

# Safety performance report on Victorian electricity networks

October 2019



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This report has been endorsed by the Director of Energy Safety in Victoria.

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## Foreword

Ten years ago 173 Victorians lost their lives in the Black Saturday bushfires. The Victorian Bushfires Royal Commission (VBRC) found that the three largest fires at Kilmore East, Coleraine and Horsham were caused by electricity network assets.

Since then and through the collaborative efforts of industry, government, regulators and many other agencies, Victoria has not experienced another catastrophic event of this magnitude. The exhortation of the VBRC was that everything must be done to ensure that the tragedy of February 2009 never happens again.

This report examines the many facets of network performance that demonstrate how this ever present and growing risk of catastrophic bushfire is being mitigated.

During the period from 1 July 2018 to 30 June 2019, the numbers of asset failures and fires from such failures is lower than the average from 2010 to 2018 (with the exception of connections faults). Vegetation contacts and associated fires are also lower this year than the long-term average.

In June 2009, we had seven staff covering all aspects of electricity safety. Today we have 29 staff dedicated to overseeing the electricity networks, including five analytics experts. There are a further 26 staff looking after equipment and installations safety. We have invested in staff and expertise, and this is critical to ensuring that Victorians have trust in its regulator overseeing and comprehensively monitoring electricity network businesses.

With these additional resources, we have been able to undertake the investigations that supported our recent successful prosecution of one network business. The results of our efforts to drive improved vegetation management practices across businesses are now evident.

We have also been better placed to undertake the recent investigations into the condition of poles in southwest Victoria. This contributed to an immediate change to network practices. This will lead to further work by ESV to robustly test and challenge the asset management practices of the networks to ensure their long-term sustainable safety.

But the task is not yet complete.

The Victorian Bushfire Royal Commission challenged us to determine why network assets are disproportionately contributing to bushfire risk on the worst of the worst days. This has not been easy and has consumed considerable effort by ESV and other researchers. Ten years later, the longer term data and tools required to further this work are becoming available, and we are gaining fresh insights.

New challenges and opportunities are emerging. New technologies are appearing, and the energy system is decentralising and evolving in response. Some of these technologies will provide greater and more timely insight into asset condition. Today's ESV provides technical oversight of a few mature and generally well-managed networks; tomorrow's will need to regulate a diffuse range of smaller networks and suppliers, businesses and individual customers. New skills will be needed — data analytics, stakeholder management, community and industry education, and more nuanced enforcement. In moving to a commission structure with a more diverse range of experts, ESV will have the leadership needed to support the organisation into the future.

I commend this ninth, and my last, safety performance report.



**Paul Fearon**  
Director of Energy Safety

## Executive summary

This report addresses the financial year from July 2018 to June 2019. 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.

Sadly, there were two fatalities this year that were associated with electrical network infrastructure:

- a 27 year old man was electrocuted while trying to dislodge a felled tree that had hit a 22kV powerline
- a vegetation worker clearing trees along a nature strip made contact with low voltage lines and was electrocuted.

ESV took no enforcement action following the first fatality and is providing subject matter expertise to support WorkSafe Victoria in its investigation of the second one.

There were no serious incidents involving electricity distribution assets that resulted in injuries.

The Electricity Safety (Bushfire Mitigation) Regulations require the distribution businesses to reduce the bushfire risk presented by the lines emanating from 45 zone substations. This will be achieved through the deployment of rapid earth fault current limiters (REFCL) and the replacement of bare conductors with underground cables or covered cables in specified areas.

By 30 April 2019, ESV had conditionally accepted seven Powercor and six AusNet Services REFCLs. Acceptance is conditional upon the resolution of certain technical issues before the start of the 2019-2020 bushfire season. On 12 July 2019, ESV granted a time extension for AusNet Services to achieve compliance for the Kinglake and Woori Yallock substations, and AusNet Services has prepared an action plan to resolve the technical issues impacting full compliance. The program remains a challenge to deliver, but the businesses are making good progress.

ESV continues to work closely with the Australian Energy Regulator (AER) in validating the F-Factor fire start reports produced by the distribution businesses. ESV is now working more closely with the AER as the businesses prepare to make their electricity distribution price review submissions.

