AC on interconnector to South Australia
Powerline length:	6573 km
No. of towers:	13,000 approx.
Basslink	
Voltages:	500kV AC and 400kV DC link between Loy Yang power station in south east Victoria and George Town in northern Tasmania
Powerline length:	67 km total in Victoria 3.2 km of 500kV AC overhead line 57.4 km of 400kV DC overhead line 6.6 km of 400kV DC underground cable
No. of towers:	142
Transmission Operations Australia	
Voltages:	132kV from Mt Mercer Wind Farm to Elaine Terminal Station
Powerline length:	22 km
No. of towers/poles:	162
Transmission Operations Australia 2	
Voltages:	132kV from Ararat Wind Farm to Ararat Terminal Station
Powerline length:	21 km
No. of towers/poles:	106

Distribution businesses	
AusNet Services	
Customers:	679,000 approx (90% residential)
Service area:	80,000 km ²
Powerline length:	49,816 km (85% rural, 13% underground)
No. of poles:	380,000 approx.
CitiPower	
Customers:	321,000 approx (85% residential)
Service area:	157 km ²
Powerline length:	7406 km (25% CBD, 40% underground)
No. of poles:	59,000 approx.
Jemena	
Customers:	319,000 approx (89% residential)
Service area:	950 km ²
Powerline length:	6,300 km (86% urban, 29% underground)
No. of poles:	104,000 approx.
Powercor	
Customers:	748,000 approx (85% residential)
Service area:	145,651 km ²
Powerline length:	84,790 km (92% rural, 11% underground)
No. of poles:	530,000 approx.
United Energy	
Customers:	640,000 approx (90% residential)
Service area:	1472 km ²
Powerline length:	13,000 km (25% urban, 20% underground)
No. of poles:	209,000 approx.

¹ AC = alternating current. DC = direct current, kV = kilo Volt (or 1000 Volt).

2.2 Responsible persons

2.2.1 Description

The Act identifies responsible persons in addition to the major electricity companies. These persons fall into two groups:

- ▶ councils in declared areas defined under Section 81(1) of the Act
- ▶ Specified Operators who are termed in the Act as persons that own or operate a high voltage (HV) overhead electric line in a Hazardous Bushfire Risk Area (HBRA) as declared by a fire control authority under Section 80 of the Act.

Not all council areas contain declared areas. Of the 79 municipal councils across Victoria, all 31 metropolitan councils and 35 of the 48 regional councils are responsible persons.

Responsible persons include several wind farms and power stations, the Australia Defence Forces/Defence Estates Victoria, Australian Paper Maryvale, Fosterville Goldmine, Melbourne Water, Melbourne Metro and Yarra Trams.

2.2.2 Regulatory requirements

Under the Act, responsible persons are required to maintain vegetation clear of overhead electric lines within their declared areas (in the case of councils) or along their electric lines (in the case of other responsible persons).

Responsible persons are required to produce an ELCMP annually, but are not obliged to submit it to ESV for approval. ESV can, and does, require such responsible persons to provide their ELCMP for audit.

2.3 ESV regulatory program

As part of its regulatory program ESV undertakes the following:

- ▶ mandatory safety plan reviews for each major electricity company
 - Safety cases
 - Electricity Safety Management Schemes
 - Bushfire Mitigation Plans
 - Electric Line Clearance Management Plans
- ▶ review of ELCMP for responsible persons (at ESV request)
- ▶ audits, inspections and observations
 - planned audits and inspections of safety plan implementation
 - planned and opportunistic observations of works practices
 - inspections of vegetation clearance and bushfire mitigation works in spring to ascertain readiness for the summer bushfire season.
- ▶ safety incidents
 - tracking and analysis of reportable safety incidents
 - investigation of major safety incidents
- ▶ directions and exemptions
 - monitoring of major electricity company performance in implementing ESV directions regarding asset safety upgrades
 - assessing requests for temporary exemptions from meeting the regulations, particularly during transitional periods after the declaration of new regulations
 - assessing exemptions related to the installation of electric lines on public lands.

2.3.1 Directions

Following the 2009 Victorian Bushfires Royal Commission, ESV issued directions to all distribution businesses to undertake upgrades of assets that had been identified by the Commission as having the potential to cause future bushfires. The two directions issued by ESV related to:

- ▶ installation of armour rods and vibration dampers to reduce wind-induced vibration and fatigue
- ▶ installation of spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines to prevent clashing of lines under high wind load.

These directions required the businesses to complete all works in the Hazardous Bushfire Risk Area (HBRA) by 2015 and in the Low Bushfire Risk Area (LBRA) by 2020. The progress of the businesses in completing these directions is included in this report.

ESV also issued a direction to Powercor on 11 July 2014 and to AusNet Services on 27 June 2014 on behalf of the Victorian Government's Powerline Replacement Fund. The directions required them to complete certain powerline replacement projects to be delivered by specified dates and to report progress monthly. The requirements of the directions were subsequently incorporated into their Bushfire Mitigation Plans.

2.3.2 Exemptions

With changes to regulations, the major electricity companies may not be immediately compliant with the new regulations. At these times, a company may seek a temporary exemption from the regulations to allow time to effect changes to its network and transition to compliance with the new regulations.

ESV has the power to grant such exemptions. In making such a decision, ESV seeks commitments from the company regarding works to be undertaken and timetables for achieving compliance, and will then monitor progress towards successful completion.

3 RISK MANAGEMENT AND GOVERNANCE

Since the 2016 Network Safety Performance Report, ESV has been developing a range of initiatives to improve its risk management and governance processes. The outcome of these processes will be closer oversight of the major electricity companies, councils and other responsible parties.

3.1 Responding to changes in the regulatory environment

3.1.1 Amended bushfire mitigation regulations

On 1 May 2016, amendments to the Electricity Safety (Bushfire Mitigation) Regulations commenced. The amended Regulations placed additional bushfire mitigation requirements on each major electricity company. These requirements are to ensure that all polyphase electric lines originating from selected zone substations achieve a required capacity², that electric lines in designated electric line construction areas³ are covered or placed underground, and that Automatic Circuit Reclosers are installed on all SWER lines.

The Victorian Parliament has since made the Electricity Safety Amendment (Bushfire Mitigation Civil Penalties Scheme) Act 2017, which commenced on 1 September 2017, and amended the Electricity Safety Act 1998 to specify civil penalties in cases where a major electricity company fails to meet the additional bushfire mitigation duties.

ESV is responsible for administering this legislation, and has ensured the necessary resources are available to regulate this activity effectively within the regulatory timeframes.

3.1.2 F-factor scheme

The F-Factor Scheme Order 2016 was gazetted on 22 December 2016. This Order revokes the previous F-Factor Scheme Order that commenced on 23 June 2011. The new Scheme establishes a new incentive mechanism that encourages the distribution businesses to target works (asset replacement, maintenance and operations) to reduce those fire ignitions that pose the greatest risk of harm.

The new Scheme weights each ignition by its location and time, with higher penalties imposed for fires of greater potential consequence.⁴ The location risks align with areas of highest consequential bushfire risk across the state and, consequently, with the areas designated for deployment of mitigation technologies under the new Electricity Safety (Bushfire Mitigation) Regulations (see Section 5.2.2). The time risk aligns with the Fire Danger Ratings declared by the Bureau of Meteorology.

The Scheme is managed by the Australian Energy Regulator (AER), with the AER being able to request ESV to validate the fire start reports submitted by the distribution businesses.

Under the Scheme, each business is required to submit a fire start report to the AER by 30 September each year. Where required, ESV will review these reports and submit individual validation reports to the AER by 30 November each year.

The first fire start reports under the new Scheme will be submitted to the AER by 30 September 2017, covering a period of 1 July 2016 to 30 June 2017.

ESV has been working with the AER throughout the year to develop standard templates for the fire start reports and terms of reference for the independent audit that each business will submit with its fire start report.

² The Amendment Regulations set targets to be achieved by 1 May 2019, 1 May 2021 and 1 May 2023 in nominated areas.

³ The Electricity Safety (Bushfire Mitigation) Regulations 2013 refer to these as “electric line construction areas”.

⁴ Further details on the new F-Factor Scheme can be found at <https://www.energy.vic.gov.au/safety-and-emergencies/powerline-bushfire-safety-program/f-factor-incentive-scheme>.

3.1.3 Grimes Review

On 18 January 2017, the Minister for Energy, Environment & Climate Change Lily D'Ambrosio announced that the Victorian Government would review the state's electricity network safety framework. The main objective of the review is to ensure the effectiveness of the framework in delivering desired safety outcomes for Victorians. The review is headed by Dr Paul Grimes.

In May 2017 the Minister expanded the scope of the review to include the regulation of gas and pipelines infrastructure.

The review is to considering:

- ▶ the objectives of the safety framework in Victoria and an assessment of its effectiveness in achieving electricity network safety outcomes
- ▶ the design and adequacy of the safety regulatory obligations (including safety cases and the Electricity Safety Management Scheme), incentives and other arrangements governing energy network businesses and any opportunities for improvement
- ▶ the extent to which the regulatory framework governing network safety ensures effective risk management by energy network businesses
- ▶ the effectiveness of the regulator and governance arrangements in place to monitor and enforce compliance with safety obligations by energy network businesses
- ▶ any other matters that the Chair considers relevant.

In undertaking the review, the Chair is to have regard to:

- ▶ best practice electricity safety and risk management frameworks in other jurisdictions, including nationally and internationally
- ▶ the relationship between the safety regime and the economic regulatory regime to ensure a balance between safety objectives and economic impacts including the cost impost on consumers

The Chair is to produce an interim report, with the final report and recommendations to be presented to the Minister for Energy, Environment and Climate Change by December 2017. Unless specifically excluded, the interim and final report and recommendations will be made publicly available.

3.2 Improving ESV practice

ESV has continued to improve its regulatory practice to provide better understanding of the industries it regulates and ensure appropriate rigour is applied to its decision-making such that it remains consistent, predictable and defensible.

Safety case and ESMS reviews are now managed through a documented process that leads to the presentation, by the evaluation team, of a case for acceptance being made to an independent panel of senior executives and managers. The responsible General Manager then accepts the safety case or ESMS. Any appeals are referred to the Director. This approach provides assurance that:

- ▶ sufficient rigour is applied to an assessment
- ▶ consistent practice across all ESV divisions
- ▶ consistent standards are applied when assessing submissions.

3.2.1 Risk-based regulation

ESV has undertaken substantial work to develop clarity and understanding of the risks it manages and the controls that are in place to prevent undesirable events occurring (for example, bushfire ignition). This has required ESV staff to carefully analyse how an event might come to pass and document the types of controls and barriers that are in place to prevent that event occurring. This degree of clarity enables ESV to better articulate its risk mitigation expectations.

This work means ESV is using risk to inform its regulatory activity in three areas:

- ▶ regulatory assurance to provide metrics to validate that regulation is effective and delivering acceptably-safe outcomes
- ▶ regulatory targeting or the use of lagging and (in future) leading indicators to inform regulatory focus
- ▶ regulatory performance to advise on how ESV is performing as a business.

3.2.2 Audit and inspection practices

Previous reports have described ESV's OSIRIS safety incident reporting system and its data analysis platform, Conduit. ESV has continued to improve these tools and develop them to better meet its needs.

ESV is now developing tools to enable it to capture its field inspection findings electronically and upload these into Conduit to enable better analysis to inform regulatory assurance and targeting. ESV will develop similar tools to analyse its past and future audit results.

3.3 ESTR expansion

The Electrical Safety and Technical Regulation division (ESTR) has started to grow its capability during the 2016-2017 period and will continue to do so during 2017-2018. This is driven by a need to secure greater assurance that the major electricity companies are appropriately delivering their current regulatory obligations and will deliver their new obligations under the changes discussed in Section 3.1.

Therefore ESV is recruiting to service its activities around:

- ▶ oversight of vegetation management and overhead line clearance
- ▶ oversight of asset and risk management practices
- ▶ data capture, management and analysis.

The expansion of ESTR will allow ESV to better test, challenge and expose the effectiveness of regulated entities in their capacity, and willingness, to comply with the regulations. In turn, this will allow ESV to better manage the network-related risks to the Victorian public.

The process began in 2016-2017 with the Line Clearance Assurance team recruiting additional subject matter experts and the Regulatory Assurance team restructuring to better target its activities. The Analytics and Intelligence team also undertook the development of an ESV-wide data strategy (see Section 3.4.

This expansion will continue in 2017-2018 with the recruitment of additional line clearance field inspectors and asset management engineers. There will also be further recruitment to expand ESTR's data capabilities to implement ESV's data strategy.

3.4 Data strategy

As noted in the 2016 Safety Performance Report, ESV has improved its data analytics capabilities through the development of its OSIRIS and Conduit web portals.

OSIRIS, which went live on 1 October 2015, allows the major electricity companies to report incidents to ESV in a consistent manner across all networks using common terminology. It also ensures that a minimum level of mandatory information is provided on all incidents in a format that allows for statistical analysis.

In the last twelve months, ESV has rolled out its Conduit portal that allows ESV's compliance officers to access standardised and self-guided analyses on near real-time data. This enhances ESV's investigatory capacity to consider individual incidents within a spatial context, to identify trends and to target investigations of specific risks.

ESV continues to identify ways to improve both these portals.

Recognising the need for better data analytics to support regulatory functions across the whole organisation, ESV undertook a review of the current state of its data management and analytics capabilities. The outcomes of this were captured in a Data Management and Analytics Strategy, where a number of opportunities were identified to raise ESV's analytics capabilities to support management and regulatory reporting and decision-making.

Improved data analytics is vital for supporting ESV's risk-based, evidence-based approach to regulation. This will see continued growth and improvement of analytics within ESV.

Within this context, ESV will continue to investigate the collation of legacy data held within ESV, to improve coordination with other agencies and to explore opportunities to expand the datasets available for analysis.

3.5 Inter-agency liaison

ESV has commenced discussions with the Country Fire Authority (CFA) and the Melbourne Metropolitan Fire Brigade to improve data sharing between the three organisations. This includes mechanisms for improved reporting between the three organisations (where there is a statutory responsibility to do so) and for increased collaboration (where the organisations can support each other in meeting their statutory responsibilities).

The CFA is currently preparing a Memorandum of Understanding to underpin any data sharing arrangements. Among other matters, this will consider controls to protect privacy of personal data and ownership of data.

ESV and CFA have also had discussions about setting up community of practice in data analytics and reporting. This will allow sharing of knowledge between data practitioners within the three organisations and, in turn, assist in building a more robust data expertise for support of improved delivery of each organisation's statutory responsibilities.

The ongoing arrangements for an effective inter-agency relationship between WorkSafe Victoria (WSV), Transport Safety Victoria (TSV) and ESV have been further improved with regular scheduled meetings occurring at the executive and operational management level. A communications protocol and jurisdictional matrix have also been collaboratively developed and being tested against various scenarios at biannual inter-agency workshops.

4 SERIOUS ELECTRICAL INCIDENTS

The safety of the public and workforce is the highest priority for ESV, and therefore the investigation of serious electrical incidents is a key function of ESV. Serious incidents are defined as those that cause or have the potential to cause the death or injury to a person, significant damage to property or a serious risk to public safety.

No fatalities due to electrical infrastructure were reported between 1 July 2016 and 30 June 2017.⁵

While serious electrical incidents overall were substantially reduced, there were two incidents where people were injured involving electricity distribution network assets when:

- ▶ a crane operator received a shock and was taken to hospital for observation after making contact with, and bringing down, two 22kV HV conductors of an overhead powerline while moving a road barrier
- ▶ a scaffold worker sustained injuries to both hands and his thighs when he contacted an 11kV HV powerline by extending a metallic object out from scaffold he was standing on.

In addition to the above serious incidents ESV also conducted investigations of incidents that posed a serious potential risk to public safety. Below are two of the major investigations ESV conducted during this period.

4.1 Major investigations

4.1.1 Alcoa 500kV line failure

In December 2016 there was a complete loss of electricity supply from Victoria to Alcoa Portland and South Australia. A conductor failure at a spacer on the Moorabool Terminal Station to Tarrone Terminal Station No. 1 500 kV line caused this line and the Tarrone Terminal Station to Heywood Terminal Station No. 1 500 kV line to trip. The loss of supply to Alcoa and South Australia occurred during planned outage works on other lines supplying the area. The lines undergoing planned outages were recalled to service; power supply to Alcoa Portland and the interconnection to South Australia was restored on the same morning.

ESV received the AusNet Services investigation into the root cause of the conductor failure, and closely monitored its corrective actions. No enforcement action was required or warranted in this instance.

4.1.2 Hendry's Lane fire

On 24 December 2016, a fire of approximately 100 hectares occurred within the Powercor distribution network area at Hendry's Lane, Bridgewater. The Country Fire Authority extinguished the fire on the day of the incident.

It was reported that the fire was started due to a tree falling onto high voltage electric lines. ESV conducted an inspection of the site and confirmed this was the most likely cause of the fire ignition.

ESV sought to satisfy itself the incident had not occurred due to Powercor failing to comply with the Electricity Safety (Electric Line Clearance) Regulations 2015.

Powercor was requested to submit its investigation report for the incident and vegetation maintenance records for ESV to review. The submitted documentation indicated the tree was most likely outside of the electric line clearance space at the time part of it fell onto the electric line.

⁵ The last network-related fatality involving the public was in May 2014, and the last involving a network employee was in August 2008. The last recorded electricity-related serious injuries involving network employees were in October and November 2013.

The Powercor incident report identified that the contributing factors were the prevailing weather on the day of the incident and the tree condition. Observations made by ESV reflected this assertion.

Based on the information available from Powercor and our own inspection data, ESV concluded that it could not be proven that Powercor had failed to comply with its approved electric line clearance management plan in its management of the tree.

This incident highlights that, despite maintenance regimes that may be employed by regulated entities, compliant vegetation can still impact the safety of the electricity network. Such events can cause fires; including bushfires, and affect the reliability of electricity supply.



Figure 1 Fire damage at Hendry's Lane, Bridgewater

4.2 Public safety trends

ESV continues to monitor public safety and interaction with network electrical assets in three main areas:

- ▶ vehicles impacting electrical assets
- ▶ encroachment and contact with underground electrical assets
- ▶ all other encroachment and contact events, including theft, vandalism, unauthorised access to electric assets and breach of the No Go Zone.

The last of these categories was the most common event placing members of the public at risk last year.⁶ Figure 2 shows that these events have been increasing since 2014-2015. Figure 3 shows the locations where these incidents were recorded in 2016-2017 for most of the incidents in this category. Figure 4 shows the locations of the encroachment events such as No Go Zone intrusions and dug-up cables.

In the Greater Melbourne region, thefts (predominantly copper) are concentrated in the inner and western suburbs out as far as Melton and Sunbury, with a smaller aggregation near Dandenong and isolated incidents in the middle south-eastern and eastern suburbs. The incidents are predominantly in commercial/industrial areas where new development provides easy access to electrical assets, potentially with minimal security.

There are also isolated incidents around Geelong and in a corridor from Bacchus Marsh to Ballarat and surrounds. There are no reported aggregations of thefts in proximity to other rural centres.

The timing of copper theft incidents does not appear to correlate with the price of copper; however, ESV will continue to monitor this.

Unauthorised access is concentrated along a band running through Melbourne's south-eastern and north-western suburbs.