We have completed our assessment of the Electrical Safety Management Schemes of the distribution businesses and are close to completing those of all the transmission businesses. This work has been delivered alongside our major investigations work into the condition of poles in southwest Victoria where we have concluded there is no immediate risk of systemic failure. We are undertaking further work to determine if there is a systemic problem that may materialise in the coming years. Our legal investigations into the Garvoc and Terang fires of St Patrick's Day 2018 continue.

Our growing capability in the field of data collection and analysis is beginning to deliver results and better expose issues with the performance of the distribution businesses and other parties we regulate such as municipal councils. For example, we now have much greater visibility, through increased inspection data, of the true status of vegetation across the state. This has resulted in the prosecution of Powercor for breaches of vegetation management requirements, but more importantly it has resulted in changes to the behaviour Powercor, CitiPower and United Energy. These changes are delivering far more robust and reliable vegetation management, greater transparency and, above all, substantially improved community safety.

ESV is also using this capability to turn its eye to the vegetation management practices of the municipal councils. In general, councils do not comply with their vegetation requirements as well as the distribution businesses, although the consequences of noncompliance are usually less. ESV now has the capability to secure statistically representative volumes of data to inform its assessment of compliance of all parties with vegetation management responsibilities. In the future, we will use this to develop and

communicate our expectations of the responsible parties to get their vegetation compliance on a specified improvement trajectory to ensure they deliver an acceptable level of community safety. We will measure their adherence to the required trajectory.

Asset failures were again generally below the long term average. Failures were also reduced across all asset types except for connections failures and the category "other". We need to undertake further analysis and engage with the distribution businesses to better understand the nature and cause of these connection failures, their materiality and hence their potential impact on community safety. Our analysis of the category "other" attributes many of the incidents to encroachment. This takes the form of theft and copper theft (deliberate acts will likely involve the work of a number of stakeholders to address them) and acts of error (infringements into no go zones and the digging up of buried assets that may be addressed by education and enforcement).

Incidents due to contact with network assets were often above the long-term average for the year and well in excess of the average for three months of the year.

While there were 585 asset fires during the reporting period, only two of these resulted in ground fires exceeding 10 hectares in size; Bulgana (outskirts of Ballarat) and Bunkers Hill (north of Ararat). There was a third large fire at Longerenong (east of Horsham). Of the asset fires, 326 (57.4 per cent) were contained to the asset and did not result in a ground fire at all.

In our last report we advised that we were prosecuting Powercor for three ground fires and 189 breaches of the electric line clearance regulations. Powercor pleaded guilty to all charges and was fined a total of \$374,000 with costs of \$165,000. Our investigation of two of the 2018 St Patrick's Day fires (Terang and Garvoc) continues, and we anticipate determining whether legal action is warranted in October 2019.

We reported on high levels of non-compliant vegetation across the Powercor network for the previous two years. This has now substantially improved to the extent that, at the time of writing, Powercor is now the best

performing distribution business for the management of vegetation in HBRA. This is a substantial turnaround and shows both that changes in behaviour can be achieved and that ESV can drive such changes.

Last year ESV identified significant levels of poor vegetation clearance on the part of United Energy. United Energy manages its vegetation utilising the same team and techniques as Powercor. Both Powercor and United Energy and now embarked on a major revamp of their vegetation management methodology that is expected deliver substantially better, transparent and consistent outcomes in the future. Both companies are working cooperatively with ESV.

As we move towards the 2019-2020 fire season, we can see that fires started by electrical assets are reducing, that vegetation is being better cleared from electrical assets and performance is steadily improving. However, there is no room for complacency and, while we cannot totally eliminate electrical assets as a cause of bushfire, we can and are doing all we can to minimise the potential for fires to start and address those broader risks associated with catastrophic ignition on extreme weather days.

Looking to the future, we are further developing our oversight of the distribution businesses as we delve into their asset management practice. New emerging technologies have the potential to provide greater insight into the condition of network assets. This, in turn, has the potential to provide even greater assurance to the community. Our intent is to ensure that existing asset management and maintenance practice will ensure that network safety performance will be maintained in the long term, and that the risk of a future systemic or large-scale asset failure is mitigated as far as practical.



**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 is committed to the safe, efficient supply and use of electricity and gas. This is the eighth year that ESV has reported on the safety performance of the Victorian electricity distribution businesses and the seventh 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 and of achieving compliance where exemptions have been granted
- 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 2018-2019 financial year, being the 12-month period from 1 July 2018 to 30 June 2019.