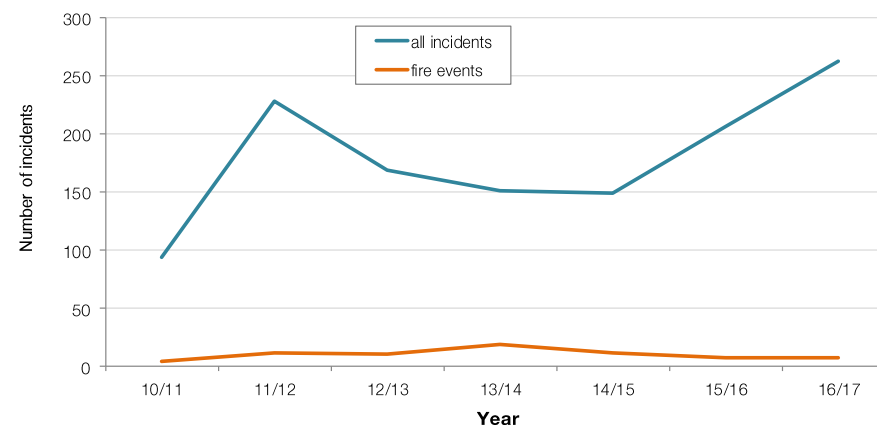


Figure 2 Other encroachment and contact events
These events include copper theft, vandalism, No Go Zone infringements

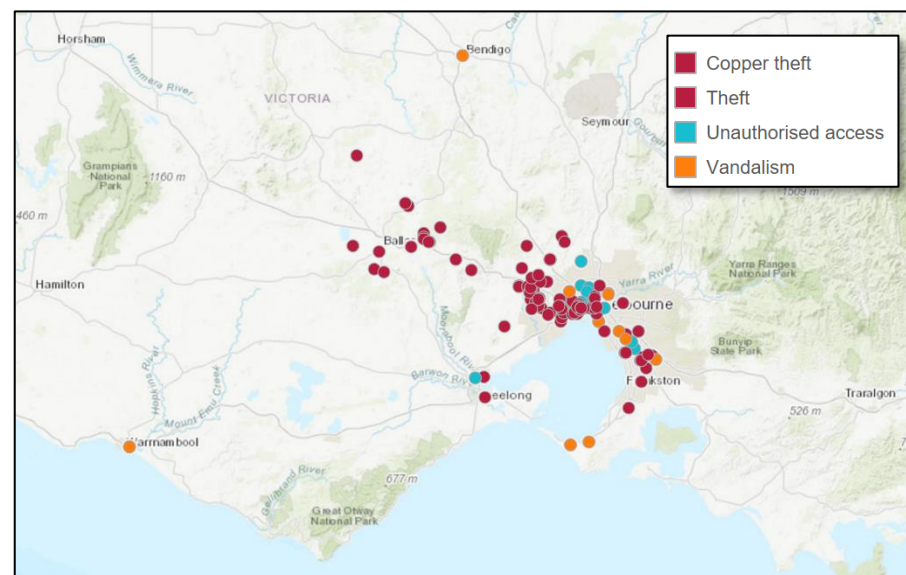


Figure 3 Deliberate contact events across the networks

⁶ Note: This year all annual data are reported on a financial year basis, whereas previous years' data was reported on a calendar year basis.

While vandalism is more common in the south-eastern and western suburbs, there are also incidents around Geelong, the Mornington Peninsula and isolated rural locations.

Infringements of the No Go Zone around overhead and underground cables are generally distributed randomly across the networks, with increased numbers around the Greater Melbourne region where network and construction density are higher (Figure 4). Unlike the wilful contact events above, No Go Zone infringements are also observed in other regional centres such as Mildura, Bendigo and Shepparton (among others). Building too close to the No Go Zone is primarily contained to Melbourne and Geelong, with a couple of incidences close to Geelong.

Figure 5 shows that the incidences of underground cables being dug-up or contacted during excavation works has decreased slightly this year, but this is not statistically significant.

Vehicle impacts comprise two components — cars colliding with poles and other roadside infrastructure⁷ and cranes and other farming/construction equipment contacting overhead powerlines⁸ (Figure 6). Such impacts have decreased for a second year in a row; however, the numbers that result in fire events has increased again this year.

Figure 7 shows concentrations of car collisions within the Greater Melbourne and Geelong regions, reflecting the higher vehicle densities in these areas. The remaining car collisions are dispersed randomly across Victoria. Incidents involving cranes and other farming/construction equipment also randomly distributed across the state, except for a concentration in the Greater Melbourne region where construction density is higher.

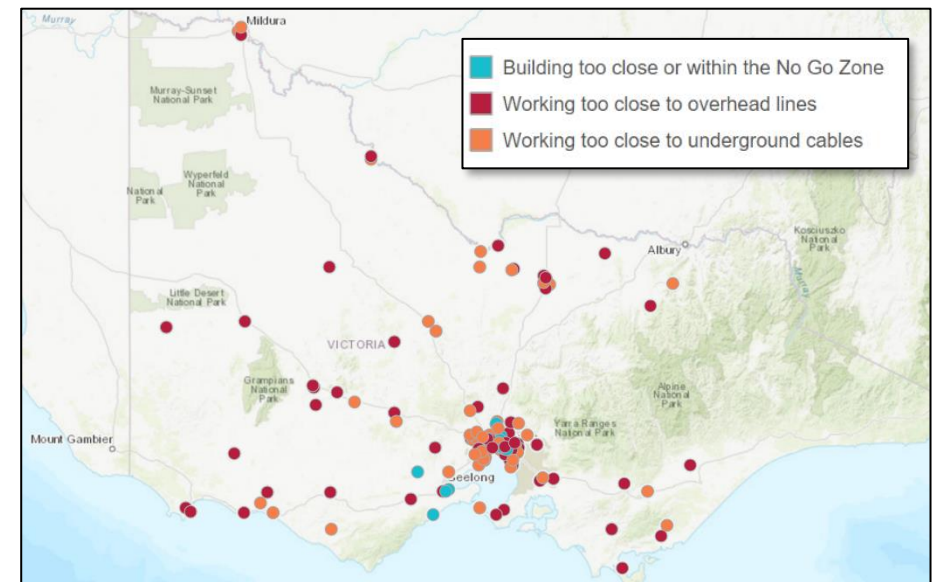


Figure 4 No Go Zone infringements (including dug-up cables)

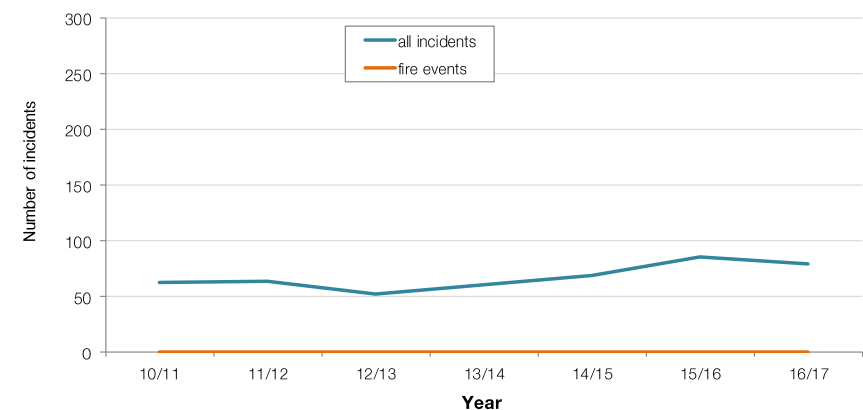


Figure 5 Dug-up cable incidents across the networks

⁷ Responsibility for managing and delivering road safety outcomes lies with VicRoads and councils; it is not the responsibility for the major electricity companies.

⁸ The major electricity companies are responsible for ensuring overhead lines maintain a minimum ground clearance. It is the responsibility of vehicle and equipment operators to ensure their equipment maintains a safe clearance from the overhead powerlines. Educating the public about these responsibilities has been a focus of ESV's Look Up and Live campaign.

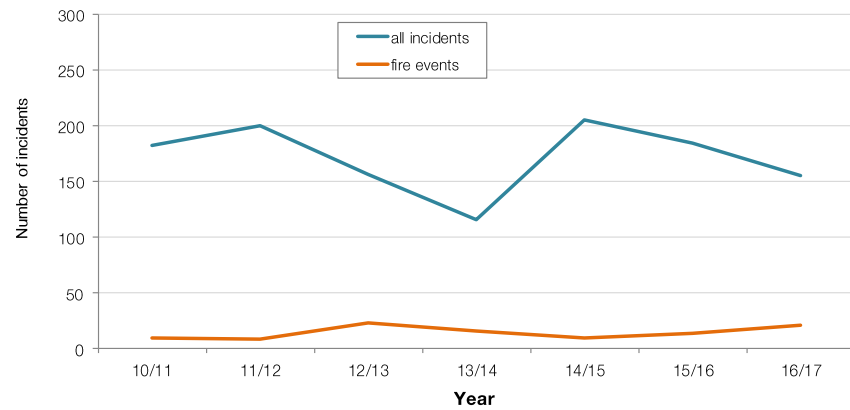


Figure 6 Vehicle impacts on electrical infrastructure

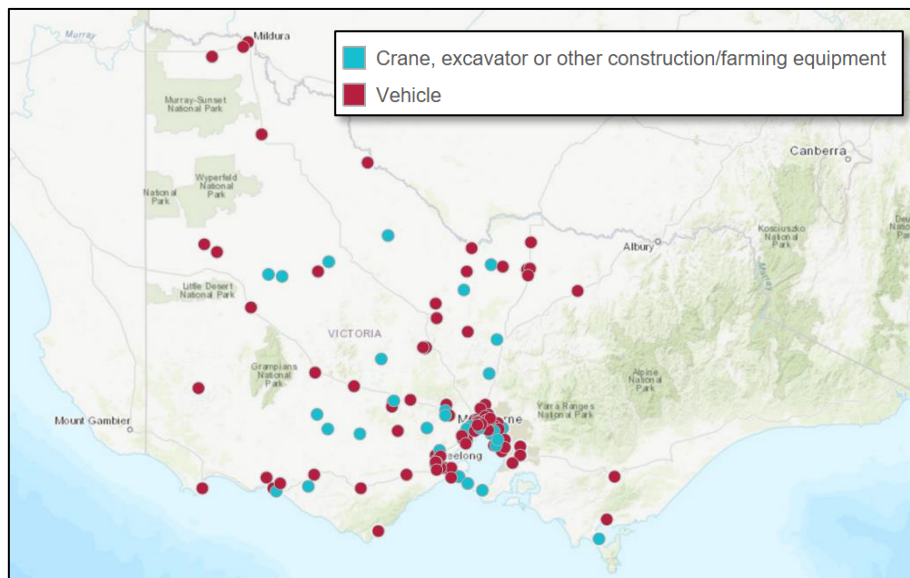


Figure 7 Vehicle impacts on electrical infrastructure across the networks

5 NETWORK INFRASTRUCTURE PERFORMANCE

5.1 Transmission company performance

Detailed information on the performance of the transmission companies is provided in Appendices A, B, F and G for AusNet Services, Basslink, Transmission Operations (Australia) Pty Ltd (TOA) and Transmission Operations (Australia) 2 Pty Ltd (TOA2) respectively.

Jointly owned by CitiPower/Powercor's major stakeholders, TOA2 was recently established to design, construct, own, operate and maintain the overhead transmission line from Ararat Wind Farm to the Ararat Terminal Station, where the line connects into the AusNet Services 220kV transmission network. TOA2 contracts CitiPower/Powercor to provide operational and maintenance support under a similar arrangement to that used by TOA2's sister company, TOA, for the connection of the Mt Mercer Wind Farm.

TOA2 submitted a Full Safety Case and ESMS in March 2016 and, after three rounds of validation, ESV accepted the TOA2 Full Safety Case and Electrical Safety Management Schemes (ESMS) on 22 June 2016. This enabled the commissioning of the line to occur in the last week of June 2016.

As regards the other transmission companies, TOA has an accepted ESMS in place (pre-dating the Safety Case regime), and AusNet Services and Basslink have submitted Full Safety Cases that are currently being reviewed by ESV. Until revised Schemes are accepted by ESV, these companies will continue to operate under their existing ESMSs.

Transmission networks are critical infrastructure forming the backbone of the national electricity grid. This infrastructure is designed, constructed and maintained to standards appropriate for ensuring a safe and reliable electricity supply for Victoria.

ESV has identified no systemic issues or areas of concern regarding the transmission networks.

5.2 Distribution company performance

Detailed information on the performance of the distribution businesses is provided in Appendices A, C, D, E and H for AusNet Services, CitiPower, Jemena, Powercor and United Energy respectively.

5.2.1 Safety Case evaluation and acceptance

ESV has required the major electricity companies to develop detailed safety cases that require them to clearly explain how they identify and appropriately mitigate the safety risks associated with their operations and other activities. This has required each major electricity company to demonstrate how it identifies the risks it faces, the risks its operations present to the community and how it manages its operations and assets to reduce these risks to an acceptable level.

During the past two years, ESV has utilised its guidance material and assessment tools to determine how effectively each major electricity company has developed and presented to ESV a full and acceptable safety case in advance of submitting its Electricity Safety Management Scheme for approval.

AusNet Services, CitiPower, Powercor and United Energy have had their Full Safety Cases approved and are working to establish an Electricity Safety Management Scheme acceptable to ESV. Jemena has recently submitted the third iteration of its Full Safety Case.

As part of the process to establish accepted ESMSs, ESV plans to undertake extensive systems validation audits of all major electricity companies (with the exceptions of the newly-established TOA and TOA2) during the 2017-2018 year.⁹

⁹ The audit will focus on systems and documented evidence that safety plans have been implemented in accordance with the ESMS. This considers asset management strategies and plans by class of asset and over full life-cycle, inspection manuals and practices (including training/competency, inspection cycles and classification of findings) and asset maintenance practices (including standard used, maintenance intervals and testing/inspection methods).

5.2.2 Amended bushfire mitigation regulations

The Electricity Safety (Bushfire Mitigation) Regulations 2013 were amended on 1 May 2016 requiring:

- ▶ All polyphase electric lines originating from 45 nominated zone substations to meet the required capacity over three tranches by 1 May 2019, 1 May 2021 and 1 May 2023. To achieve this performance target the affected distribution businesses are deploying Rapid Earth Fault Current Limiters (REFCL).
- ▶ On and from 1 May 2016, each electric line with a nominal voltage of between 1 kV and 22 kV that is constructed, or is wholly or substantially replaced, within an electric line construction area is to be a covered or underground electric line. AusNet Services, United Energy and Powercor are trialling new covered conductor technologies to achieve this requirement.
- ▶ Each distribution business to have installed, by 1 May 2023, an Automatic Circuit Recloser (ACR) in relation to each SWER line in its supply network. Powercor is the only business with outstanding ACR installations.

Rapid Earth Fault Current Limiters

AusNet Services and Powercor both have 22 zone substations affected by the REFCL deployment and Jemena has one. REFCLs are designed to minimise the fault current dissipated from phase to ground faults on a 22kV network in order to reduce the risk of fire ignition.

There is no requirement under the regulations for CitiPower and United Energy to install REFCLs on their networks.

Conductor replacement

AusNet Services and Powercor both have approximately 1,600 km of conductor within designated electric line construction areas. These electric lines are to be progressively replaced with insulated or underground solutions. With the exception of the powerline replacement fund activities, neither business has made extensive proactive replacement projects over the past financial year. However, several new technologies have trialled at a number of locations to determine their suitability for addressing the regulatory obligations.

Automatic Circuit Reclosers

The amended regulations require the distribution businesses to install a new-generation ACR in respect to each SWER line within their distribution network by 2020. With the exception of Powercor, all the businesses had met this obligation prior to enactment of the regulations.

At 30 June 2017, Powercor had installed 126 of the 1062 ACRs to be installed on its network and this is consistent with its schedule.

Over the last financial year, ESV reviewed and accepted the use of FuseSavers, an alternative device that performs the same functions as an ACR. Powercor revised its deployment plan with a promise of increased delivery and improved safety outcomes.

5.2.3 Safety performance statistics

Figure 8 shows all the electrical infrastructure safety incidents reported to ESV between July 2016 and June 2017 for all the distribution businesses. It differentiates the non-fire events from those resulting in a fire.

In general, the incidents in the 2016-2017 period were in line with the historical data for the period January 2010 to June 2016. More specifically, Figure 8 also shows the following general features:

- ▶ the monthly incidents were around the historical average in the winter and spring months
- ▶ the monthly incidents were below the historical average in the summer and autumn months
- ▶ seasonal variability was reduced in 2016-2017
- ▶ the number of fire-related incidents increased in summer and autumn, peaking from December through to March.

Figure 9 provides more detail on incidents that resulted in a ground fire event. In general, the monthly fire incidents in the 2016-2017 period were below the historical average with three notable exceptions: August, March and April.

In August, the number of ground fire events exceeded one standard deviation from the historical average. That said, the number of fire incidents reported was small (seven incidents compared to an average plus standard deviation of six incidents).¹⁰ In March and April, the number of incidents reported exceeded the average, but were well within one standard deviation of the average. Given the number of incidents reported monthly were close to the average, the observed monthly numbers of fire incidents were not abnormal.

As well as being below the historic average, the number of ground fires in December, January and February were respectively 45 per cent, 48 per cent and 38 per cent lower than the previous year.

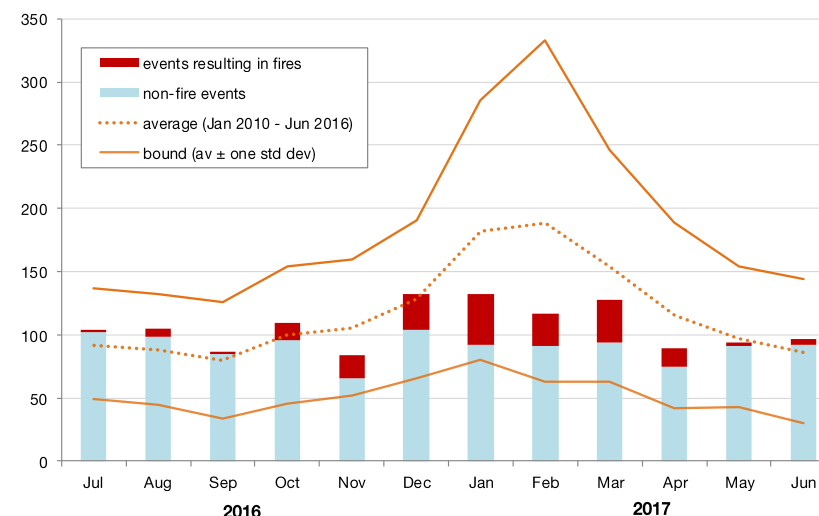


Figure 8 All incidents in the 2016-2017 period

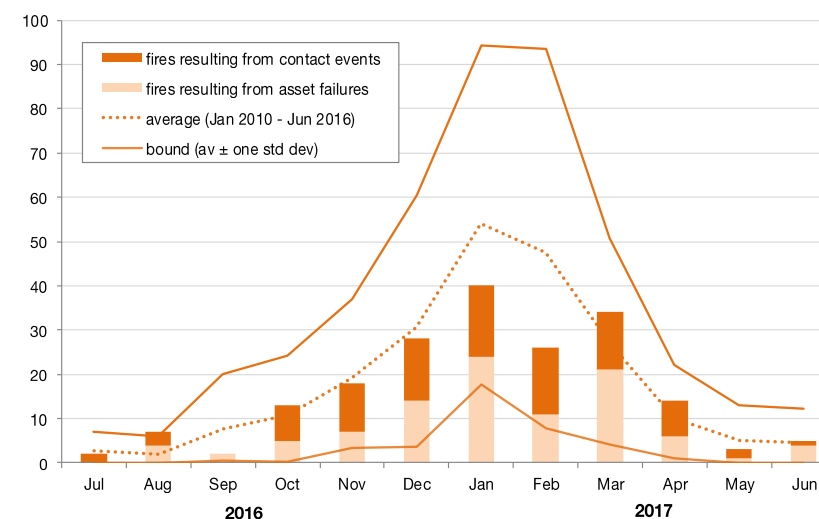


Figure 9 Ground fire incidents in the 2016-2017 period

¹⁰ Assuming the likelihood of an incident is normally distributed, 68% of incidents should fall within one standard deviation either side of the average.