## 1.2 Objective

The objective is to analyse the broad range of safety-related information that ESV acquired during the 2018-2019 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 2018-2019 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 other responsible persons. These groups and the regulatory context for ESV's powers are described below.

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

### 2.1 Major electricity companies

#### 2.1.1 Description

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

An overview of the major electricity companies is provided in Table 1.<sup>1</sup>

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.

<sup>1</sup> The asset statistics presented are from the Economic and Category Analysis Regulatory Information Notice (RIN) data found on the website of the Australian Energy Regulator (AER) ([www.aer.gov.au/networks-pipelines/network-performance](http://www.aer.gov.au/networks-pipelines/network-performance)). These data have been subject to independent audit as part of the RIN reporting process. The other data are compiled from the websites of the major electricity companies.

#### 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:

- Electricity 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 the preparation of an ESMS.
- Electricity Safety (Bushfire Mitigation) Regulations 2013
 

These prescribe the particulars of bushfire mitigation plans, which the major electricity companies are required to submit to ESV every five years for acceptance under the Act. ESV regularly audits each major electricity company for compliance with its plan.
- Electricity Safety (Bushfire Mitigation Duties) Regulations 2017
 

These prescribe additional bushfire mitigation requirements applying to major electricity companies under part 10A of the Act. These duties are discussed in more detail in Section 6.2.2.
- Electricity Safety (Electric Line Clearance) Regulations 2015
 

These establish the requirement for each major electricity company to submit an electric line clearance management plan to ESV each year for approval and to comply with the Code of Practice for Electric Line Clearance, a schedule to the regulations. ESV regularly audits and inspects each major electricity company for compliance with its approved plan.

Table 1 Electricity network overview

Transmission companies		Distribution businesses	
<b>AusNet Services</b>		<b>AusNet Services</b>	
Voltages:	500kV AC and 220kV AC transmission across Victoria <sup>2</sup> 66kV AC sub-transmission across Victoria 330kV AC on interconnector to New South Wales 275kV AC on interconnector to South Australia	Customers:	741,840 approx. (88% residential)
Powerline length:	6,630 km, including 8.5 km of underground cable	Service area:	80,000 km <sup>2</sup>
No. of towers:	13,210 approx.	Powerline length:	45,120 km (93% rural, 15% underground)
<b>Basslink</b>		No. of poles:	334,400 power and 90,470 public lighting approx.
Voltages:	500kV AC and 400kV DC link between Loy Yang power station in south east Victoria and George Town in northern Tasmania	<b>CitiPower</b>	
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	Customers:	342,670 approx. (83% residential)
No. of towers:	142	Service area:	157 km <sup>2</sup>
<b>Transmission Operations Australia</b>		Powerline length:	5,230 km (0% rural, 19% CBD, 51% underground)
Voltages:	132kV from Mt Mercer Wind Farm to Elaine Terminal Station	No. of poles:	49,030 power and 9,090 public lighting approx.
Powerline length:	22 km	<b>Jemena</b>	
No. of towers/poles:	162	Customers:	343,660 approx. (90% residential)
<b>Transmission Operations Australia 2</b>		Service area:	950 km <sup>2</sup>
Voltages:	132kV from Ararat Wind Farm to Ararat Terminal Station	Powerline length:	6,580 (26% rural, 32% underground)
Powerline length:	21 km	No. of poles:	91,400 power and 26,750 public lighting approx.
No. of towers/poles:	106	<b>Powercor</b>	
		Customers:	835,780 approx. (86% residential)
		Service area:	145,651 km <sup>2</sup>
		Powerline length:	76,820 km (92% rural, 11% underground)
		No. of poles:	489,700 power and 87,730 public lighting approx.
		<b>United Energy</b>	
		Customers:	685,030 approx. (90% residential)
		Service area:	1472 km <sup>2</sup>
		Powerline length:	13,850 km (32% rural, 28% underground)
		No. of poles:	168,800 power and 34,700 public lighting approx.

<sup>2</sup> AC = alternating current. DC = direct current, kV = kilo Volt (or 1000 Volt).