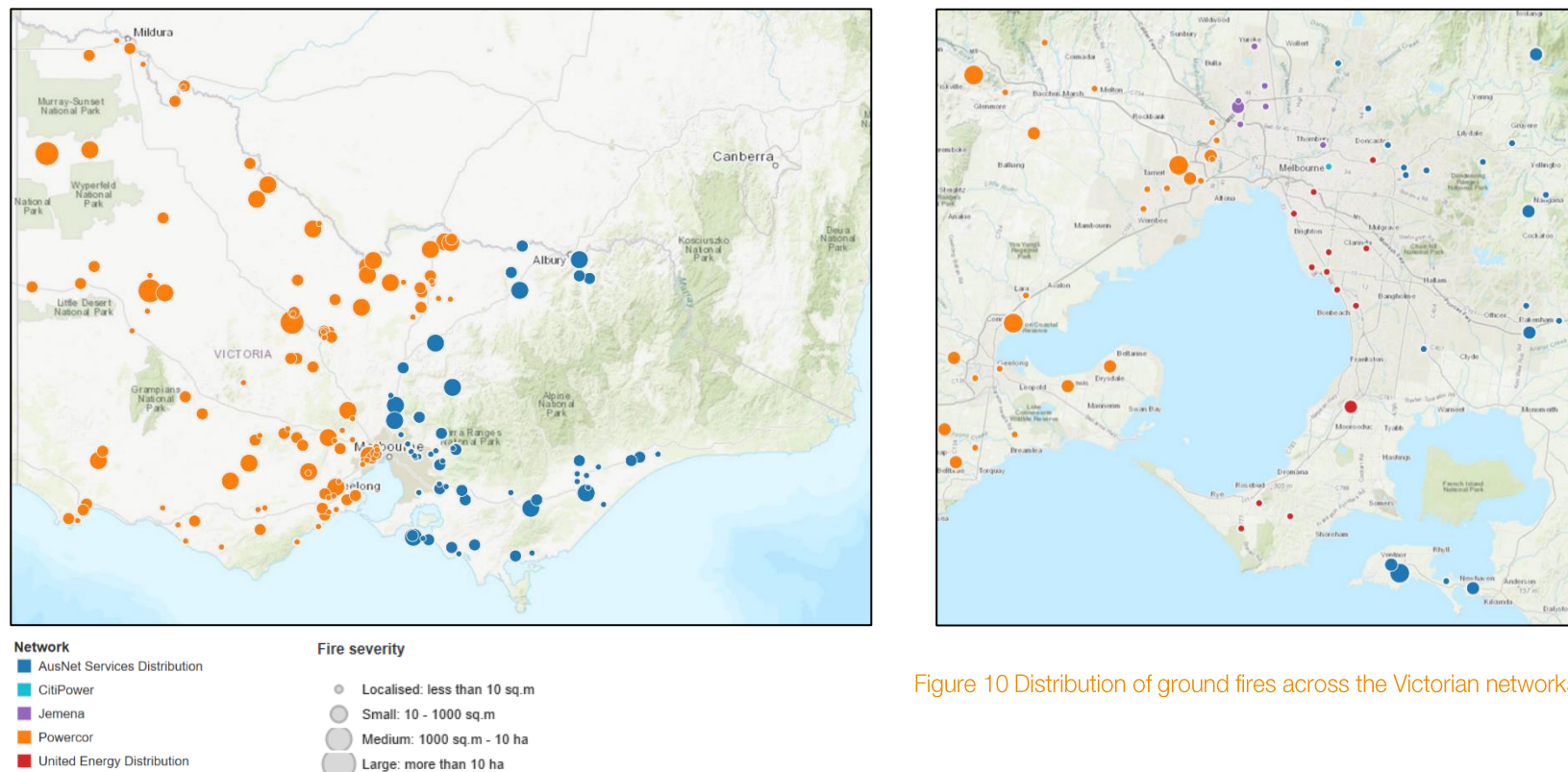


Figure 10 Distribution of ground fires across the Victorian networks

Figure 10 shows where ground fires occurred on the electricity networks across regional Victoria and within the Greater Melbourne region. The majority of incidents occurred on the Powercor and AusNet Services networks.

Of the 446 fires reported in the period, 248 fires were contained to the asset (56%), 96 were smaller than 10 m² (21%), 69 were between 10 m² and 1000 m² (15%) and 30 were between 1000 m² and 10 ha (7%). Respectively, these were reductions of 78, 24, 29 and one from the 2015-2016 period.

There were three fires larger than 10 ha during the 2016-2017 period (0.7%), an increase of three on the previous year. All three were on the Powercor network and all were outside the direct control of Powercor. The three fires were caused by:

- ▶ lightning striking a power pole (35 ha fire)
- ▶ farming equipment contacting overhead lines as it was being transported across the property (150 ha fire)
- ▶ a tree branch falling onto the lines (120 ha fire; see Section 4.1.2).

Figure 11 shows the number of incidents on the Victorian networks from most common to least common. It also shows, in orange, the difference in incidents between 2016-2017 and the long-term average of the 2010-2016 period.

In the 2016-2017 period, two of the five most common events were outside the direct control of the networks to manage — other contact events and vehicle impacts. Both of these are discussed in more detail in Section 4.2.

There were three events within the control of the networks, namely other asset failures, connections failures and tree contact.

When compared to the long-term averages across the period from January 2010 to June 2016, the incidents in 2016-2017 are elevated in six categories, stable in three categories and reduced in five categories. Of particular note are the significant reductions in crossarm and HV fuse failures, which have fallen from fourth and fifth places last year to eleventh and tenth places this year respectively.

Figure 12 shows the trend over the last seven years for the three events above that were within control of the networks. This indicates that:

- ▶ there was a small reduction in other asset failures over the last twelve months, although these incidents are elevated over the longer term
- ▶ there is an ongoing reduction in connection failures
- ▶ there was an increase in tree contact events, but such events are lower than historic levels.

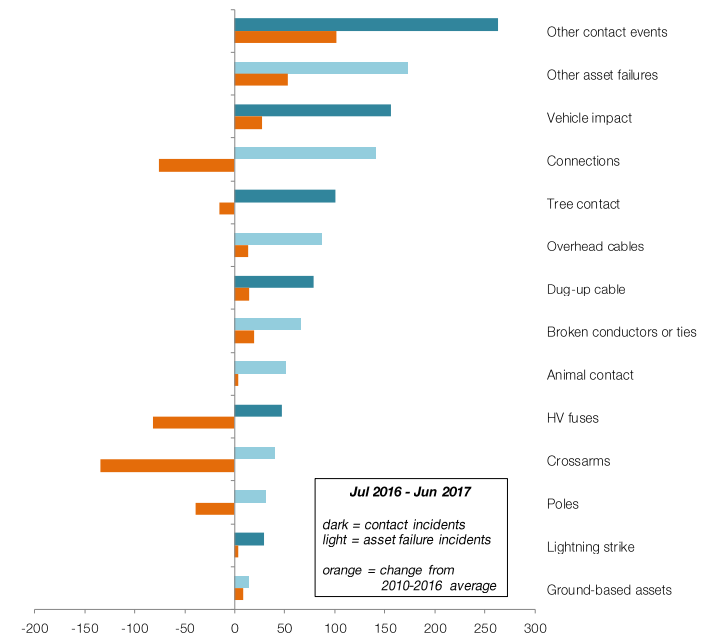


Figure 11 Incidents occurring on Victorian networks

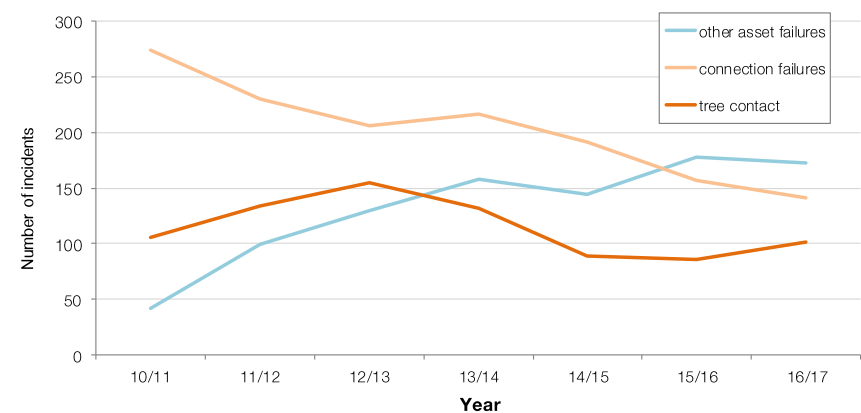


Figure 12 Historic trends for common incident events

Figure 13 shows the number of ground fire events on the Victorian networks from most common to least common. It also shows, in blue, the difference in incidents between 2016-2017 and the long-term average of the 2010-2016 period.

In the 2016-2017 period, only fires from vehicle impacts were outside the direct control of the networks to manage (see Section 4.2).

The four fire events within the control of the networks were due to animal contact, other asset failures, connections failures and tree contact.

When compared to the long-term averages across the period from January 2010 to June 2016, fire numbers in 2016-2017 are elevated in four categories, stable in four categories and reduced in six categories. Of particular note are the significant reductions in fires from tree contact and HV fuse failures, which have fallen from first and fifth places last year to fourth and ninth places this year respectively. The current number of crossarm fires is also significantly lower than the long-term average.

Figure 14 shows the trend over the last seven years for the four fire events above that were within control of the networks. This indicates that:

- ▶ fires from other asset failures were stable over the last two years; however, these are higher than levels six to seven years ago
- ▶ there were reductions in fires from the other three incident types
- ▶ fires from tree contact are at historic low levels
- ▶ fires from connection failures are still higher than historic levels.

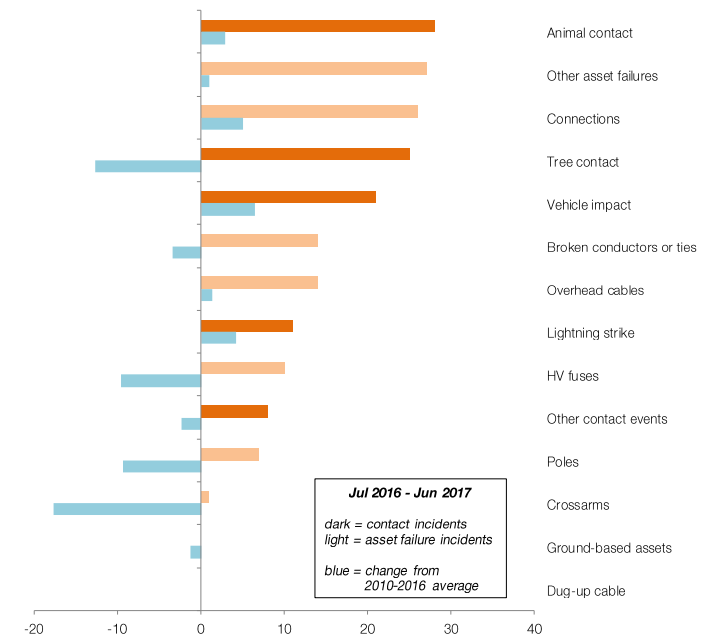


Figure 13 Ground fire-related incidents occurring on Victorian networks

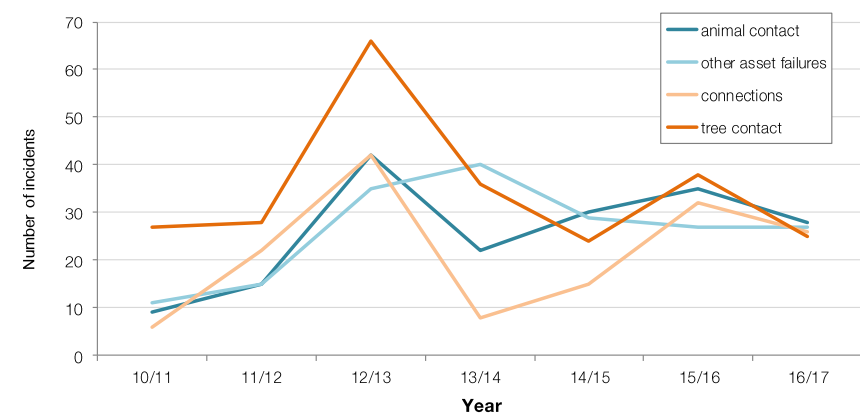


Figure 14 Historic trends for common ground fire incident events

5.2.4 Influence of weather on fire incidents

Figure 15 shows the monthly ground fires between 2010 and 2017 broken into those resulting from contact events and asset failure events (column data). There is a clear seasonal pattern driven by the average maximum temperatures and rainfall observed over the year with higher incidents peaking during the warmer summer months and the lowest incidents during cooler, wetter winter months.

Figure 15 also includes an estimation of fire events (blue line) based on average maximum temperatures across six sites across Victoria, with an adjustment based on monthly rainfall. This provides a reasonable prediction of ground fire events (84 per cent correlation), although a mechanical basis for the correlation has yet to be determined.

This analysis indicates that, while weather is a major contributor affecting the number of fire incidents experienced on the Victorian network, network management can particularly influence the major peaks observed in Figure 15.

ESV has sought to improve this prediction by including the effect of wind speed, a potential stress on assets. Preliminary analysis did not show an improved correlation; however, this could be due to statewide averaging. ESV will continue to investigate opportunities to improve this prediction by including localised wind effects, multiple high temperature days and terrain type.

Understanding the strong correlation between ground fires and weather will allow ESV to predict the likely long-term effects of climate change on the risk of network-related fires. On a shorter timeframe, it will allow us to estimate levels of fire incidents against which we can measure improvements from implementing REFCLs and the other measures discussed in Section 5.2.2.

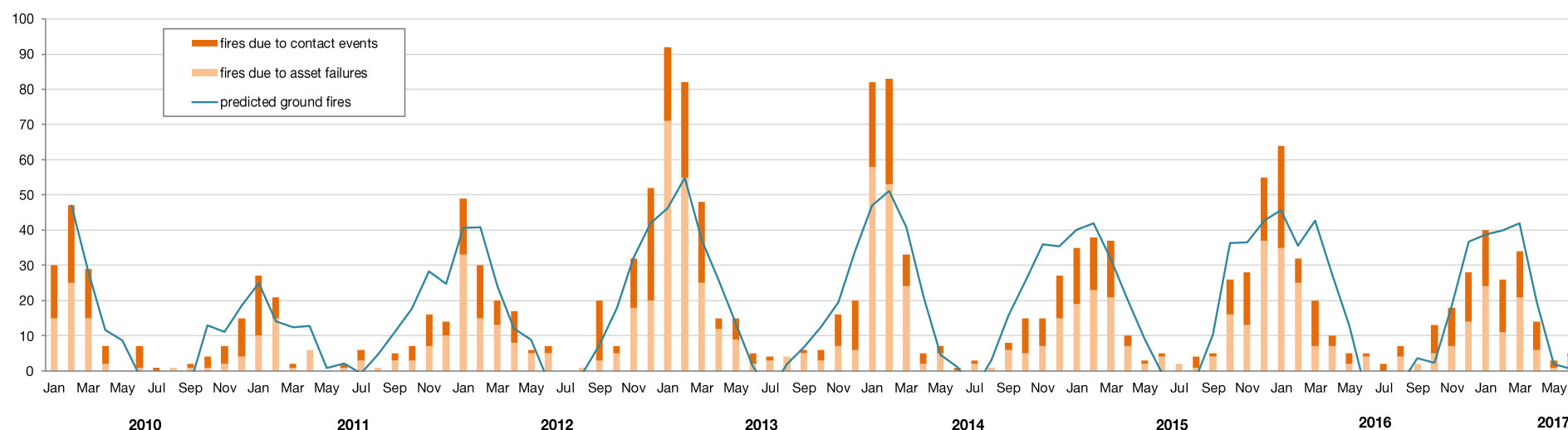


Figure 15 Monthly ground fires from January 2010 to June 2017

5.2.5 Conductor clashing – making Victoria safer

The 2009 Victorian Bushfires Royal Commission noted that conductor clashing and the subsequent arcing between conductors caused molten material to fall to the ground, raising the potential for fire start (Volume 2 Section 4.6.4). This led to Recommendation 33 to “fit spreaders to any lines with a history of clashing or the potential to do so”.

ESV subsequently issued a direction to all distribution businesses to install spreaders on low voltage lines in HBRA by the end of 2015 and in LBRA by the end of 2020. Further details are provided in Section 2.3.1.

Progress in completing this direction is routinely monitored by ESV. This is reported individually for each business in the appendices to this report.

In 2009, conductor clashing was regarded as commonly occurring on the networks across Victoria and this, together with the risk clashing imposed, justified addressing this issue through targeted capital works programs.

While ESV does not have readily-available data on such events at the time of the 2009 bushfires, Figure 16 shows the locations of all conductor clashing events reported to ESV since 1 October 2015.

Over the last 21 months, there have been 44 incidences of conductor clashing recorded in the Greater Melbourne / Mornington Peninsula region. This region is primarily classified as LBRA and is, therefore, yet to have spreaders installed under the terms of the direction. There have only been six recorded incidences of conductor clashing outside of this region

The lack of clashing incidents outside of the LBRA region support a hypothesis that this direction has been successful. ESV will continue to monitor such incidents over the next few years to demonstrate the effectiveness of the direction in LBRA and confirm this hypothesis.

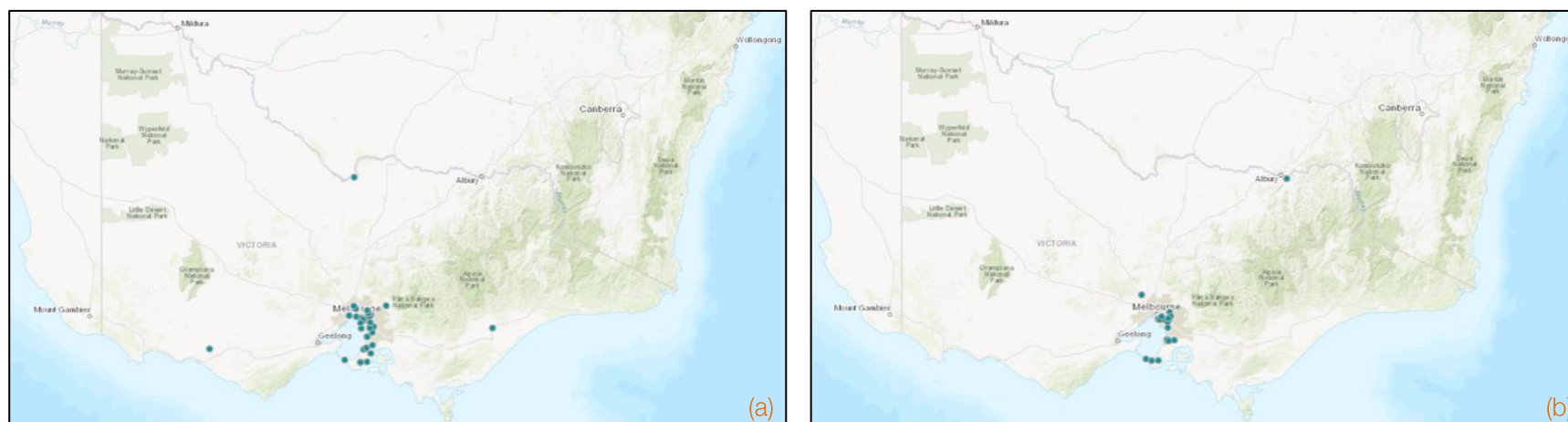


Figure 16 HV conductor clashing across the networks

(a) incidents reported between 1 October 2015 and 30 June 2016 (b) incidents reported between 1 July 2016 and 30 June 2017

5.3 Issues for attention

5.3.1 Emerging technologies

The advent of new technologies (particularly energy storage and micro-grids) is likely to significantly shift the electricity supply paradigm in the years to come. This has the potential to impact retailers, distributors and markets as new players enter the arena. Such a paradigm shift is likely to have significant impact on safety regulation as new issues emerge. ESV recognises this and needs to understand how the industry may change and ensure it is prepared and equipped to ensure safety is maintained while this change takes place.

As energy storage and micro grid options for sharing stored energy become more prevalent and evolve, a key concern for network owners is the prospect of uneconomic bypass and stranded assets. This could occur where investment in the networks is undertaken to cater for the current demand and expected growth, only for energy storage and micro grids to reduce demand on the networks in the not too distant future.

Network investment is generally determined based on a return on investment over the next 50 years; however, the potential of new technologies is creating a level of future market uncertainty for network owners.

The challenge for ESV will be to prepare proactively to respond to any safety concerns arising in this ever-evolving area. These include the impacts on the long-term integrity of the networks and the sustainability of assets.

ESV continues to monitor the potential for 'New Energy' to impact on Victoria's networks. This may manifest through direct impacts of new technologies, changes to network operation or reductions in maintenance should existing business models become unviable. This will allow ESV to ensure that public safety is considered in discussions about these technologies and that future regulations address any emerging risks.

5.3.2 Asset management

Following concerns raised about the performance of service cables in the northern district, ESV instigated a review into the asset management approaches of the distribution businesses. The aim of the review was to verify if appropriate life cycle management was being considered, and adopted, to acceptably manage safety risks.

This identified areas to focus regulatory efforts, including more targeted audits and inspections to review critical control effectiveness. Some distribution businesses implement solely reactive-based programs for the management of their service cables. The review has caused these businesses to review their strategic directions and works practices to be more proactive, where appropriate.

ESV has commenced preliminary work and expects to continue by:

- ▶ reviewing asset management approach
- ▶ reviewing critical control effectiveness
- ▶ benchmarking safety performance
- ▶ establishing what is acceptably safe.