## 2.2 Other parties identified in the Act

### 2.2.1 Description

The Act identifies responsible persons in addition to the major electricity companies that have responsibility for electric line clearance. These persons fall into two groups:

- municipal councils whose duties are specified in Section 84C of the Act in relation to declared areas
- other responsible persons specified in Sections 84A, 84B and 84D.

Not all municipalities contain declared areas. Of the 79 municipal councils across Victoria, all 31 metropolitan councils and 36 of the 48 regional councils are responsible persons.

The Act also identifies specified operators that are persons that operate a high-voltage overhead electric line in a hazardous bushfire risk area (HBRA) as declared by a fire control authority under Section 80 of the Act. These are a subset of responsible person with additional bushfire mitigation responsibilities.

Specified operators include several wind farms and power stations, the Australian Defence Forces/Defence Estates Victoria, Australian Paper Maryvale, Fosterville Goldmine, Melbourne Water and Coliban Water.

### 2.2.2 Regulatory requirements

Under the Act, responsible persons are required to maintain vegetation clear of electric lines. For councils, this is the case for all vegetation on public land that they manage within their declared areas. Other responsible persons are required to clear all vegetation from their electric lines. This is the case for the major electricity companies as well, except for vegetation on public land in declared areas where the municipal council is responsible.

Responsible persons under sections 84 of the Act (distribution companies), 84C (municipal councils) and 84D (electric line owners and operators, which include transmission companies) are required to produce an ELCMP annually. Of these, only the major electricity companies must submit their ELCMP by 31 March of every year for approval.

While municipal councils and other responsible persons are required to prepare an ELCMP before 31 March every year, they do not have to submit it to ESV for approval each year. Such responsible persons are required to provide a current ELCMP if requested by ESV and ESV may decide to approve these ELCMPs.

## 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 (ESMS)
  - bushfire mitigation plans (BMP)
  - electric line clearance management plans (ELCMP).
- reviews of ELCMPs for other responsible persons (at ESV request)
- audits, inspections and observations
  - planned audits and inspections of safety plan implementation
  - planned and unannounced observations of works practices
  - inspections of vegetation clearance and bushfire mitigation works, including those prior to the fire danger period to ascertain bushfire preparedness.
- 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 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 in high winds.

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 by specified dates and to report progress quarterly. The requirements of the directions were subsequently incorporated into their bushfire mitigation plans and the last of the directions were completed during the 2017-2018 financial year.

### 2.3.2 Exemptions

The major electricity companies may seek exemptions from regulations from time to time. This may be to allow for additional time to transition to compliance or in specific circumstances where compliance would be impracticable to achieve.

ESV has broad powers to grant exemptions from certain regulatory obligations; however, ESV does not have the power to grant exemptions from the Electricity Safety Act. Exemptions from the Act can only be granted by the Governor in Council on the recommendation of the Minister.<sup>3</sup>

When making decisions regarding exemptions, ESV may seek:

- demonstration that safety risks are reduced or remain the same, or
- commitments from the company regarding works to be undertaken and timetables for achieving compliance.

ESV will then monitor progress towards successful completion and continued operation.

### 2.3.3 ESV program performance

Statistics on ESV's performance in managing its regulatory program are provided in Appendix A.

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<sup>3</sup> In forming a recommendation regarding such an exemption from the Electricity Safety Act, the Minister will receive a recommendation from the Director of Energy Safety based on advice from ESV staff and, if he so requests, the Powerline Bushfire Safety Committee. The Minister may also take advice from the Department of Environment, Land, Water and Planning.

If the Governor in Council grants an exemption from the Act, ESV subsequently grants an exemption from the associated regulations.

## 3. Risk management and governance

ESV continues to implement a range of initiatives to improve its risk management and governance processes. The outcome of these improvements will be closer oversight of the major electricity companies, councils and other responsible persons.

### 3.1 Electricity and Gas Network Safety Framework Review

As previously reported, an *Independent Review of Victoria's Electricity and Gas Network Safety Framework* (the Review) was conducted in 2017, headed by Dr Paul Grimes. The main objective of the Review was to ensure the effectiveness of the framework in delivering desired safety outcomes for Victorians.

An interim report was released for public comment on 31 October 2017. The final report of the Review was released on 1 August 2018, together with the Victorian Government's response to its findings.