Completing these works will provide ESV assurance that the distribution businesses are adopting appropriate life cycle management practices.

6 LINE CLEARANCE PERFORMANCE

Electric line clearance responsibilities are prescribed by the Electricity Safety (Electric Line Clearance) Regulations 2015. The primary purpose of the regulations is to prevent vegetation growing too close to electric lines.

If vegetation grows too close to an electric line it increases risks such as electric shock, fire (including bushfire) and diminished reliability of electricity supply.

6.1 Performance of major electricity companies

6.1.1 ELCMP evaluation and approval

The Electricity Safety (Electric Line Clearance) Regulations 2015 (the regulations) require all major electricity companies to prepare and submit an electric line clearance management plan (ELCMP) to ESV before 31 March each year.

An ELCMP is used to articulate the company's objectives and the management strategies that will be used to comply with its regulatory obligations. During 2016/17 each major electricity company submitted its plan to ESV.

ESV evaluated the plans against established criteria to validate that the plans met the minimum expectations of a quality plan and complied with the regulations.

Where ESV identified deficiencies in the plans, feedback was provided to the relevant company and the company was required to submit amended plans that addressed the deficiencies. ESV then evaluated the resubmitted plans and, when found to meet the minimum expectations, referred them to the Director of Energy Safety for approval.

ESV has reviewed and approved the ELCMPs for AusNet Services, Jemena and United Energy. We continue to work with CitiPower/Powercor, TOA and TOA2 to ensure they have approved ELCMPs in place for the 2017-2018 fire season.

6.1.2 Preparedness for the fire danger period

To prevent vegetation coming into contact with powerlines and igniting, it is important that the regulated clearance space is maintained around overhead powerlines. Due to the elevated fire risk, this is critical in Hazardous Bushfire Risk Areas (HBRA) and even more so in areas where the Country Fire Authority has declared a fire danger period to be in place.

Each major electricity company must have management systems in place to ensure that, where it has management responsibility in HBRA, the vegetation remains compliant for the duration of the declared fire danger period.

ESV completed audits and inspections of all major electricity companies to validate compliance with the regulations. This gauged the preparedness of the companies leading into the 2016/17 declared fire danger period. The results of the audits and inspections are further described in the individual appendices for each company.

Generally, appropriate clearance standards were observed to have been achieved in the areas that were audited.

6.1.3 Reporting over summer season

The major electricity companies were required to report to ESV on aspects of their preparedness for 2016/17 fire danger period. The reporting period commenced on 1 October 2016 and concluded on 30 April 2017.

In part, the companies measure their preparedness for the declared fire danger period through a bushfire mitigation index (BMI). Together with other measures, the BMI provides an indication of the status of vegetation compliance in areas where the fire danger period has been declared.

Each company reported its BMI to ESV leading up to and during the 2016/17 fire danger period. This provided ESV some perspective of the companies' vegetation management programs in HBRA.

The aim is that each company maintains a BMI of zero throughout the declared fire danger period. It should be noted a BMI of zero may not mean all noncompliant vegetation has been cleared from the electricity network.¹¹

In addition to its BMI, each company was also required to report the total number of noncompliant spans that existed in HBRA leading up to and during the fire danger period.

Figure 17 shows the total number of noncompliant vegetation spans for the five distribution businesses across the fire danger period. This also shows the number of municipalities for which the CFA has declared the fire danger season active.

ESV monitored the progress of vegetation clearing and the BMI of the major electricity companies to establish an understanding of their electric line clearance performance and the overall safety of the electricity networks.

ESV identified extensive noncompliance on the part of one major electricity company. This is the subject of a detailed investigation that may result in enforcement action.

Given our concerns with the reporting of clearance rates and differences in BMI measurement methods, ESV will be seeking a greater degree of detail in reporting of line clearance rates for the 2017-2018 fire season. ESV is also looking at developing an improved performance measure.

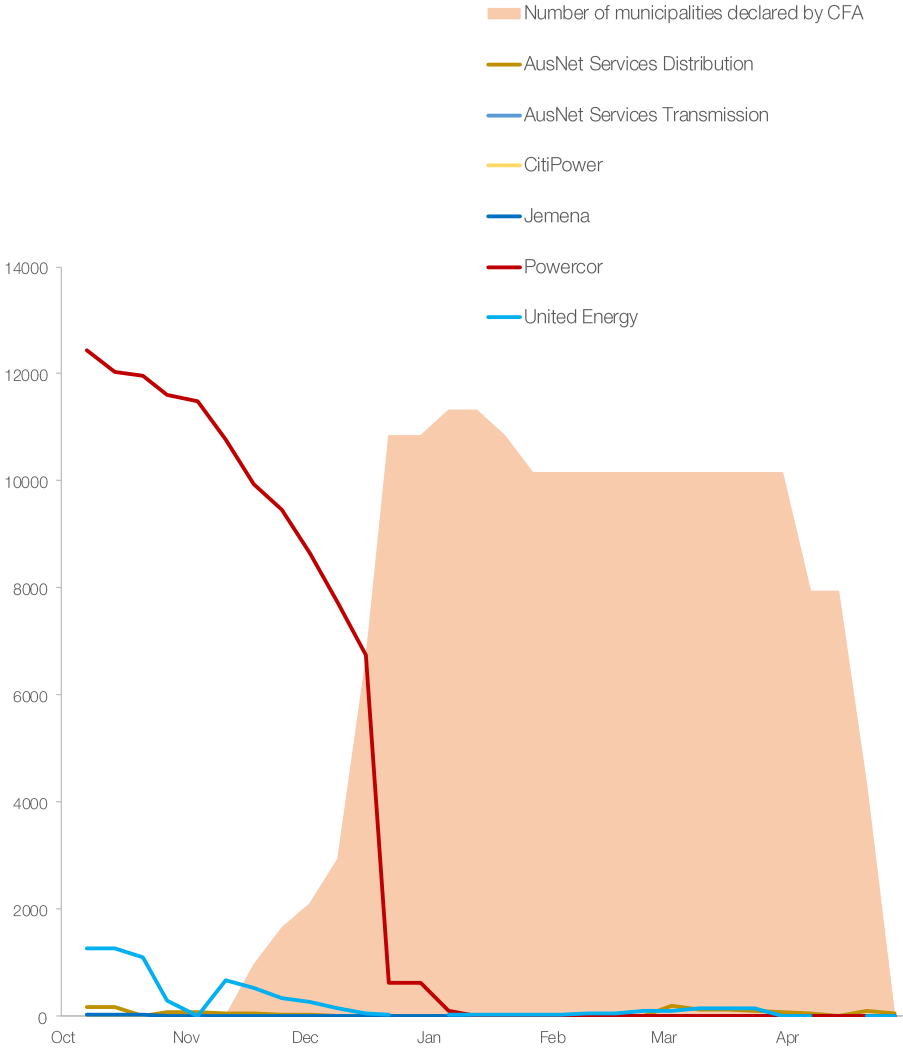


Figure 17 Noncompliant spans by distribution business

¹¹ An index of zero may be maintained either through ensuring clearance around the overhead lines or through a process of re-inspection and risk assessment during a declared fire danger period. Undertaking these actions allows for the resetting of the required maintenance action targets.

It should be noted that BMI is an internal measure for each distribution business and it is not measured the same way in all companies.

6.1.4 Exemptions

Under Regulation 11 ESV may exempt a responsible person from any of the requirements of the regulations. Both AusNet Services and Powercor have exemptions in place.

The AusNet Services exemption pertains to clause 28(2)(b) of the Code of Practice for Electric Line Clearance (the code). It applies to vegetation clearance distances for electric lines in HBRA, provided that:

- ▶ any overhanging branches and the trees supporting the branches do not exhibit any potential hazardous structural defect
- ▶ a minimum clearance of 3000 mm is maintained above the powerline to any overhanging tree branch.

The exemption was granted to provide an opportunity to AusNet Services to augment 2284 electric line spans in the Dandenong Ranges and surrounding areas. The augmentation involved replacing uninsulated electric lines with aerial bundled or underground cables.

Granting the exemption delivered and enhanced long-term electricity safety outcomes. It also meant that extensive clearing of vegetation in an environmentally-sensitive area could be avoided.

The exemption is to expire on 31 October 2017. All vegetation managed under the exemption will need to be made compliant by this date. At the beginning of 2017, AusNet Services reported the exemption still applied to a total of 284 electric line spans.

As of 9 October, all but ten spans had been made compliant, with the remaining to be made compliant once AusNet Services had received cultural heritage approval for the works.

Powercor has two exemptions in place that relate to the management of significant vegetation at:

- ▶ 14-16 Armstrong Street, Creswick
- ▶ 2 Barley Street, Ballarat East.

The exemptions apply to clause 25 and clause 28 of the code respectively. They are conditional on specific management strategies being employed to mitigate electricity safety risks. The strategies include (but are not limited to):

- ▶ increased inspection regimes performed by suitably qualified arborists
- ▶ risk assessment
- ▶ maintaining specified reduced clearance distances.

These exemptions remain ongoing provided all specified conditions are met.

6.1.5 Technology

LiDAR is a surveying method that uses pulsed laser light to accurately measure the distance between two targets. Within the vegetation management industry an aircraft such as a light plane or helicopter would be used in the collection of the data.

LiDAR is a technology that previously has been used sparingly for the purpose of vegetation assessment in determining electric line clearance responsibilities and maintenance requirements. Typically it would be used where highly accurate measurement is required or if site access was an issue.

During the 2016/17 period, Powercor indicated a transition from a vegetation management model that uses human resource for inspection to one that exclusively uses LiDAR. ESV seeks to inform itself of the merit of using this technology as a primary management tool as its use has not been tested to this extent in Victoria.

The merit of Powercor's LiDAR inspection methodology will be scrutinised through evaluation of its 2017-2018 electric line clearance management plan, and tested through auditing of Powercor management systems and inspecting sites to validate the assertion that the technology delivers outcomes at least as good as current inspection practices.

6.2 Performance of other responsible persons

6.2.1 ELCMP evaluation and acceptance

The regulations require all municipal councils and specified operators¹² with electric line clearance responsibilities to prepare an ELCMP before 31 March every year.

Unlike the major electricity companies, other responsible persons are not required to submit their plan to ESV annually; however, they must do so if requested by ESV. During the 2016/17 period, ESV evaluated 26 plans submitted by municipal councils and five submitted by specified operators.

The evaluation process indicated a lack of understanding by the relevant organisations of how to prepare a quality plan. Extensive consultation was required to affect plan amendment to ensure they met the standard expected by ESV.

ESV subsequently prepared and released educational material to assist all councils and specified operators with improving the quality of their plans. The material provided interpretation of the requirements of the regulations and clarified the obligations required of the regulated entities. It also provided insight into ESV's expectations regarding the quality of plans.

During the 2016/17 period, the Director of Energy Safety approved a total of 19 municipal council and three specified operator plans.

6.2.2 Compliance observations

Throughout the 2016/17 ESV conducted compliance inspections of municipal councils to monitor the effectiveness of their electric line clearance management strategies.

ESV inspected:

- ▶ City of Greater Geelong
- ▶ The Borough of Queenscliff
- ▶ Moorabool Shire Council
- ▶ Darebin City Council
- ▶ Melbourne City Council
- ▶ Moreland City Council
- ▶ Stonnington City Council
- ▶ Yarra City Council

Compliance standards varied significantly between the organisations. It was also evident that some organisations lacked the level of knowledge of the regulations that is expected of a regulated entity. ESV sought to educate these organisations to ensure they were capable of managing their electric line clearance risks.

Where noncompliant vegetation was observed, ESV consulted (and is currently consulting) with the relevant councils to ensure noncompliant vegetation is cleared.

6.2.3 Exemptions

On 19 December 2016, Manningham City Council submitted an application to ESV seeking an exemption from clause 28(2)(b) of the code. The exemption was requested to allow Manningham to coordinate the augmentation of several electric line spans that existed in a Hazardous Bushfire Risk Area.

The electric lines were affected by trees described by Manningham as significant. The trees would normally have to be removed to achieve compliance; however, they could be retained by changing the electricity infrastructure to an aerial bundled cable configuration.

AusNet Services, as the local electricity distributor, provided Manningham with a quotation to install the aerial bundled cable. After conducting a cost benefit analysis of the situation Manningham settled on tree removal as the preferred option.

Manningham subsequently removed the noncompliant vegetation and withdrew its exemption application.

¹² Owners or operators of electricity networks that are not a major electricity company.

6.2.4 Consultation and education

Electric line clearance has been a long-standing responsibility of organisations such as, but not limited to, municipal councils, Metro Trains Melbourne and Yarra Trams. Despite the responsibility they bear, these organisations do not always have a mature understanding of their responsibilities, particularly when compared to the major electricity companies.

The reasons for this may include:

- ▶ regulatory oversight set too low within the organisational structure
- ▶ lack of electricity network expertise
- ▶ preservation of amenity prioritised over electricity safety
- ▶ availability of suitable vegetation management resource
- ▶ network authorisation and/or access constraints.

In the 2016/17 period, ESV developed and disseminated educational information to assist the regulated entities in better understanding their electric line clearance responsibilities. This material provided interpretation of aspects of the regulations and advised on how to prepare a quality ELCMP.

Additionally ESV has actively consulted with industry to inform it on the electric line clearance regulations and the subsequent obligations. This has occurred both through proactive interaction and in response to requests for advice and clarification.

6.3 Issues for attention

6.3.1 Environmental impacts

In September 2016, Victoria experienced an extreme weather event resulting in its highest September rainfall in 100 years. This broadly affected the state's west and north-west; including the districts of the Mallee, Northern Country, North Central, North East, Wimmera and parts of the Central and South West.

As a consequence, wet ground conditions particularly affected the Powercor distribution network area. The effects of the rain event persisted beyond the time of its initial impact.

Powercor reported it was delayed in being able to safely access many sites where clearing of noncompliant vegetation was needed across the affected districts. This initially contributed to the inability of Powercor to manage its electric line clearance risks. Powercor found itself having to address substantial numbers of noncompliant spans, and this was further compounded by the issues discussed in Section 6.3.2. This issue was particularly relevant to HBRA during the declared fire danger period.

In December 2016, ESV undertook inspections in the Northern Country area where this matter had been reported as being a significant issue. At the time of the inspections, ESV did not identify safe site access due to wet ground conditions to be a discernible issue.

6.3.2 Contractor viability

In the 2015-2016 period, Powercor experienced the failure of their principal vegetation management contractor. As this occurred prior to the conclusion of the contract period, the ability of Powercor to manage its electric line clearance risks was compromised.

Powercor advised ESV that the effects of the contractor's failure, coupled with the access issues discussed in Section 6.3.1, continued to affect its vegetation management programs well into 2016-2017. This was despite having appointed a new vegetation management contractor.

Powercor subsequently inspected its entire network to determine the compliance status of all its overhead lines. This identified a substantial quantum of noncompliant vegetation that needed to be addressed.

While the failure of the Powercor contractor may have been unexpected, it should have been anticipated. The lack of robust contractual oversight may be a factor that contributed to Powercor not being able to effectively manage its electric line clearance risks in 2016-2017.

APPENDIX A : AUSNET SERVICES

AusNet Services Ltd has two shareholders with a significant investment and board representation, being Singapore Power International Pte Ltd (SPI) and State Grid Corporation of China (State Grid). Through a partnership in SGSP (Australia) Assets Pty Ltd, both companies also have 100 per cent ownership of Jemena and 34 per cent interest in United Energy.

AusNet Services has two operating electricity subsidiaries: AusNet Services Transmission (owns and operates the electricity transmission business) and AusNet Services Distribution (owns and operates the electricity distribution business). As the two subsidiaries are managed by the same CEO and Board and use similar procedures, ESV encompasses both subsidiaries into a single entity for reporting purposes. Where the discussion relates to a specific area of the business, this will be identified within the text.

AusNet Services is the only major electricity company in Victoria operating both transmission and distribution networks.¹³

The transmission network services all of Victoria (500kV and 220kV) and also includes interconnections with New South Wales and South Australia (330kV and 275kV respectively). It comprises approximately 6570 km of transmission lines and 13,000 towers.

The distribution network covers any area of approximately 80,000 km², and includes Melbourne's outer-eastern suburbs and runs north to the New South Wales border and south and east to the coast (Figure 18). It comprises approximately 43,000 km of overhead line, 6500 km of underground cable and 380,000 poles. Most of this network (85 per cent) is in rural areas.

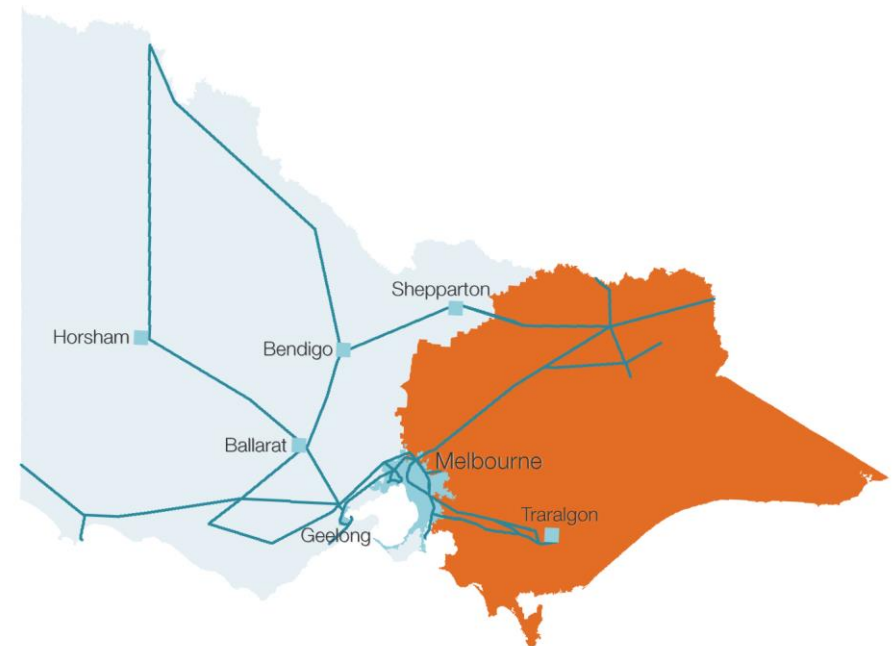


Figure 18 Service area for the AusNet Services distribution network (orange area) and transmission lines (dark blue)

¹³ While TOA and TOA2 are closely associated with CitiPower/Powercor, these have been established as separate companies. Their transmission assets are also limited in comparison to those of AusNet Services.

A1 Plans and processes

AusNet Services was scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) for distribution network before 3 December 2015
- ▶ Electrical Safety Management Scheme (ESMS) for transmission network before 29 March 2016
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revision of the accepted bushfire mitigation plan, although revised plans have been accepted annually due to regular revisions in the regulations
- ▶ Electric Line Clearance Management Plan by 31 March each year.

With the new requirement to submit a Safety Case for acceptance prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 3 December 2015 and this would be seen by ESV to have triggered the ESMS process.

A Preliminary Safety Case was first provided by AusNet Services Distribution on 31 July 2015. After two iterations, a Preliminary Safety Case was accepted by ESV on 10 May 2016. AusNet Services Distribution submitted its Full Safety Case for assessment on 13 July 2016, and ESV accepted this on 12 December 2016. AusNet Services then submitted its Electricity Safety Management Scheme on 1 May 2017, and ESV is in the process of assessing this scheme.

AusNet Services Transmission submitted its Full Safety Case on 10 July 2017, and this is currently being reviewed by ESV.

AusNet Services submitted its transmission and distribution Electric Line Clearance Management Plan to ESV on 31 March 2017. ESV approved the ELCMP on 19 July 2017.

A2 Directions

ESV has issued three directions to AusNet Services to:

- ▶ install armour rods and vibration dampers in hazardous bushfire risk areas (HBRA) by 1 November 2015 and in low bushfire risk areas (LBRA) by 1 November 2020
- ▶ install spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines in HBRA by 1 November 2015 and in LBRA by 1 November 2020
- ▶ undertake powerline replacement projects specified by the Powerline Bushfire Safety Program under the Powerline Replacement Fund.

In April 2017 AusNet Services approached ESV to amend its armour rods and vibration dampers plan for HBRA and LBRA. Its proposal was based on Australian Standard AS/NZS 7000 Overhead line design, which allows for an engineering assessment to determine if vibration dampers are effective in a given location. ESV reviewed the methodology behind the proposal and the amended installation plan and has accepted both.