The final report included 43 recommendations. In its response, the Victorian Government fully supported 21 of the report's recommendations and supported, in principle, a further 21 recommendations. ESV has developed an achievement plan for every supported recommendation. The progress of implementation will be reported publicly in ESV's Annual Reports; progress against recommendation 6 is reported in Section 3.3.<sup>4</sup>

The Review's final report and the Victorian Government response can be found at [engage.vic.gov.au/electricity-network-safety-review](https://engage.vic.gov.au/electricity-network-safety-review).

<sup>4</sup> When it is finalised, the 2019 ESV Annual Report will be made available at [esv.vic.gov.au/annual-reports/](https://esv.vic.gov.au/annual-reports/).

### 3.2 Improving ESV practice

ESV continues to improve its regulatory practice to provide clear and transparent guidance to industry of its expectations, and its decision-making such that it remains consistent, predictable and defensible.

To achieve this, and as part of the process towards the implementation of revised Electricity Safety (Management) Regulations in November 2019, ESV has developed and is consulting on draft ESV Energy Infrastructure Safety Management Policy, Electricity Safety Case (ESMS) Preparation and Submission Guideline for MECs, and Incident and Safety Performance Reporting Guidelines.

Additionally, Safety case and ESMS reviews are managed through a documented process that leads to the presentation, by the evaluation team, of a case for acceptance to an independent panel of senior executives and managers. The responsible General Manager then accepts the safety case or ESMS. Matters in dispute are escalated to the Director.

This approach ensures:

- 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

Last year ESV undertook considerable work to better understand the risks ESV regulates and the controls available to prevent undesirable events from occurring. That work has continued with further effort to establish performance standards detailing critical controls identified in risk bow-ties to improve ESV's regulatory targeting. These performance standards document regulatory oversight measures to determine the effectiveness of the available controls.

Whole-of-life, risk-based asset management and risk assessment are two critical controls that ESV will focus on in coming years. During these reviews, safety system audits are to be conducted in order to benchmark the industry and identify if risks are being managed as far as practicable.

This work will assist in strengthening ESV's capability and preparedness to take strong regulatory action.

### 3.2.2 Audit and inspection practices

ESV has now developed a survey tool to capture electric line clearance field inspection findings electronically. This data is managed through ESV's Geographical Information System. The capture of inspection data in this manner has enabled better analysis of compliance standards and is being used to inform regulatory assurance and targeting.

ESV will continue to develop this tool to see where it can be applied to other aspects of the business. Our Data and Analytics team is already looking to how we can better target audits and inspections, improve the analysis of results and make the reporting process more efficient.

## 3.3 ESTR growth

The Electrical Safety and Technical Regulation division (ESTR) within ESV has expanded its capability further during the 2018-2019 period. This is driven by a need to secure greater assurance that the major electricity companies and other regulated entities are appropriately delivering their regulatory obligations. It was also reinforced by recommendation 6 from the Review headed by Dr Paul Grimes.

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

The Regulatory Assurance group has reviewed its structure and has commenced the establishment a new team specifically focused on risk and asset management practices. This new team will, to be led by a new engineering team leader, will focus on the sustainability of the systems, practices and controls of the major electricity companies. Two qualified and experienced asset inspectors are being recruited into this team to provide a greater field presence and enable increased inspections, audits and investigations.

The growth in the Line Clearance Assurance team over the previous two years has provided ESV with a greatly improved capacity to oversee the systems used to manage vegetation. Additionally, the extra resources in the team have allowed ESV to inspect approximately 18,000 spans this reporting period. Prior to securing these resources, ESV typically inspected 2000-3000 spans per annum due to limited capacity.

The team is now better equipped to validate vegetation clearances and promote the ESV safety message on matters relating to electric line clearance. As a result, ESV has observed a distinct improvement in electricity safety standards. The increased enforcement ESV has undertaken over the last 12-18 months also would not have been possible without the enhanced field presence this growth allowed.

## 3.4 Data capability

With the extended team on board, a number of pilot, demonstration and proof-of-concept projects have been conducted. This is in addition to business-as-usual work in setting up the ESV data hub, developing data governance structures and building relationships with internal and external stakeholders.

More than a dozen different analyses were conducted over the 2018-2019 period to assist in interpreting results from audits and inspections, prosecution, educational programs, and investigation outcomes.