The direction to install spacers and spreaders was completed on time in HBRA and AusNet Services has commenced the works in LBRA.

AusNet Services was also directed to undertake sixteen projects for the Powerline Replacement Fund by 31 December 2015. Fifteen projects have been completed, with four delivered on schedule, 11 delivered late and one project still to be fully completed.

These directions arose from Recommendations 27 and 32 of the Victorian Bushfires Royal Commission and the target was to complete these within a 10-year period. Given that overall completion is on track to be completed ahead of the Commission's target date, ESV is satisfied with AusNet Services' progress to date in delivery of these directions.

A3 Bushfire mitigation regulations programs

To meet its bushfire mitigation obligations, AusNet Services plans to implement REFCL technology at 22 nominated zone substations over three delivery tranches. Consistent with its bushfire mitigation plan, AusNet Services is to address eight zone substations¹⁴ in its first delivery tranche by 30 April 2019.

Over FY16/17, AusNet Services cautiously progressed its REFCL program, encountering a number of technical issues on the way. Table 2 provides a delivery breakdown for each of the eight zone substations.

Table 2 AusNet Services REFCL delivery progress

REFCL delivery milestone	BWA	KLK	MYT	RUBA	SMR	WN	WGI	WYK
Initiate	●	●	●	●	●	●	●	●
Design	●	●	●	●	●	●	●	●
Procurement – Ordered	●	●	●	●	●	●	●	●
Construction – Lines	●	●	●	●	●	●	●	●
Construction – Stations	●	●	●	●	●	●	●	●
Construction – Third-party	●	-	-	●	●	●	●	●
Testing / Commissioning	●	●	●	●	●	●	●	●
Close Out	●	●	●	●	●	●	●	●

● Complete
● Not commenced

● In progress
- Not required

ESV continues its engagement with AusNet Services to develop a consistent compliance testing methodology to ensure that regulatory requirements are achieved, and that its REFCL program delivers the mandated required capacity and, hence, safety outcomes.

A4 Exemptions

In 2010, the Electricity Safety (Electric Lines Clearance) Regulations were revised and the clearance distance required between overhead electric powerlines and trees was increased.

AusNet Services was not immediately compliant with the new regulations and sought an exemption to allow time to transition to compliance with the new regulations. ESV granted this exemption with regard to:

- ▶ cyclic clearing – ABC or insulated cable in all areas
- ▶ cyclic clearing – powerlines other than ABC or insulated cable in HBRA
- ▶ cyclic clearing – powerlines other than ABC or insulated cable in LBRA
- ▶ overhanging vegetation in HBRA.

Completion of all exemptions except for overhanging vegetation in HBRA was achieved by 31 December 2013.

In 2015 AusNet Services applied for an exemption from the revised 2015 regulations for overhanging vegetation. The exemption sought to reduce the number of spans to be addressed by the end of 2015 from 2000 to 1620, with the funding to be reallocated to replacement of HV ABC in the Dandenong Ranges to eliminate the risk of cable failures due to deterioration. Given the latter was proposed to address a more immediate potential bushfire threat, ESV consented to the request for an exemption.

Having completed the Dandenong Ranges HV ABC replacement program in 2015-2016, the exemption required the overhanging vegetation to be cleared by 31 October 2017. As of 9 October, AusNet Services was only awaiting heritage approval before clearing the remaining ten spans.

¹⁴ Barnawartha (BWA), Kinglake (KLK), Myrtleford (MYT), Rubicon-A (RUBA), Seymour (SMR), Wangaratta (WN). Wonthaggi (WGI) and Woori Yallock (WYK)

A5 **Audit performance**

A5.1 **Electrical Safety Management Scheme (ESMS)**

During the 2016-17 period, ESV continued to focus its attention on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. AusNet Services Distribution had its Full Safety Case accepted in February 2017.

As part of the process to establish an accepted ESMS, ESV plans to undertake extensive systems validation audits of AusNet Services during October to December 2017.

A5.2 **Electric line clearance**

Transmission and distribution network desktop audit

As a broad system audit was undertaken in 2015-2016 and one would be undertaken as part of the ESMS acceptance process, ESV did not undertake an audit of the AusNet Services management system in the 2016-2017 period.

Distribution network field inspection

An electric line clearance field inspection of the AusNet Services distribution network was conducted between 16 and 25 November 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

The inspection occurred at randomly selected locations in the east, central and northern regions of the network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected, but to a lesser extent.

A total of 192 electricity spans were inspected during the audit. Of these spans, 118 were located within HBRA and 74 in LBRA.

The inspection found the following:

▶ noncompliant spans	
▪ HBRA	1
▪ LBRA	10
▶ variance	
▪ total sample = 11 out of 192	5.7%
▪ HBRA = 1 out of 118	0.8%
▪ LBRA = 10 out of 74	13.5%

Generally the noncompliant spans fell into two groups:

- ▶ Spans for which AusNet Services is responsible = 2

The inspection results indicate that, where AusNet Services is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for high compliance standards (total noncompliance = 1.0 per cent).

This is most important for HBRA, where noncompliance improved from 3.9 per cent in 2015-2016 to 0.8 per cent in 2016-2017. The results in LBRA are also much improved — from 13.3 per cent in 2014 to 2.5 per cent in 2015-2016 to 1.4 per cent in 2016-2017.

Overall the accuracy of the AusNet Services vegetation management data and the line clearance compliance standards was acceptable.

- ▶ Spans for which AusNet Services is not responsible = 10

Where noncompliant vegetation identified was not the management responsibility of AusNet Services, it was the responsibility of municipal councils or private property owners and occupiers. This was only within the LBRA audited, as HBRA was solely the responsibility of AusNet Services within the audit area.

The Electricity Safety (Electric Line Clearance) Regulations 2015 place greater emphasis on effective notification, follow up and escalation processes to ensure noncompliant spans are not allowed to remain.

Where the noncompliant vegetation was not the management responsibility of AusNet Services, it was generally the responsibility of a municipal council. This was only within the LBRA audited, as HBRA was solely AusNet Services responsibility within the inspection area.

ESV requested those councils responsible for noncompliant vegetation to clear it to ensure the spans were made compliant.

The electric line clearance inspection recommended that AusNet Services:

- ▶ continue to use and develop its electric line clearance procedures to ensure annual inspection programs are completed efficiently and its vegetation management database is maintained to a high level of currency and accuracy
- ▶ ensure noncompliant vegetation is managed by other regulated entities, as per its ELCMP expectations and notification processes, to ensure the ongoing security of its network assets and ensure appropriate escalation processes are in place in instances where vegetation is not cleared by other responsible persons in a timely or effective manner.

A5.3 Bushfire mitigation

Transmission network

ESV conducted an inspection of the towers between Mount Beauty and Mansfield and towers between Rowville and the Latrobe Valley. A total of 79 transmission towers were inspected.

The inspection found:

- ▶ damaged polymeric insulators at two sites (most likely occurred since the last maintenance inspection)
- ▶ one bent member, which is a minor issue.

The visual inspection found the transmission assets to be generally in very good condition with a low risk of failure. The issues found were very minor in nature and would be repaired as part of routine maintenance. ESV recommended that AusNet Services should follow up and ensure these issues are addressed.

Overall, AusNet Services was found to have a detailed knowledge of its assets, their condition and the proximity of vegetation to its assets. The easement report provided by AusNet Services included detailed information on the condition of the lines. The AusNet Services system of regular patrols of the network would ensure that its knowledge is regularly updated.

Distribution network

The bushfire mitigation inspection focused on the general condition of the network to prevent fire starts. ESV auditors visited distribution feeders in the Bairnsdale, Sale, Moe, Ferntree Gully, Wangaratta and Mansfield areas and viewed 134 sites in total.

The findings of the inspection were:

- ▶ the assets inspected were in a condition reflective of the data provided at the time of inspection with defect items accurately recorded and coded for action as required
- ▶ two HBRA sites were observed without LV spreaders
- ▶ five unserviceable poles were identified as marginally beyond their due date for replacement (based on dates within the database provided).

ESV recommended that AusNet Services install LV spreaders at the two sites, extend the life of or replace the defective poles in accordance with their processes, and continue to monitor and address the condition of its assets in accordance with its current inspection cycles and practices.

The inspection concluded that systems and processes in place provide AusNet Services with reliable knowledge of the state of their system and the assets.

None of the issues identified was of a major safety concern if promptly resolved. AusNet Services has provided a response and action plan to address the inspection findings.

A5.4 Work practices

In 2016-2017, ESV undertook six observations of AusNet Services' work practices across six sites. The findings of these observations were as follows:

▶ noncompliances	0
▶ minor noncompliances	2
▶ opportunities for improvement	5

These findings are consistent with those of the 2014 and 2015 audits, where the key areas of concern related to:

- ▶ understanding and referencing of Safe Work Method Statements (SWMS)
- ▶ checking and use of appropriate Personal Protective Equipment (PPE), tools and equipment
- ▶ operating and access permit issuing practices.

ESV understands and recognises that AusNet Services has implemented an internal work practices observation program in line with ESV recommendations from previous years. ESV recommends that AusNet Services continues to develop its internal observation program to ensure it has an internal work practices program with specific focus on ensuring all workers:

- ▶ have a detailed understanding of the Job Safety Assessment process and know the contents of relevant Safe Work Method Statements
- ▶ refer to and use safe working practices
- ▶ check the condition of Personal Protective Equipment and equipment prior to use, particularly LV and HV insulating gloves and fall prevention equipment
- ▶ are involved in the permit issuing process and:
 - confirm all permit documents are completed to standard
 - ensure all persons involved in the work understand the permit they are signing onto
 - ensure the permit issuing process is to standard with appropriate communication, with strong, effective site leadership.

A6 Safety indicators

Figure 19 shows the annualised number of all serious electrical incidents reported to ESV by AusNet Services, with the data sorted from most frequent to least frequent. Figure 20 shows the same for those incidents that result in an asset or ground/vegetation fire. Both graphs also show the change in incident numbers from 2015-2016.

All of the five most common incidents and fire-related incidents are within the direct control of AusNet Services to manage.

The most common incidents on the AusNet Services network in 2015-2016 were HV fuse failures and tree contact. In 2016-2017, these have dropped to fourth and third place respectively, with both exhibiting significant reductions in the number of incidents. Unfortunately, the incidents that ranked in fourth and fifth places last year (other asset failures and connection failures) have increased to rank in first and second place this year due to significant increases in the number of incidents.

Even though there has been a reduction in HV fuse failures in the current reporting period, AusNet Services still has the highest number of such events of all the distribution businesses. It had about twice as many fuse failures as second-placed Powercor, although the number of fires attributable to such events is comparable to that experienced by Powercor. ESV will engage with AusNet Services to better understand the reasons for its higher fuse failure rate.

Of the five most common fire events, AusNet Services has experienced increases in the number of fires resulting from failures of connections and other assets and from animal contact. There has also been a significant reduction in fires from tree contact and HV fuse failures.

While other asset failures are the most common incident on the AusNet Services network, only 20 per cent result in fires. The second most common incident, connection failures, is the most common cause of fires; just under half of these events result in a fire incident.

On a positive note, last year's report noted that about 55 per cent of tree contact events result in a fire. This year has seen the number of tree contact fires more than halve, and also seen the number of tree contact events resulting in a fire dropping to 37 per cent this year.

Despite having a larger service area and more assets than all the other companies (with the exception of Powercor), the number of incidents reported by AusNet Services is comparable or lower than that of the other companies.

AusNet Services has the second highest number of fires on its network, with the total number of fires about half that experienced by Powercor. About 27 per cent result of incidents reported by AusNet Services result in fires. This is the highest rate of all the distribution businesses; Powercor and United Energy are in second and third places with 18 per cent and 7 per cent respectively. While the number of incidents fell this year, this ratio has remained stable over the last two years. ESV will engage with AusNet Services to better understand the reasons for this.

ESV has a high level of confidence that AusNet Services is effectively managing its network safety and safety initiatives. Its low incident rates, together with its strong delivery of its safety programs and directions, demonstrate that it is highly focused on network safety improvements. It also takes a positive and co-operative approach with ESV as the regulator.

Even so, the higher likelihood that an incident will result in a fire is of concern. Given the high tree density and geography of the AusNet Services region,¹⁵ there is a higher risk that fire starts in this region may escalate to a bushfire event. Therefore, it is important that we better understand the reasons for an elevated percentage of AusNet Services incidents resulting in fires.

Continued vigilance and implementation of programs under the amended bushfire mitigation regulations is needed to minimise opportunities for contact events to result in fires.

Further attention also needs to be paid to reducing connection failure and fires.

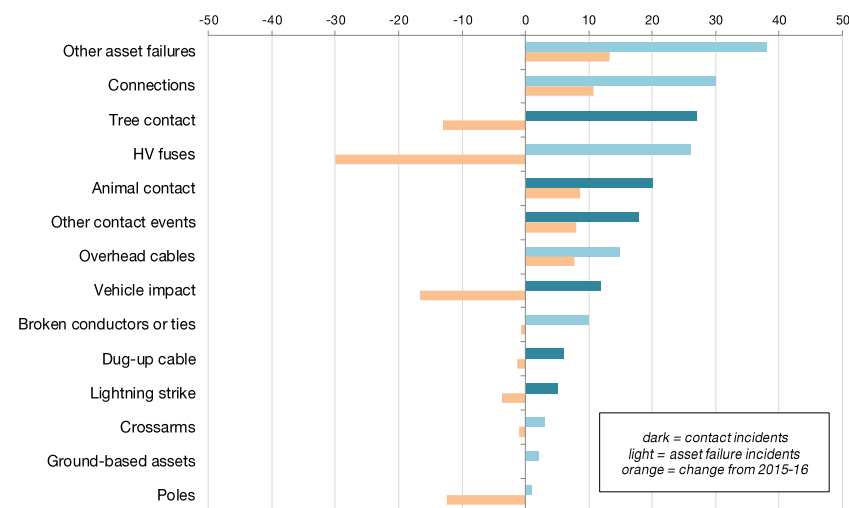


Figure 19 Incidents on the AusNet Services network

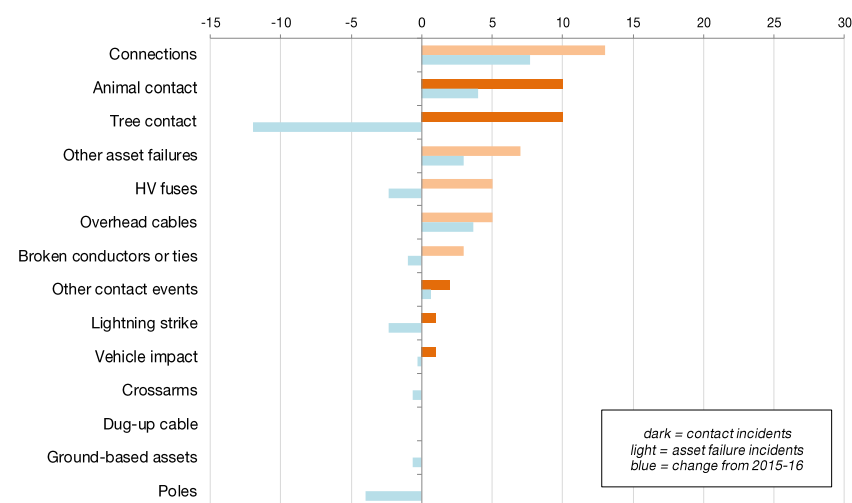


Figure 20 Incidents on the AusNet Services network resulting in ground fires

¹⁵ Tree density across Victoria is shown in Appendix I.

APPENDIX B : BASSLINK

Basslink is owned by Keppel Infrastructure Trust, an entity listed on the Singapore stock exchange, and is registered as a Market Network Service Provider.

Basslink owns and operates the HVDC interconnector between Victoria and Tasmania. In Victoria its assets comprise the Loy Yang converter station connected to the 500kV transmission system via 3.2 km of overhead line. From the converter station, 57 km of overhead line and 6.4 km of underground cable connect to the submarine cables that cross Bass Strait to Tasmania (Figure 21). Only the onshore assets in Victoria are subject to regulation by ESV.

The Basslink asset base in Victoria is significantly smaller than that of AusNet Services Transmission; it has only one per cent of the towers that AusNet owns and maintains. Its assets are also newer, having only been commissioned in April 2006.



Figure 21 Location of Basslink transmission assets (dark blue line)

B1 Plans and processes

Basslink was scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) before 30 September 2016
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revised bushfire mitigation plan
- ▶ Electric Line Clearance Management Plan by 31 March each year.

With the new requirement to submit a Safety Case for acceptance prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 30 September 2016. This will be seen by ESV as triggering the ESMS process. Basslink submitted its Preliminary Safety Case to ESV on 12 September 2016. ESV has assessed the Safety Case and, in December 2016, requested Basslink to submit its Full Safety Case. The Full Safety Case was submitted to ESV on 13 July 2017.

Basslink also submitted its Electric Line Clearance Management Plan to ESV on 31 March 2017. ESV assessed the submitted plan and approved it on 6 July 2017.

B2 Directions

ESV has not had cause to issue directions to Basslink.

B3 Exemptions

Basslink has sought no exemptions from regulations.

B4 Audit performance

B4.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attention on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Basslink has recently submitted its Full Safety Case to ESV with ESV assessment underway.

As part of the process to establish an accepted ESMS, ESV plans to undertake extensive systems validation audits on Basslink during January to March 2018.

B4.2 Electric line clearance

An electric line clearance inspection of the Basslink transmission network was conducted 1 December 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

The inspection occurred at randomly selected locations on the easement of the network, which exists entirely in HBRA. A total of 50 electricity spans were inspected during the audit.

All the inspected spans were found to be compliant to the clearance requirements of the electric line clearance regulations. This was consistent with the findings of the most recent line clearance inspection of Basslink, which occurred in 2013.

While the clearance distances being achieved by Basslink were compliant, discrepancies were found in the data that was submitted to the inspection. This included:

- ▶ inspection scheduling
- ▶ maintaining current data
- ▶ applying inspection codes as defined in by the Basslink ELCMP.

The electric line clearance inspection recommended that Basslink:

- ▶ review its processes and ensure consistent application of span inspection codes and priority work recommendations
- ▶ ensure the timing of its annual inspections aligns with that detailed in its electric line clearance management plan
- ▶ ensure clearing inspection and clearing databases are maintained as current and up to date as possible.

B4.3 Bushfire mitigation

ESV inspected the 400kV DC powerlines running between the Loy Yang convertor station and the coastal connector station. A total of 64 transmission towers along the route were inspected.

The inspection made the following observations:

- ▶ the transmission line is relatively new
- ▶ in general, the visual ground inspection of assets along the line route indicate that the line was in good condition, reflecting its most recent line condition inspection conducted in February 2015
- ▶ a small number of minor maintenance items were recorded and Basslink will manage these via its maintenance management processes.

The inspection found the transmission assets to be generally in very good condition with a low risk of failure. No safety issues were found regarding asset condition from the inspection.

Overall, Basslink was found to have a detailed knowledge of its assets, their condition and the proximity of vegetation to its assets. The easement report provided by Basslink included detailed information on the condition of the lines. Regular patrols of the system by Basslink would ensure that its knowledge is regularly updated.

Basslink has provided a response to the inspection findings.

B4.4 Work practices

In 2016/17 ESV conducted one observation of Basslink works practices. The results of this observation are:

▶ noncompliances	0
▶ minor noncompliances	0
▶ opportunities for improvement	3

This is the first time that ESV has observed Basslink works practices. The Basslink transmission line is operational most of the time with scheduled maintenance occurring every two years. This observation was the result of a coal stacker being relocated between two of AGL's operations in the Latrobe Valley. The path of the relocation passed under the DC transmission line immediately adjacent to the Loy Yang converter station (Figure 22).



Figure 22 The AGL coal stacker approaching the Loy Yang converter station

The relocation of the stacker required the 400 kV DC overhead powerlines between the Loy Yang converter station and the coast to be lowered and reinstated. AusNet Services was engaged to undertake the works on Basslink's behalf.

The stacker move involved five years of planning. As part of this, Basslink, AusNet Services, AGL and ESV undertook a trial of the overhead line lowering and reinstatement at a site in South Morang, in order to develop an appropriate earthing procedure and confirm all procedures and works practices.

Form the audit of the works involved in the relocation, ESV recommends that Basslink ensures it has an internal work practices program with specific focus on ensuring all workers:

- ▶ have a detailed understanding of the JSA process and know the contents of relevant SWMS
- ▶ check the condition of equipment prior to use
- ▶ ensure the description of apparatus to be switched and switching instruction number are used as an identifier for the work.

B5 Safety indicators

Transmission infrastructure generally has low levels of incidents due to the nature of the assets and the clearances maintained around these higher voltage assets. Transmission assets are also less dispersed than distribution assets, thereby reducing exposure to environmental threats and third-party impacts. This also makes them easier to maintain.

Compared to the AusNet Services transmission network, Basslink has the further advantage of having a relatively short transmission line in Victoria. Also being a relatively new asset, Basslink has not entered a phase of its life cycle where major maintenance is required.

It is therefore not unexpected that Basslink recorded no incidents on its transmission network during the 2016-2017 period.

Within Victoria, any threats to the Basslink network are most likely to arise from load stresses from constant switching or reversing of power flowing through substation assets due to loading demands dictated by market.

APPENDIX C : CITIPOWER

CitiPower/Powercor is jointly owned by Cheung Kong Infrastructure, Power Assets Holdings and Spark Infrastructure. Cheung Kong Infrastructure, Power Assets Holdings are both part of the Cheung Kong Group of companies. They jointly own 51 per cent of CitiPower/Powercor, with the remaining 49 per cent held by Spark Infrastructure.

In May 2017, Cheung Kong Infrastructure purchased the DUET Group, thereby giving it majority ownership (66 per cent) of United Energy. This buyout will see some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls; however, this had not yet impacted CitiPower/Powercor during the 2016-2017 period.

CitiPower and Powercor are managed by a single executive management team using common procedures and systems across the two distribution businesses. As a result, the Electricity Safety Management System (Section C4.1) and the work practices observations audits (Section C4.4) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the CitiPower network and have therefore been assessed independently of the Powercor assets.

The CitiPower distribution network covers an area of approximately 157 km², and includes Melbourne's central business district and inner suburbs (Figure 23). It comprises approximately 4440 km of overhead line, 2960 km of underground cable and 59,000 poles. Most of this network (75 per cent) is in the central business district.



Figure 23 Service area for the CitiPower distribution network (orange area)

Jemena and United Energy service boundaries are shown in orange

C1 Plans and processes

CitiPower was scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) before 14 December 2015
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revision of the accepted bushfire mitigation plan, although revised plans have been accepted annually due to regular revisions in the regulations
- ▶ Electric Line Clearance Management Plan by 31 March each year.

With the new requirement to submit a Safety Case for acceptance prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 14 December 2015 and this would be seen by ESV to have triggered the ESMS process.

A Preliminary Safety Case was first provided by CitiPower on 27 July 2015. After three iterations, a Preliminary Safety Case was accepted by ESV on 1 September 2016. CitiPower submitted its Full Safety Case, incorporating feedback from the Preliminary Safety Case assessment, to ESV on 22 December 2016. After two further iterations, ESV accepted the Full Safety Case on 8 August 2017. CitiPower is currently working on its ESMS.

CitiPower also submitted its Electric Line Clearance Management Plan to ESV on 3 April 2017. ESV has assessed the submitted plan and is working with CitiPower to ensure a compliant and approved plan is in place prior to the fire danger period.

C2 Directions

CitiPower has no hazardous bushfire risk areas (HBRA) in its region, so no directions were placed on CitiPower regarding the installation of armour rods and vibration dampers in HBRA.

Two directions have been placed on CitiPower that are yet to commence, namely to:

- ▶ install armour rods and vibration dampers in low bushfire risk areas (LBRA)
- ▶ install spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines in LBRA.

These directions are not due to be completed until 2020. These directions will be monitored by ESV.

C3 Exemptions

There were no outstanding exemptions applicable to CitiPower. All previous exemptions issued in the last five years have been complied with through the completion of tree clearance works.

C4 Audit performance

C4.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attention on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. CitiPower/Powercor had its Preliminary Safety Case accepted in August 2017.

As part of the process to establish an accepted ESMS, ESV plans to undertake extensive systems validation audits on CitiPower during January to March 2018.

C4.2 Electric line clearance

An electric line clearance inspection of the CitiPower distribution network was conducted in January 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at randomly selected locations supplied by the CitiPower network in the suburbs of Toorak, Hawthorn, Collingwood, Camberwell and West Brunswick. The entire network is LBRA or of an undefined bushfire risk.

A total of 266 electricity spans were inspected. CitiPower was responsible for all spans inspected.

The inspection found the following:

- | | |
|------------------------------|-------|
| ▶ noncompliant spans in LBRA | 31 |
| ▶ variance = 31 out of 266 | 11.7% |

The inspection results indicate that CitiPower's processes and clearing activities are implemented effectively and provide reasonable compliance standards. That said, the overall rate of noncompliance had increased from 10.4% in 2015-2016 to 11.7% in 2016-2017. This level of compliance could be improved.

ESV also found the CitiPower vegetation management data to be inaccurate. At the time of the audit, CitiPower advised it was revising its vegetation management systems to address the data inaccuracies.

The electric line clearance inspection recommended that CitiPower:

- ▶ ensures it has an accurate and current vegetation management database upon which to base its future work recommendation and vegetation management programs
- ▶ review and update the information within its vegetation management database to ensure recorded span information is accurate and up to date.

- ▶ review its post-assessment activity data capture processes to ensure accurate records of cutting activity
- ▶ ensures its line clearance inspection practices are effective at validating the accuracy of currently recorded span clearance and code information.

C4.3 Bushfire mitigation

The bushfire mitigation inspection assessed compliance with legislation and internal business process, with a focus on the state of assets in the Toorak, Hawthorn, Collingwood, Camberwell and West Brunswick areas. Inspections were carried out on 47 poles randomly selected from these areas.

The inspection found:

- ▶ a priority (P1) low LV conductor and a condemned pole without a white cross painted on it
- ▶ two low priority (P3) deteriorated crossarms not previously reported in the database
- ▶ examples of underground XLPE cables terminating into fuse boxes with the coloured underground tails exposed.

In relation to the XLPE cables, there is an opportunity for improvement for CitiPower to review its practices in line with its construction standards to determine whether corrective actions are required to ensure these items are not subject to UV degradation over time. Providing guidance for asset inspectors to report these items within the asset inspection manual may also be valuable.

The inspection also recorded additional maintenance items not included within the data provided for 15 of the poles audited. Although a high percentage, feedback from CitiPower has confirmed items at eleven sites were not reportable as per its inspection and reporting policy at the time of inspection. The additional items mainly related to potential public hazards (e.g. loose gang nails), non-standard LV service terminations or fittings, and unused assets on poles.

Items at a further two sites have been confirmed as not reportable or incorrectly assessed at the time of audit — a daisy chain service and an incorrectly-terminated LV cable.

CitiPower was made aware of these findings, and recommendations were made for CitiPower to follow up on all items reported.

The inspection findings showed that CitiPower generally had sound processes and procedures in place to adequately manage and check on the assets in the field. None of the issues identified was of a major concern.

CitiPower has provided a response and action plan to address the findings of the inspection.

C4.4 Work practices

In 2016-2017, ESV undertook two observations of CitiPower work practices across four sites. The findings of these observations were as follows:

▶ noncompliances	0
▶ minor noncompliances	2
▶ opportunities for improvement	4

These findings are consistent with some those of the 2015-2016 observations, where the key areas of concern related to:

- ▶ quality of Job Safety Assessments (JSAs)
- ▶ checking and use of appropriate PPE, tools and equipment
- ▶ operating and access permit issuing practices.

There was an additional finding about ensuring that the safety observers were in place to watch work before commencing such work.

ESV recommends CitiPower ensures it has an internal work practices program with specific focus on ensuring all workers:

- ▶ have a detailed understanding of the JSA process and know the contents of relevant Safe Work Method Statements
- ▶ check the condition of equipment prior to use, and use appropriate PPE, particularly LV and HV insulating gloves and fall prevention equipment
- ▶ confirm the safety observer is ready to undertake his duties before starting work
- ▶ are involved in the permit issuing process and:
 - confirm all permit documents are completed to standard
 - ensure all persons involved in the work understand the permit they are signing onto
 - ensure the permit issuing process is to standard with appropriate communication, with strong, effective site leadership.

C5 Safety indicators

Figure 24 shows the annualised number of all serious electrical incidents reported to ESV by CitiPower, with the data sorted from most frequent to least frequent. Figure 25 shows the same for those incidents that result in an asset or ground/vegetation fire. Both graphs also show the change in incident numbers from 2015-2016.

Of the five most common incidents, the top three events are largely outside of the direct control of CitiPower. Vandalism, copper theft and intrusions into the No Go Zones around overhead lines are included within other contact events. These have increased by about 50 per cent since last year. Dug-up cable incidents have reduced slightly. Vehicle impacts, the most common event last year, has reduced by two-thirds in the last twelve months.

The other two incident types within the top five events — other asset failures and tree contact events — are within the direct control of CitiPower. Both of these have doubled in 2016-2017.

The number of fires on the CitiPower network has reduced to zero across all categories except for broken conductors or ties. This is a positive outcome for the year.

ESV is pleased with the low incident rates experienced by CitiPower, particularly the extremely low number of fires.

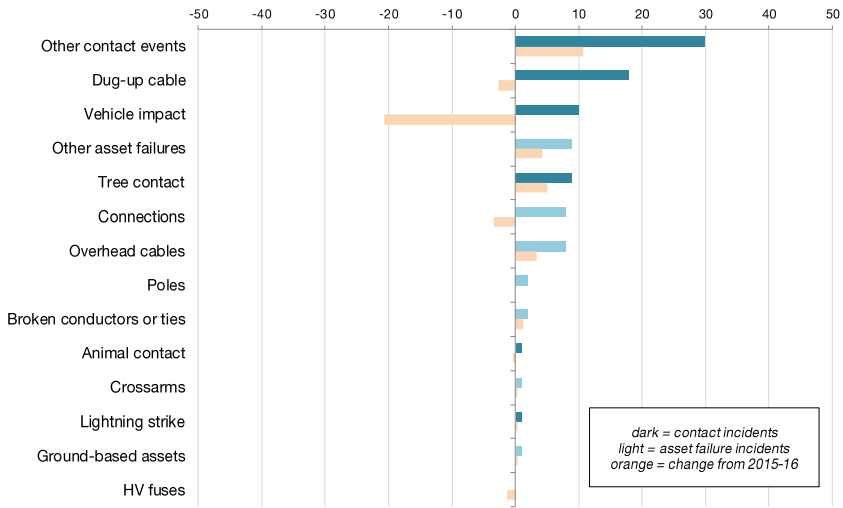


Figure 24 Incidents on the CitiPower network

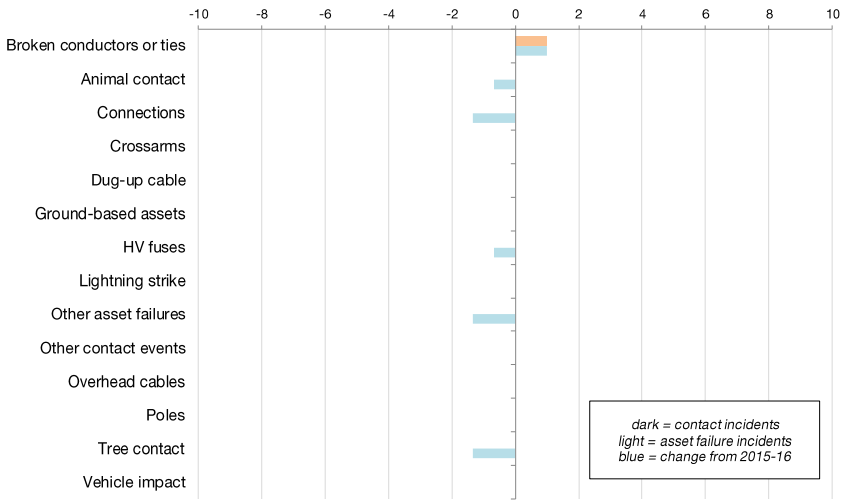


Figure 25 Incidents on the CitiPower network resulting in ground fires

APPENDIX D : JEMENA

Jemena Electricity Networks (Jemena) is one of the subsidiaries of SGSP (Australia) Assets Pty Ltd, which is jointly owned by the State Grid International Development Australia Investment Company Limited (SGIDAIC) and Singapore Power International Pte Ltd (SPI). SGIDAIC holds a 60 per cent shareholding in SGSPAA and SPI holds the remaining 40 per cent.

SGIDAIC is owned by the State Grid Corporation of China. SPI is owned by Singapore Power Limited and its ultimate holding company is Temasek Holdings (Private) Limited.

As well as 100 per cent ownership of Jemena, SGSPAA also owns a 34 per cent interest in United Energy Distribution Holdings Pty Ltd, the holding company of United Energy Distribution Pty Ltd. The two companies forming SGSPAA also own the controlling interest (51 per cent) in AusNet Services.

The Jemena AC distribution network covers any area of approximately 950 km², across Melbourne's northern and western suburbs, including Melbourne International Airport (Figure 26). It comprises approximately 4450 km of overhead line, 1850 km of underground cable and 104,000 poles. Most of this network (86 per cent) is in urban areas.



Figure 26 Service area for the Jemena distribution network (orange area)

CitiPower and United Energy service boundaries are shown in orange

D1 Plans and processes

Jemena was scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) before 3 December 2015
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revision of the accepted bushfire mitigation plan, although revised plans have been accepted annually due to regular revisions in the regulations
- ▶ Electric Line Clearance Management Plan by 31 March each year.

With the new requirement to submit a Safety Case for acceptance prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 3 December 2015 and this would be seen by ESV to have triggered the ESMS process.

A Preliminary Safety Case was first provided by Jemena on 5 October 2015. After three iterations, a Preliminary Safety Case was accepted by ESV on 20 September 2016. Jemena submitted its Full Safety Case, incorporating feedback from the Preliminary Safety Case, to ESV on 7 March 2017. ESV is still in the process of assessing this Full Safety Case.

Jemena has now been working for two years without delivering an acceptable Safety Case. ESV will escalate this with Jemena senior management.

Jemena also submitted its Electric Line Clearance Management Plan to ESV on 31 March 2017. ESV approved the ELCMP on 22 August 2017.

D2 Directions

ESV has issued two directions to Jemena:

- ▶ install armour rods and vibration dampers in hazardous bushfire risk areas (HBRA) by the end of 2015 and in low bushfire risk areas (LBRA) by the end of 2020
- ▶ install spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines in HBRA by the end of 2015 and in LBRA by the end of 2020.

By 31 December 2015, Jemena had only installed 1701 armour rods against a target of 5100. Jemena advised that it had over-estimated the number of armour rods that required installation when the target was developed as part of the 2011-2015 Electricity Distribution Price Review. Jemena also asserted that all spans have been inspected and those requiring armour rods have had them installed. ESV undertook further assessment and accepted Jemena's safety rationale for reporting less than the original estimated target.

Jemena successfully completed the direction to install spacers and spreaders by 31 December 2015.

Jemena is installing armour rods, vibration dampers, spacers and spreaders in the LBRA as part of the routine maintenance program. Jemena estimates that 271 spans will be completed by November 2020. The plan is to retrofit vibration dampers and armour rods annually to approximately 90 LBRA spans over three years — 91 in 2018, 90 in 2019 and 90 in 2020.

D3 Bushfire mitigation regulations programs

To meet its bushfire mitigation obligations, Jemena is mandated to implement REFCL technology at Coolaroo zone substation by 30 April 2023. This work has yet to commence.

Over the 2016-2017 period, Jemena installed Arc Suppression Coils at Sydenham and has plans to install a similar device at Sunbury. While these operate like a REFCL and will provide some level of fire ignition risk reduction, they do not provide the same level of sensitivity and protection as a REFCL. That said, Jemena does not have an obligation to install these devices and should be commended for taking this proactive action.

D4 Exemptions

Jemena completed all works on its exemptions resulting from the 2010 revision of Electricity Safety (Electric Lines Clearance) Regulations prior to the 2016-2017 period.

There are no other exemptions currently applicable to Jemena.

D5 Audit performance

D5.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attention on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention.

While ESV plans to undertake extensive systems validation audits of Jemena's revised ESMS during 2018, ESV is currently unable to confirm the timing of these audits. This timing is dependent on receipt of a revised ESMS from Jemena, and this cannot be submitted to ESV until the Safety Case is in an acceptable form (see Section D1).

D5.2 Electric line clearance

An electric line clearance inspection of the Jemena distribution network was conducted between 28 October and 4 November 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at randomly selected locations in the suburbs of Coolaroo, Sunbury, Clarkefield and Gisbourne that are supplied by the Jemena network. Particular emphasis was placed on inspecting spans located in HBRA due to the increased fire threats that exist. Spans in LBRA were not inspected.

A total of 125 electricity spans were inspected. Jemena was responsible for all spans audited.

The inspection found the following:

▶ noncompliant spans in HBRA	6
▶ variance = 6 out of 125	4.8%

The inspection results indicate that Jemena's processes and clearing activities are implemented effectively providing very good compliance standards. This is most important for HBRA.

The 2016-2017 results were consistent with those from 2015-2016. Overall the accuracy of the Jemena vegetation management data and the electric line clearance compliance standards was acceptable.

The electric line clearance inspection recommended that Jemena:

- ▶ continues to utilise and develop procedures to ensure annual inspection programs are completed efficiently and;
- ▶ manages its vegetation database to a high level of currency and accuracy

- ▶ undertakes its vegetation clearance activities to ensure line clearance standards are maintained
- ▶ manages identified noncompliant spans as per its line clearance procedures, monitoring and actioning spans as appropriate.

D5.3 Bushfire mitigation

The bushfire mitigation field inspection assessed compliance with legislation and internal business process with a focus on the status of assets in the Coolaroo, Sunbury, Clarkefield, and Gisborne areas. Inspections were carried out at 90 sites randomly selected in these areas.

The inspection findings showed that Jemena generally had sound processes and procedures in place to adequately manage and check on the assets.

Particular items identified during the inspection included:

- ▶ two LBRA sites where three deteriorated LV crossarms were called in for immediate repair by the Jemena representative at the time of the inspection — one with a visible fungal fruiting body and another where two crossarms showed signs of heavy deterioration¹⁶
- ▶ 14 poles were observed where the installation of dampers was not in accordance with Jemena standards (i.e. installed one hand width beyond the end of the armour rod or other fittings)
- ▶ five potentially low-hanging LV services.

None of the issues identified was of major concern.

Jemena has provided ESV with actions that adequately rectify all of the findings of the inspection.

D5.4 Work practices

In 2016-2017, ESV undertook two observations of Jemena work practices, one on a Jemena work crew and one on a Jemena contractor. The findings of these observations were as follows:

- | | |
|---------------------------------|---|
| ▶ noncompliances | 2 |
| ▶ minor noncompliances | 5 |
| ▶ opportunities for improvement | 7 |

These findings are consistent with those of the 2014 observations, where the key areas of concern related to:

- ▶ checking and use of appropriate PPE, tools and equipment
- ▶ establishing and managing the drop zone and safe areas
- ▶ appropriate pre-site job planning to consider all variables.

ESV recommends that Jemena ensures it has an internal work practices program with specific focus on ensuring:

- ▶ all workers check the condition of equipment prior to use, and use appropriate PPE, particularly LV and HV insulating gloves and fall prevention equipment
- ▶ all workers including contractors be involved in the onsite JSA process
- ▶ the work planning processes ensure adequate pre-site job planning, including consultation with work crew leaders.

¹⁶ Both sites were last inspected in 2013.

D6 Safety indicators

Figure 27 shows the annualised number of all serious electrical incidents reported to ESV by Jemena, with the data sorted from most frequent to least frequent. Figure 28 shows the same for those incidents that result in an asset or ground/vegetation fire. Both graphs also show the change in incident numbers from 2015-2016.

Of the five most common incidents, other contact events and vehicle impacts are largely outside of the direct control of Jemena to manage. Other asset failures, broken conductor/ties and tree contact events are within the direct control of Jemena. Of these, all increased in numbers in 2016-2017 except for vehicle impacts. While the number of other asset failure events is low, these have trebled in last year and ESV will continue to monitor this to ensure it does not become a significant issue.