Some of the most prominent results include:

- an analysis of line clearance inspections results to determine levels of compliance among the major electricity companies and municipal councils
- an analysis of typical defects in Certificates of Electrical Safety audits for publication in the ESV magazine
- a proof-of-concept trial using advanced analytical techniques to help identify noncompliant electrical goods being offered for sale on-line
- an analysis to better understand the causes of No Go Zone incidents across the state over the past five years
- an analysis to identify apprentices who have recently completed, or are about to complete, their apprenticeships so that we can ensure they have applied for a license or remind them of their obligation to apply for a license once they have completed the apprenticeship
- the formation of a consistent dataset of electricity network incidents going back to 2012.

The last of these projects, in combination with a detailed weather conditions data from the Bureau of Meteorology, has allowed us to apply advanced analytics techniques to investigate the links between weather conditions and the occurrence of electricity-related incidents (see Section 5.1).

This year we consulted with the key stakeholders and introduced a number of small but important improvements to our key incidents reporting system OSIRIS. The results will not only improve user experience, but also improve data quality that will in turn improve our analysis and reporting capabilities.

The work on the establishment of a single source of all official ESV reporting, the ESV data hub, is progressing well with many key datasets having now been brought into the hub. In particular, we have brought the OSIRIS incident reporting system and the Complaints and Investigations Management System into the data hub, with the latter providing improved transparency of ESV performance in managing and closing out customer requests, complaints and investigations.

## 4. Serious electrical incidents

The safety of the public and energy sector 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.

Two fatalities occurred during the 2018-2019 period due to people clearing trees near electric lines. The fatality of a worker performing electric line clearance work has not occurred since the inception of ESV in 2005.

ESV investigated all these events, and further details are provided below.

### 4.1 Property owner fatality

On 31 August 2018, ESV investigated an incident where a 27 year old man was electrocuted when felling a tree on a private property.

The investigation concluded the victim was clearing trees close to a property fence line. A tree he was cutting fell towards the road and rested on a 22,000 volt uninsulated powerline that ran down the road adjacent to the property.

It was established the victim used his foot to dislodge the tree from the electricity conductor. In doing so, he received the fatal electric shock when he touched the tree and earth at the same time.

ESV reviewed network operation information for this incident that was provided by AusNet Services. The review of this data indicated the network safety operation systems had operated as they should for an incident of this nature.

ESV did not take enforcement action on this matter.

### 4.2 Vegetation worker fatality

On 7 February 2019, a vegetation worker was clearing trees from overhead electric lines along a nature strip on behalf of the City of Monash. The City of Monash is identified by Section 84C of the Act to be responsible for keeping trees on public land that it manages, clear of overhead electric lines.

In the course of this work, the worker made contact with uninsulated, low voltage overhead electric lines, resulting in his electrocution.

ESV personnel attended the scene and supported WorkSafe Victoria in its investigation of the matter. This involved providing subject matter advice to WorkSafe Victoria as the work was governed by the Installations Regulations and Electric Line Clearance Regulations; both of which are administered by ESV.

ESV's review of the matter found breaches of Regulation 318(3) of the installations regulations and the ESV safety rules had occurred. The breaches were attributed to the direct actions of the deceased worker and, therefore, ESV took no further action.

### 4.3 Vegetation worker contact with electric line

On 12 March 2019, vegetation workers clearing electric lines on behalf of the City of Greater Geelong contacted bare low voltage electric lines with equipment being used to cut the trees. The contact caused two lines to clash and one of the lines to break and fall to the ground. There were no reported injuries.

In June 2019, the findings of the investigation were presented to the ESV Electrical Infrastructure Enforcement Committee. The committee determined the appropriate enforcement actions included:

- refer the matter, including the details and outcomes of the ESV investigation, to WorkSafe Victoria
- issue an infringement notice on ATM (the Contractor) for a breach of Section 318 of the regulations relating to minimum distances to be maintained between persons and aerial lines; in this instance, a person must not come closer to a bare low voltage conductor than 1500mm
- request the Greater Geelong City Council to submit its plan in the coming financial year to allow for its evaluation and approval by ESV
- issue a 'safety alert' from ESV to all municipal councils with electric line clearance responsibilities to review their systems to ensure the safety of line clearance workers.

All of the above actions have been completed.