Over the last twelve months, fire-related incidents on Jemena's network fell across all categories except for other asset failures and vehicle impacts. As a result, the number of fires fell to zero across all categories except for other asset failures, vehicle impacts and connection failures. This is a positive outcome for the year.

While ESV is generally pleased with the low rate of fire incidents experienced on the network, Jemena should consider reducing the number of failures involving broken conductors/ties and other asset failures. Jemena is also to be commended for its proactive approach in implementing voluntary bushfire mitigation regulations programs.

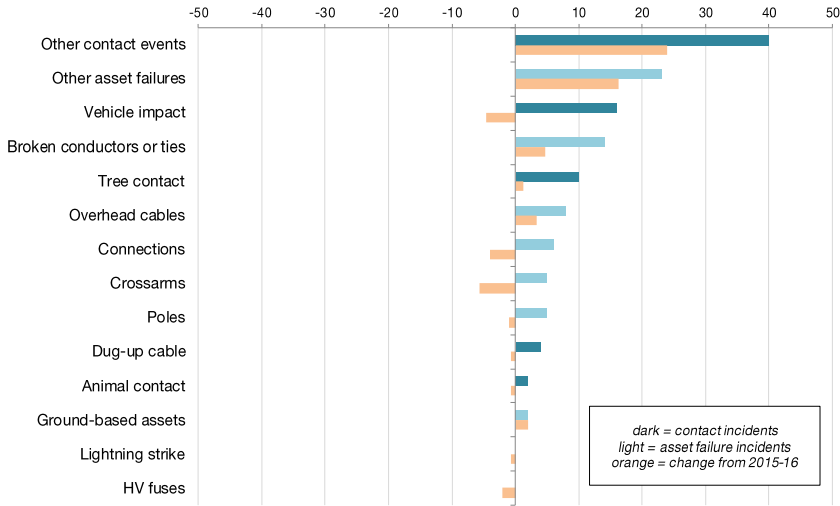


Figure 27 Incidents on the Jemena network

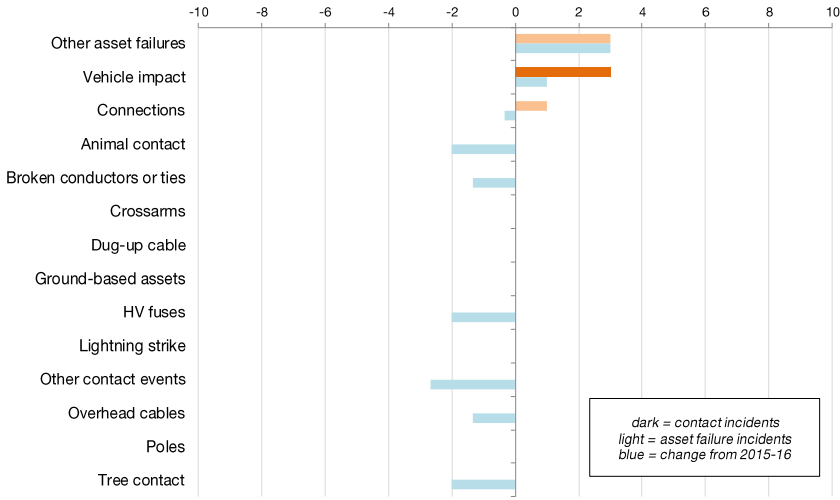


Figure 28 Incidents on the Jemena network resulting in ground fires

APPENDIX E : POWERCOR

CitiPower/Powercor is jointly owned by Cheung Kong Infrastructure, Power Assets Holdings and Spark Infrastructure. Cheung Kong Infrastructure and Power Assets Holdings are both part of the Cheung Kong Group of companies. They jointly own 51 per cent of CitiPower/Powercor, with the remaining 49 per cent held by Spark Infrastructure.

In May 2017, Cheung Kong Infrastructure purchased the DUET Group, thereby giving it majority ownership (66 per cent) of United Energy. This buyout will see some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls; however, this had not yet impacted CitiPower/Powercor during the 2016-2017 period.

CitiPower and Powercor are managed by a single executive management team using common procedures and systems across the two distribution businesses. As a result, the Electricity Safety Management System (Section C4.1) and the work practices observations audits (Section C4.4) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the Powercor network and have therefore been assessed independently of the CitiPower assets.

The Powercor distribution network covers any area of approximately 145,700 km², and includes Melbourne's Docklands Precinct, west from Williamstown to the South Australian border, north to the Murray and south to the coast (Figure 29). It comprises approximately 75,460 km of overhead line, 9330 km of underground cable and 530,000 poles. Most of this network (92 per cent) is in rural areas.



Figure 29 Service area for the Powercor distribution network (orange area)

E1 Plans and processes

Powercor was scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) before 14 December 2015
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revision of the accepted bushfire mitigation plan submitted to ESV although, due to regular revisions in the regulations, revised plans have been accepted annually
- ▶ Electric Line Clearance Management Plan by 31 March each year.

With the new requirement to submit a Safety Case for acceptance prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 14 December 2015 and this would be seen by ESV to have triggered the ESMS process.

A Preliminary Safety Case was first provided by Powercor on 27 July 2015. After three iterations, a Preliminary Safety Case was accepted by ESV on 1 September 2016. Powercor submitted its Full Safety Case, incorporating feedback from the Preliminary Safety Case, to ESV on 22 December 2016. After two further iterations, ESV is still assessing the Full Safety Case.

Powercor also submitted its Electric Line Clearance Management Plan to ESV on 3 April 2017. ESV has assessed the submitted plan and is still working with Powercor to ensure a compliant and approved plan is in place prior to the fire danger period.

E2 Directions

ESV has issued four directions to Powercor:

- ▶ install armour rods and vibration dampers in hazardous bushfire risk areas (HBRA) by 1 November 2015 and in low bushfire risk areas (LBRA) by 1 November 2020

- ▶ install spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines in HBRA by 1 November 2015 and LBRA by 1 November 2020
- ▶ undertake powerline replacement projects specified by the Powerline Bushfire Safety Program under the Powerline Replacement Fund
- ▶ ensure that all SWER ACRs have protection settings and reclose functions that can be controlled by Powercor's SCADA system.

In setting up the armour rod and vibration damper direction, Powercor estimated 20,300 armour rods and 195,700 vibration dampers would be needed.

By 31 December 2015 Powercor had installed armour rods and/or vibration dampers at 177,558 sites. In failing to meet the direction deadline, Powercor estimated that approximately 9 per cent of its asset locations in HBRA still needed to have armour rods and vibration dampers installed. Powercor advised that the remaining spans would be completed by the end of 2016.

In early 2016 ESV conducted a thorough audit of Powercor's systems, procedures and processes in relation to the armour rods and vibration dampers program. ESV made recommendations to Powercor for areas of improvement, and these were accepted by Powercor.

The installation of armour rods and vibration dampers in HBRA was finally completed in April 2017, except for one location that was surrounded by flood water and completed in June 2017 — twenty months after the original completion date and six months after the revised completion date.

The installation of spacers and spreaders in HBRA was completed on time by 1 November 2015.

Powercor is in the process of developing a plan to complete the armour rod, vibration dampers and spacer program for installation in the LBRA. While final installation numbers are still being ascertained, Powercor has started installing armour rods and vibration dampers and plans to complete installation works at 8000 sites in LBRA by 31 December 2017.

Powercor was directed to undertake nineteen projects for the Powerline Replacement Fund with separate completion dates for each project. All projects were completed on time, by December 2015.

For the ACR direction, Powercor submitted an alternative product (FuserSaver) to ESV for acceptance as an ACR. This product was reviewed by ESV and deemed to meet the requirements of the regulation as an ACR. Powercor plans to install 265 of these devices during 2017, and to install a further 1062 by 2020. This will ensure all SWER lines in the Powercor area have an ACR in accordance with the direction.

ESV will monitor Powercor's implementation of the recommendations and completion of the works in LBRA and installation of FuseSavers to ensure the directions are met.

E3 Bushfire mitigation regulations programs

To meet its bushfire mitigation obligations, Powercor plans to implement REFCL technology at 22 nominated zone substations over three delivery tranches. Consistent with its bushfire mitigation plan, Powercor is to address seven zone substations¹⁷ in its first delivery tranche by 30 April 2019.

Over the 2016-2017 period, Powercor progressed its REFCL program encountering a number of technical issues. Table 3 provides a delivery breakdown for each of the seven zone substations.

ESV continues its engagement with Powercor to resolve the need for a consistent compliance testing methodology to ensure that regulatory requirements are achieved.

ESV will continue its regulatory administration and exercise its best endeavours to support the delivery of safe, cost-effective and efficient solutions.

¹⁷ Camperdown (CDN), Castlemaine (CMN), Colac (CLC), Gisborne (GSB), Maryborough (MRO), Winchelsea (WIN) and Woodend (WND)

In relation to the SWER ACR program, ESV accepted the use of FuseSavers, an alternative device that meets the requirements of an ACR. Powercor revised its deployment plan, as provided in Table 4, to increase delivery to provide improved safety outcomes. It has since experienced some firmware issues that have further delayed the program. Powercor should have time to recover any delays and deliver the overall program by 2020. ESV will continue to monitor closely the progress of this program.

Table 3 Powercor REFCL delivery progress

REFCL delivery milestone	CDN	CMN	CLC	GSB	MRO	WIN	WND
Initiate	●	●	●	●	●	●	●
Design	●	●	●	●	●	●	●
Procurement – Ordered	●	●	●	●	●	●	●
Construction – Lines	●	●	●	●	●	●	●
Construction – Stations	●	●	●	●	●	●	●
Construction – Third-party	●	●	●	-	-	-	-
Testing / Commissioning	●	●	●	●	●	●	●
Close Out	●	●	●	●	●	●	●

● Complete
● In progress
● Not commenced
- Not required

Table 4 Powercor ACR delivery progress

ACR program	2016	2017	2018	2019	2020	Total
Planned delivery	117	265	265	265	150	1062
Actual installed	117	9	0	0	0	126

E4 Exemptions

ESV has received two exemption requests from Powercor to install, on a temporary basis, overhead bare SWER in the Electric Line Construction Area.

On 13 January 2017 and then on 5 April 2017 Powercor requested an exemption to install a single overhead bare conductor SWER extension to a customer in the Leichardt and Morang areas respectively. The exemptions were requested on a temporary basis until LoSag conductor is approved.

ESV reviewed and accepted the exemptions on the basis that the supply was required for a customer and the SWER will be changed to an insulated cable in accordance with regulations in a few months. ESV will monitor Powercor to ensure the exemption conditions are met.

E5 Audit performance

E5.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attention on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. CitiPower/Powercor had its Safety Case accepted in August 2017.

As part of the process to establish an accepted ESMS, ESV plans to undertake extensive systems validation audits on Powercor during January to March 2018.

E5.2 Electric line clearance

An electric line clearance inspection of the Powercor distribution network commenced on 24 October 2016 and was completed on 1 December 2016.

The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at randomly selected locations in the Bridgewater, Serpentine, Ballarat West, Geelong East and Drysdale areas supplied by the Powercor network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected but to a lesser extent.

A total of 588 electricity spans were inspected. Of these spans, 568 were located within HBRA and 20 in LBRA. Powercor was responsible for all spans audited.

The inspection found:

- ▶ noncompliant spans
 - HBRA 16
 - LBRA 0
- ▶ variance
 - total sample = 16 out of 588 2.7%
 - HBRA = 16 out of 568 2.8%
 - LBRA = 0 out of 20 0.0%

The inspection results indicated that Powercor’s processes and clearing activities were being implemented effectively and were providing good compliance standards in the areas inspected. This is most important for HBRA.

The 2016-2017 results improved on those from 2015-2016. Overall, the accuracy of the Powercor vegetation management data could be improved; however, the line clearance compliance standards were acceptable.

The electric line clearance inspection recommended that Powercor:

- ▶ review and update information within its vegetation management database to ensure span information is accurate and continuously updated; this being particularly relevant to HBRA

- ▶ review and amend its vegetation management processes to ensure span inspection coding accurately reflects what is necessary to ensure compliant clearance distances can be maintained between cyclic inspections
- ▶ manage confirmed noncompliant spans as per its line clearance management processes and procedures to ensure compliant span clearance outcomes are achieved and maintained.

Despite these inspection results, information reported by Powercor (see Section 6.3.2) indicated that noncompliance rates across the wider network may be higher than indicated by the line clearance inspection.

ESV sought to inform itself more broadly of the state of the network by conducting further field inspections. These activities identified noncompliant and unsafe vegetation in HBRA in regions where the fire danger period had been declared by the Country Fire Authority.

The noncompliance identified through the additional inspections has been the subject of ongoing investigation by ESV during the 2016-2017 period and may be the subject of enforcement action.

E5.3 Bushfire mitigation

The bushfire mitigation field inspection assessed compliance with legislation and internal business process with a focus on asset condition in the Bridgewater, Serpentine, Ballarat West, Geelong East, and Drysdale areas. Inspections were carried out at 120 sites randomly selected in these areas.

The inspection findings showed that Powercor generally had sound processes and procedures in place to adequately manage and check on the quality of the assets.

Some items identified during the inspection included:

- ▶ a transformer secured to a bracket using wire, indicating a potential issue with “as-built” detailing (if this was done during construction) or “fault follow-up” processes (if done during fault repairs)
- ▶ one span that contained nine conductor repair sleeves that, while not defective, may warrant further follow-up by Powercor due to the large number present on a single span
- ▶ some assets that were not constructed to current standards and where the database did not list the assets as being non-standard
- ▶ three items recorded that would not be reportable using the processes in Powercor’s asset inspection manual
- ▶ two items related to defects on Private Overhead Electric Lines that are likely to have occurred from storm damage after their last inspection.

In relation to assets not constructed to current standards, there is an opportunity for Powercor to provide further clarification in the asset inspection manual to encourage the identification and reporting of such items.

It was acknowledged by Powercor that further clarity could be provided in its asset inspection manual regarding reporting of assets not constructed to standard and where there may be ambiguity regarding triggers for reporting.

Recommendations have been made in relation to the provision of further guidance in relation to a number of observations, including the recording of assets not constructed to standard, identification and recording of deteriorated conductor ties, and potential defects relating to armour rod installations.

None of the issues identified was of major concern.

Powercor has provided a response to ESV with actions to address the audit findings.

E5.4 Work practices

In 2016-2017, ESV undertook one observation of the work practices of one of Powercor’s service providers across two sites. The findings of these observations were as follows:

- ▶ noncompliances 2
- ▶ minor noncompliances 3
- ▶ opportunities for improvement 2

These findings are consistent with those of the 2014 observations, where the key areas of concern related to:

- ▶ quality of Job Safety Assessments (JSAs)
- ▶ checking and use of appropriate PPE, tools and equipment
- ▶ operating and access permit issuing practices.

ESV recommends that Powercor ensures it has an internal work practices program with specific focus on ensuring all workers (including contractors):

- ▶ have a detailed understanding of the JSA process and know the contents of relevant Safe Work Method Statements
- ▶ check the condition of equipment prior to use, and use appropriate PPE, particularly LV and HV insulating gloves and fall prevention equipment
- ▶ are involved in the permit issuing process and:
 - confirm all permit documents are completed to standard
 - ensure all persons involved in the work understand the permit they are signing onto
 - ensure the permit issuing process is to standard with appropriate communication, with strong, effective site leadership.

E6 Safety indicators

Figure 30 shows the annualised number of all serious electrical incidents reported to ESV by Powercor, with the data sorted from most frequent to least frequent. Figure 31 shows the same for those incidents that result in an asset or ground/vegetation fire. Both graphs also show the change in incident numbers from 2015-2016.

Of the five most common incidents, three of the events are outside of the direct control of Powercor to manage. Only other asset failures and connections are within the direct control of Powercor. In the last 12 months, the numbers of these events increased by 44 and 89 per cent respectively.

For the other events, overhead cable failures and tree contact events almost doubled, and there were significant reductions in crossarm, pole and HV fuse failures. The reduction in crossarm failures resulted in it falling from the second most common event in 2015-2016 to tenth place this year.

Four of the five most common fire-related incidents are within the direct control of Powercor. The exception is the most common event, vehicle impacts, which also increased by 70 per cent in 2016-2017. There were also significant increases in tree contact events and lightning strikes (31 and 88 per cent respectively), and a minor increase (two per cent) in other asset failures.

All other types of fire events remained the same or experienced reductions of between 33 to 57 per cent.

Powercor operates the largest network in Victoria: the area it services is 82 per cent larger than AusNet Services and it owns 68 per cent more overhead lines than AusNet Services. It is therefore not surprising that Powercor recorded the highest number of electrical safety incidents in the 2016-2017 period. Even so, Powercor experienced seventeen times as many pole failures and seven times more crossarm failures than AusNet Services despite only having 39% more wooden poles.

In contrast, Powercor experienced fewer HV fuse failures than AusNet Services (see Section A6). Powercor has a larger network with more fuses and, therefore, more HV fuse failures could be expected on its network. That it has a lower fuse failure rate than AusNet Services is a positive result for which Powercor should be commended.

Powercor experienced more fire events than the other businesses combined. It also experienced more fires in all categories than the other businesses except for two; AusNet Services had the largest number of fuse and connection fires.

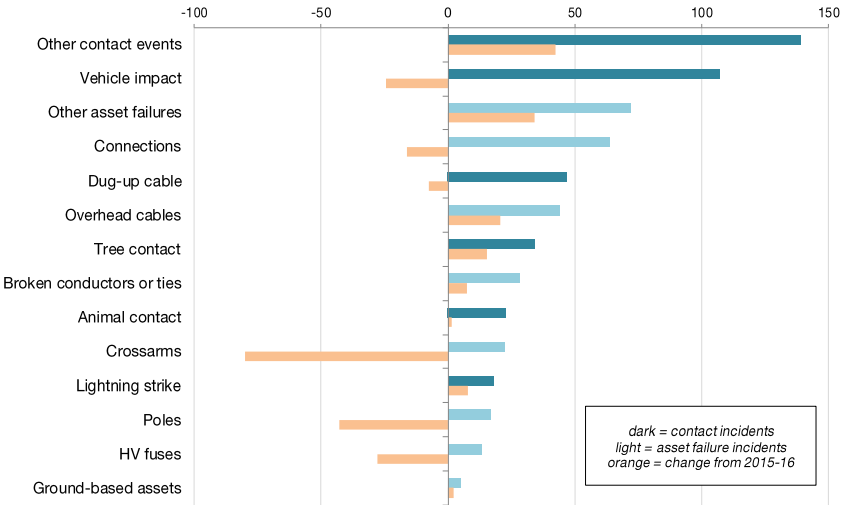


Figure 30 Incidents on the Powercor network

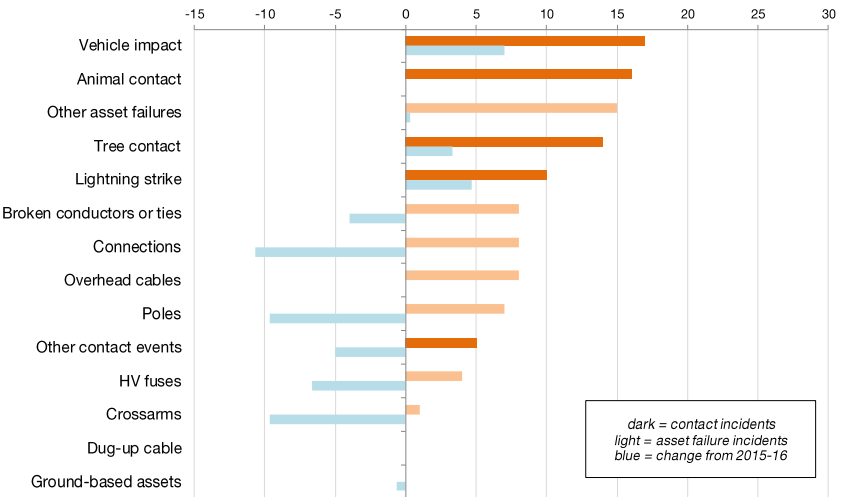


Figure 31 Incidents on the Powercor network resulting in ground fires

APPENDIX F : TRANSMISSION OPERATIONS AUSTRALIA

Transmission Operations (Australia) (TOA) is jointly owned by Cheung Kong Infrastructure Holdings Ltd (50 per cent) and Power Assets Holdings Ltd (50 per cent). Both are part of the Cheung Kong Group of companies. Together they hold a majority ownership (51 per cent) of the CitiPower/Powercor Group of companies, which are contracted to provide services in support of ongoing TOA operations. As of May 2017, Cheung Kong Infrastructure also holds majority ownership (66 per cent) of United Energy.

TOA owns and operates the connection from the Mt Mercer Wind Farm to the electrical transmission network (Figure 32). This includes a 22km 132kV powerline and the Elaine Terminal Station, which steps the voltage up from 132kV to 220kV for injection into the AusNet Services transmission network.

The TOA asset base in Victoria is significantly smaller than that of AusNet Services Transmission; it has only 1.2 per cent of the towers and poles that AusNet Services owns and maintains. Its assets are also newer having only been commissioned in November 2013.



Figure 32 Location of TOA transmission assets (orange square)

F1 Plans and processes

TOA is scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) before 2 October 2018
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revised bushfire mitigation plan
- ▶ Electric Line Clearance Management Plan by 31 March each year.

TOA submitted its Electric Line Clearance Management Plan to ESV on 3 April 2017. ESV has assessed the submitted plan and is working with TOA to ensure a compliant and approved plan is in place prior to the fire danger period.

F2 Directions

ESV has not had cause to issue directions to TOA.

F3 Exemptions

TOA has sought no exemptions from regulations.

F4 Audit performance

F4.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attentions on electric line clearance and bushfire mitigation audits as subsets of the Electricity Safety Management Scheme (ESMS) and key elements of bushfire prevention.

TOA had its ESMS accepted in November 2013. The process for validating and accepting the ESMS involved significant ESV system and field audits.

TOA is a new asset that requires little maintenance at this early stage of its life cycle and is of low risk given its short length. The system TOA utilises is essentially the CitiPower/Powercor system as the entity charged with operating and maintaining the TOA line. Given this and its reduced risk, ESV determined there is greater merit in focusing the 2017-2018 systems audits on the CitiPower/Powercor system.

F4.2 Electric line clearance

An electric line clearance inspection of the TOA transmission network was conducted on 11 November 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

Given its limited size the entire TOA network was inspected and included a total of 160 electricity spans. All of the spans were located in HBRA.

The audit found the following:

- | | |
|------------------------------|------|
| ▶ noncompliant spans in HBRA | 3 |
| ▶ variance = 3 out of 160 | 1.9% |

While this was an increase from the previous inspection conducted in October 2013, the standard of electric line clearance compliance was acceptable.

The three noncompliant spans were represented in the TOA vegetation management database and were scheduled to be cleared before the fire danger period would be declared. This was consistent with the findings of the 2013 electric line clearance audit.

The electric line clearance inspection recommended that TOA:

- ▶ continues to utilise, review and develop procedures to ensure its vegetation management programs managed compliant vegetation clearances
- ▶ continues to update its vegetation management database to ensure it is maintained to a high level of currency and accuracy.

F4.3 Bushfire mitigation

The bushfire mitigation field inspection was coupled with the electric line clearance inspection. The inspection assessed compliance with legislation and internal business process with a focus on asset condition.

The inspection reviewed all 160 spans of the 132kV line, which is situated entirely within HBRA.

A general visual ground inspection of assets along the line route indicates that the line was in good condition and reflective of its relatively young age (commissioned in November 2013). No obvious line defects or maintenance items were identified.

The inspection findings showed that TOA, as a relatively new asset, requires very little maintenance at this stage of its life cycle. TOA generally had sound processes and procedures in place to adequately manage and check on the quality of the assets

F4.4 Work practices

ESV is yet to undertake a work practice observation of TOA as the transmission line is expected to be operational almost all the time, and is a relatively new asset (commissioned in November 2013) requiring very little maintenance at this stage of its life cycle.

F5 Safety indicators

Transmission infrastructure generally has low levels of incidents due to the nature of the assets and the clearances maintained around these higher voltage assets. Transmission assets are also less dispersed than distribution assets, thereby reducing exposure to environmental threats and third-party impacts. This also makes them easier to maintain.

The risks associated with TOA are reduced by it being a short transmission line and only having been operating for a short time (i.e. four years). Being a relatively new asset, TOA also has not entered a phase of its life cycle where major maintenance is required.

It is therefore not unexpected that TOA recorded no incidents on its transmission network during the 2016-2017 period.

APPENDIX G : TRANSMISSION OPERATIONS AUSTRALIA 2

Transmission Operations (Australia) 2 (TOA2) is jointly owned by Cheung Kong Infrastructure Holdings Ltd (50 per cent) and Power Assets Holdings Ltd (50 per cent). Both are part of the Cheung Kong Group of companies. Together they hold a majority ownership (51 per cent) of the CitiPower/Powercor Group of companies, which are contracted to provide services in support of ongoing TOA2 operations. As of May 2017, Cheung Kong Infrastructure also holds majority ownership (66 per cent) of United Energy.

TOA2 owns and operates the connection from the Ararat Wind Farm to the electrical transmission network (Figure 33). This includes a 21 km 132kV powerline and the Ararat Terminal Station, which steps the voltage up from 132kV to 220kV for injection into the AusNet Services transmission network.

The TOA2 asset base in Victoria is significantly smaller than that of AusNet Services Transmission; it has less than one per cent of the towers and poles that AusNet Services owns and maintains. Its assets are also newer, having only been commissioned in June 2016.



Figure 33 Location of TOA2 transmission assets (orange square)

G1 Plans and processes

As part of the requirements for TOA2 to operate the new transmission line, TOA2 was required to have in place an accepted Electrical Safety Management Scheme (ESMS), Bushfire Mitigation Plan and the Electric Line Clearance Management Plan prior to commencement of operations. ESV reviewed the TOA2 plans and accepted these on the 22 June 2016.

The ESMS and Bushfire Mitigation Plan require resubmission every five years commencing from the date of the most recent acceptance. This resubmission is due on 22 June 2021.

An Electric Line Clearance Management Plan is to be submitted by 31 March each year. TOA2 submitted its Electric Line Clearance Management Plan to ESV on 3 April 2017. ESV has assessed the submitted plan and is working with TOA2 to ensure a compliant and approved plan is in place prior to the fire danger period.

G2 Directions

ESV has not had cause to issue directions to TOA2.

G3 Exemptions

TOA2 has sought no exemptions from regulations.

G4 Audit performance

G4.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attentions on electric line clearance and bushfire mitigation audits as subsets of the Electricity Safety Management Scheme (ESMS) and key elements of bushfire prevention.

TOA2 submitted a Full Safety Case and ESMS in March 2016. After three iterations, ESV granted approval of the TOA2 Full Safety Case and ESMS on 22 June 2016. The process for validating and accepting the ESMS involved significant ESV system and field audits. Securing this approval allowed TOA2 to commission the new line in the last week of June 2016.

TOA2 is a new asset that requires little maintenance at this early stage of its life cycle and is of low risk given its short length. The system TOA2 utilises is essentially the CitiPower/Powercor system as the entity charged with operating and maintaining the TOA2 line. Given this and its reduced risk, ESV determined there is greater merit in focusing the 2017-2018 systems audits on the CitiPower/Powercor system.

G4.2 Electric line clearance

An electric line clearance inspection of the TOA2 transmission network was conducted on 8 November 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

Given its limited size, the majority of the TOA2 network was inspected — 94 out of a total 107 electricity spans. All of the spans were located in HBRA.

The inspection found:

▶ noncompliant spans in HBRA	0
▶ variance = 0 out of 94	0.0%

TOA2 is a new facility that ESV has not previously audited. The standard of electric line clearance compliance was acceptable.

The electric line clearance inspection recommended that TOA2 continues to develop and use procedures to ensure line clearance inspection programs are completed efficiently and that management of its vegetation database is maintained to a high level of currency and accuracy.

G4.3 Bushfire mitigation

The bushfire mitigation field inspection was coupled with the electric line clearance inspection. The inspection assessed compliance with legislation and internal business process with a focus on asset condition.

The inspection reviewed 94 spans of the 132kV line, which is situated entirely within HBRA.

A general visual ground inspection of assets along the line route indicates that the line was in good condition and reflective of its relatively young age (commissioned in July 2016). No obvious line defects or maintenance items were reported by the field auditor.

The audit findings showed that TOA2, as a relatively new asset, requires very little maintenance at this stage of its life cycle. TOA2 generally had sound processes and procedures in place to adequately manage and check on the quality of the assets.

G4.4 Work practices

As the new TOA2 assets were only commissioned in June 2016, no maintenance work has been required in the last year to afford ESV an opportunity to observe TOA2 works practices.

G5 Safety indicators

Transmission infrastructure generally has low levels of incidents due to the nature of the assets and the clearances maintained around these higher voltage assets. Transmission assets are also less dispersed than distribution assets, thereby reducing exposure to environmental threats and third-party impacts. This also makes them easier to maintain.

The risks associated with TOA2 are reduced by it being a short transmission line and only having been operating for a short time (i.e. one year). Being a relatively new asset, TOA2 also has not entered a phase of its life cycle where major maintenance is required.

It is therefore not unexpected that TOA2 recorded no incidents on its transmission network during the 2016-2017 period.

APPENDIX H : UNITED ENERGY

United Energy was jointly owned by DUET Group (66 per cent) and SGSP (Australia) Assets Pty Ltd (34 per cent) until May 2017, when the DUET Group was bought out by Cheung Kong Infrastructure.

SGSP (Australia) Assets also owns 100 per cent of Jemena and the two companies forming SGSP (Australia) Assets Pty Ltd also own the controlling interest in AusNet Services.

Cheung Kong Infrastructure, together with Power Asset Holdings, also owns 51 per cent of CitiPower/Powercor and 50 per cent of Transmission Operations (Australia) and Transmission Operations (Australia) 2.

The buyout by Cheung Kong Infrastructure will see some consolidation of activities and processes across the companies it controls; however, this had not yet impacted United Energy during the 2016-2017 period.

United Energy engages EDI Downer and ZNX (Zinfra) as subcontractors to manage aspects of its operations and maintenance services; Tenix was responsible for the southern region and ZNX for the northern region. Any reference to United Energy within this section also encompasses EDI Downer and ZNX operations on United Energy assets.

The distribution network covers an area of approximately 1470 km² across Melbourne's eastern and south-eastern suburbs and the Mornington Peninsula (Figure 34). It comprises approximately 10,300 km of overhead line, 2600 km of underground cable and 204,000 poles. Most of this network (75 per cent) is in rural areas.



Figure 34 Service area for the United Energy distribution network (orange area)

Jemena and CitiPower service boundaries are shown in orange

H1 Plans and processes

United Energy was scheduled to submit the following documents to ESV for review and acceptance/approval:

- ▶ Electrical Safety Management Scheme (ESMS) before 3 December 2015
- ▶ Bushfire Mitigation Plan every five years commencing from the date of the most recent acceptance of a revision of the accepted bushfire mitigation plan, although revised plans have been accepted annually due to regular revisions in the regulations
- ▶ Electric Line Clearance Management Plan by 31 March each year.

With the new requirement to submit a Safety Case for acceptance prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 3 December 2015 and this would be seen by ESV to have triggered the ESMS process.

A Preliminary Safety Case was first provided by United Energy on 30 September 2015, and accepted by ESV on 11 March 2016. United Energy submitted its Full Safety Case for assessment on 1 July 2016. After two iterations, the Full Safety Case was accepted by ESV on 6 June 2017. An ESMS was submitted to ESV on 30 June 2017.

United Energy submitted its Electric Line Clearance Management Plan to ESV on 28 March 2017. ESV approved the ELCMP on 20 September 2017.

H2 Directions

ESV has issued two directions to United Energy:

- ▶ install armour rods and vibration dampers in hazardous bushfire risk areas (HBRA) by the end of 2015 and in low bushfire risk areas (LBRA) by the end of 2020
- ▶ install spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines in HBRA by the end of 2015 and in LBRA by the end of 2020.

Both directions were due for completion in HBRA by 31 December 2015. United Energy completed both directions on time and, in the case of the armour rods and vibration dampers direction, installed a greater number than originally estimated.

H3 Exemptions

United Energy had completed all works on its exemptions resulting from the 2010 revision of Electricity Safety (Electric Lines Clearance) Regulations prior to the 2016-2017 period.

There are no other exemptions currently applicable to United Energy.

H4 Audit performance

H4.1 Electrical Safety Management Scheme (ESMS)

During the 2016-17 period, ESV continued to focus its attention on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. United Energy had its Full Safety Case accepted in June 2017.

As part of the process to establish an accepted ESMS, ESV plans to undertake extensive systems validation audits on United Energy during October to December 2017.

H4.2 Electric line clearance

An electric line clearance inspection of the United Energy distribution network was conducted between 7 and 11 November 2016. The focus of the inspection was to validate the accuracy of its vegetation management data and to obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at randomly selected locations in the suburbs of Mornington and Sorrento that are supplied by the United Energy network.

Particular emphasis was placed on inspecting spans located in HBRA due to the increased fire threats that exist. Spans in LBRA were not inspected.

A total of 286 electricity spans were inspected.

The inspection found:

▶ noncompliant spans in HBRA	19
▶ noncompliant spans in HBRA (United Energy)	6
▶ noncompliant spans in HBRA (third-party)	13
▶ variance = 19 out of 286	6.6%

The inspection results indicate that, where United Energy is responsible for vegetation management, its processes and clearing activities are implemented effectively providing good compliance standards. This is most important for HBRA.

Where noncompliant vegetation was identified and not the management responsibility of United Energy, it was identified to be the responsibility of a municipal council. ESV requested that United Energy ensure those councils responsible for noncompliant vegetation clear it to ensure the spans were made compliant.

The electric line clearance inspection recommended that United Energy:

- ▶ continues to use and develop procedures to ensure annual inspection programs are completed efficiently and accurately
- ▶ clarifies the responsibility for identifying vegetation impacting electricity assets (other than line clearance issues) and how this is recorded and referred for action
- ▶ ensures noncompliant vegetation that is not the responsibility of United Energy is referred, as per its notification and escalation processes, to assist with the ongoing security of its network.

H4.3 Bushfire mitigation

The bushfire mitigation field inspection assessed compliance with legislation and internal business process with a focus on asset condition. Field audits were carried out on 118 poles across the United Energy network in the Mornington, Frankston South, Hastings, Sorrento, Rosebud, Dromana, Glen Waverley and Doncaster areas.

The inspection findings showed that United Energy generally had sound processes and procedures in place to adequately manage and check on the condition of the assets in the field.

Some items identified during the inspection included:

- ▶ one site where LV spreaders were missing from two bays
- ▶ two sites were recorded with low LV services
- ▶ a number of sites with non-standard items (e.g. possum guards)
- ▶ a birds nest in the end of a HV steel arm.

The auditor recommended that United Energy review actions in relation to the additional maintenance items observed, in particular in relation to the spans missing LV spreaders, and determine whether any corrective actions are required and report findings to ESV.

None of the issues identified was of major concern.

United Energy has provided a response to ESV with actions to address the inspection findings.

H4.4 Work practices

In 2016-2017, ESV undertook three observations of United Energy work practices across four sites. The findings of these observations were as follows:

▶ noncompliances	0
▶ minor noncompliances	1
▶ opportunities for improvement	9

These findings are consistent with those of the 2015-2016 observations, where the key areas of concern related to:

- ▶ checking and use of appropriate PPE, tools and equipment
- ▶ conducting metering and servicing activities in compliance with work practices and testing procedures
- ▶ appropriate pre-site job planning to consider all variables.

ESV recommends United Energy ensures its internal work practices program specifically focus on ensuring:

- ▶ all workers check the condition of equipment prior to use, and use appropriate PPE, particularly LV and HV insulating gloves and fall prevention equipment
- ▶ all workers conducting metering and servicing activities apply the correct work practices and testing procedures in the field
- ▶ the work planning processes ensure adequate pre-site job planning, including consultation with work crew leaders.

H5 Safety indicators

Figure 35 shows the annualised number of all serious electrical incidents reported to ESV by United Energy, with the data sorted from most frequent to least frequent. Figure 36 shows the same for those incidents that result in an asset or ground/vegetation fire. Both graphs also show the change in incident numbers from 2015-2016.

Of the five most common incidents, only one of the events (other contact events) is outside of the direct control of United Energy to manage. The other four of the incident types are within its direct control.

Other contact events increased by 38 per cent from 2015-2016, other asset failures by 16 per cent and broken conductors/ties by 50 per cent. Connection failures and tree contact events reduced by 15 and 10 per cent respectively. There were also significant reductions in vehicle impacts (41 per cent) and crossarm failures (70 per cent) in the last 12 months.

In 2014, United Energy reviewed and amended its pole-top inspection practices to align with well-established industry best practice. This has allowed United Energy to better assess the condition of its crossarms, and hence the need to replace them. This has led to a step-change increase in crossarm replacement rates from late 2015. This appears to have contributed to lower numbers of failures in 2016-2017.

All of the five most common fire-related incidents are within the direct control of United Energy.

In the last 12 months, fire incidents on the United Energy network decreased across all categories. United Energy had a program to replace non-metallic screened HV ABC in HBRA by December 2017. This was completed early in in August 2017. Given this was a two-year, 50 km replacement project, United Energy is to be commended for delivering this ahead of schedule. The progressive roll-out of this conductor replacement may have contributed to the reduced fire incidents in the 2016-2017 period.

Last year, United Energy experienced the highest number of ground-based asset failures and the second-highest number of failures in six other categories. In contrast, United Energy did not rank in the top two in any of the event categories this year. United Energy is to be commended for this result.

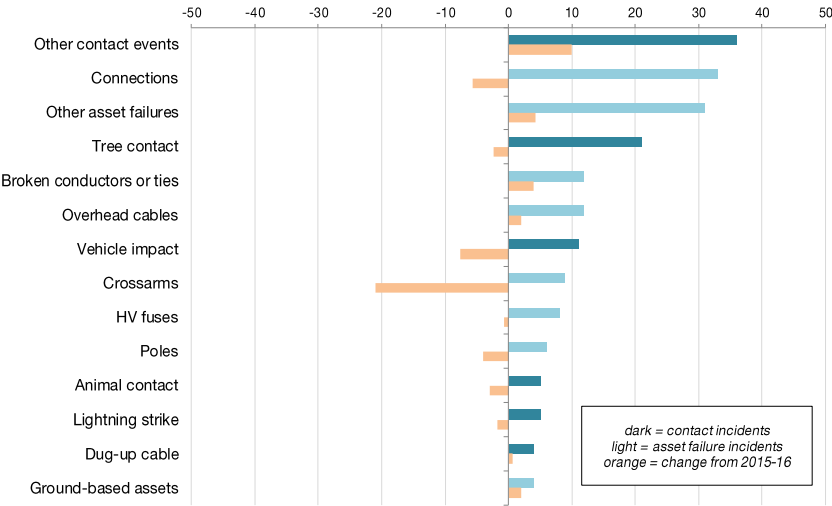


Figure 35 Incidents on the United Energy network

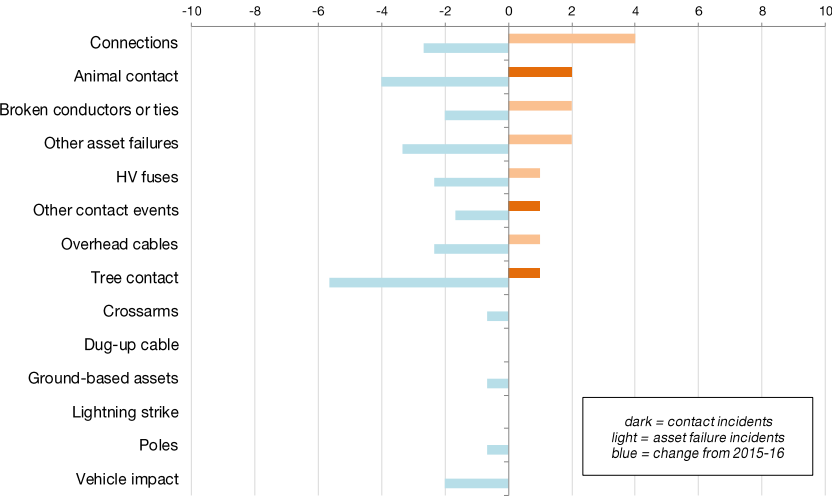


Figure 36 Incidents on the United Energy network resulting in ground fires

APPENDIX I : TREE DENSITY ACROSS VICTORIA

The figure below maps tree density across Victoria with the boundaries of the five distribution businesses in orange. Of the businesses, AusNet Services is most exposed to a high density of tree cover.