#### 4.4 Transmission network incidents

There were three incidents this year involving transmission assets, namely:

- a 66kV line fell to the ground due to failure of an insulator
- a failure of a 500kV insulator
- a Zinfra linesman (contracted to AusNet Services) received a minor shock while installing a new top section on a transmission monopole.

ESV undertook an investigation into the cause of the 66kV insulator failure and concluded that there was evidence that the insulator had been impacted by a high-velocity projectile, most likely a bullet.<sup>5</sup>

AusNet Services undertook an internal investigation to identify the cause of the 500kV insulator failure. This was completed in July 2019 and provided to

<sup>5</sup> The investigation report can be downloaded at [esv.vic.gov.au/pdfs/salt-creek-technical-report/](https://esv.vic.gov.au/pdfs/salt-creek-technical-report/).

ESV. Subsequent to the investigation, AusNet Services has created a plan to replace all similar insulators on the line where the failed insulator was found.

The minor shock resulted from induction in the new top section of a monopole while it was being lowered into place. The linesman received a shock when he contacted the top section, and was subsequently transferred to a local hospital for a precautionary medical check and monitoring where he was given a clean bill of health. ESV is currently following up with AusNet Services about why induction was allowed to build up in the top section and why earthing was not applied.

The failure to apply earthing is not restricted to AusNet Services; ESV staff also have witnessed this occurring during their works practice observations of Powercor personnel (see Section F5.4). ESV is concerned that this is being allowed to occur and will be following up with all transmission and distribution businesses to ensure there are no recurrences.

#### 4.5 2018 bushfires in southwest Victoria

In the *2018 Safety performance report on Victorian electricity networks*<sup>6</sup> we discussed ESV's investigation of the fires that occurred in southwest Victoria on the St Patrick's Day weekend (17-18 March 2018).

One of the six fires involved a broken power pole and, during the ESV investigation of these fires, the community raised concerns about the potential for further fire from pole failures.

ESV has subsequently been working with Powercor, the community and independent experts to determine whether there is an immediate and systemic risk of further pole failures in the region. Through this investigation, we have also reviewed Powercor's pole inspection and maintenance process to determine whether it is fit for purpose or requires modification.

<sup>6</sup> The network report can be downloaded at [esv.vic.gov.au/pdfs/2018-safety-performance-report-victorian-electricity-networks/](https://esv.vic.gov.au/pdfs/2018-safety-performance-report-victorian-electricity-networks/).

The investigation included:

- Powercor visual inspections and 'hammer' tests of 19,000 poles
- ESV independent visual inspections and 'hammer' tests of 1200 poles (with a sub-sample overlapping the Powercor sample to ensure reproducibility of the test findings)
- ESV sonic tomography and electronic impedance testing of 112 poles within the ESV sample to determine whether internal cavities were present
- breaking point tests of 13 poles from the area by an independent technical expert and witnessed by ESV.

Throughout the investigation, ESV met several times with community members (with some meetings attended by the Minister and Department) and attended Powercor's community forum in Warrnambool.

As an outcome of the investigation, Powercor changed its pole inspection and maintenance processes to increase the frequency of inspections and increase the safety factor applied to all poles on Powercor's from 1.25 to 1.40. Together these changes will reduce the likelihood of unanticipated failures.

ESV will continue monitoring Powercor to ensure that these changes are being implemented appropriately.

## 5. Safety trends and analysis

### 5.1 Fires

This year there were 568 network-related fires, with 242 (43 per cent) resulting in ground fires. Of the latter, 217 (90 per cent) occurred during the fire season (10 September 2017 to 30 April 2018) when the risk of a bushfire is highest.<sup>7</sup>

The averages and bounds in Figure 1 show a clear seasonal trend in ground fires due to both asset failures/faults and contact events. Throughout most of the year, there are similar numbers of both types of events; however, the peak in asset-related ground fires is more pronounced historically and has dominated the summer period.

This year, the numbers of asset-related ground fires (blue bars in Figure 1a) were within one standard deviation of the 2010-2018 average; however, the peak in fires that normally occurs in early January was shifted to February/March. In contrast, Figure 1b shows that the numbers of contact-related fires were well in excess of the historic numbers in August, January, March and April.

Figure 2 shows the cumulative number of ground fires throughout the year. While the total fires climbed to a level similar to 2015-2016, this was mainly due to fires occurring much later in the fire season.

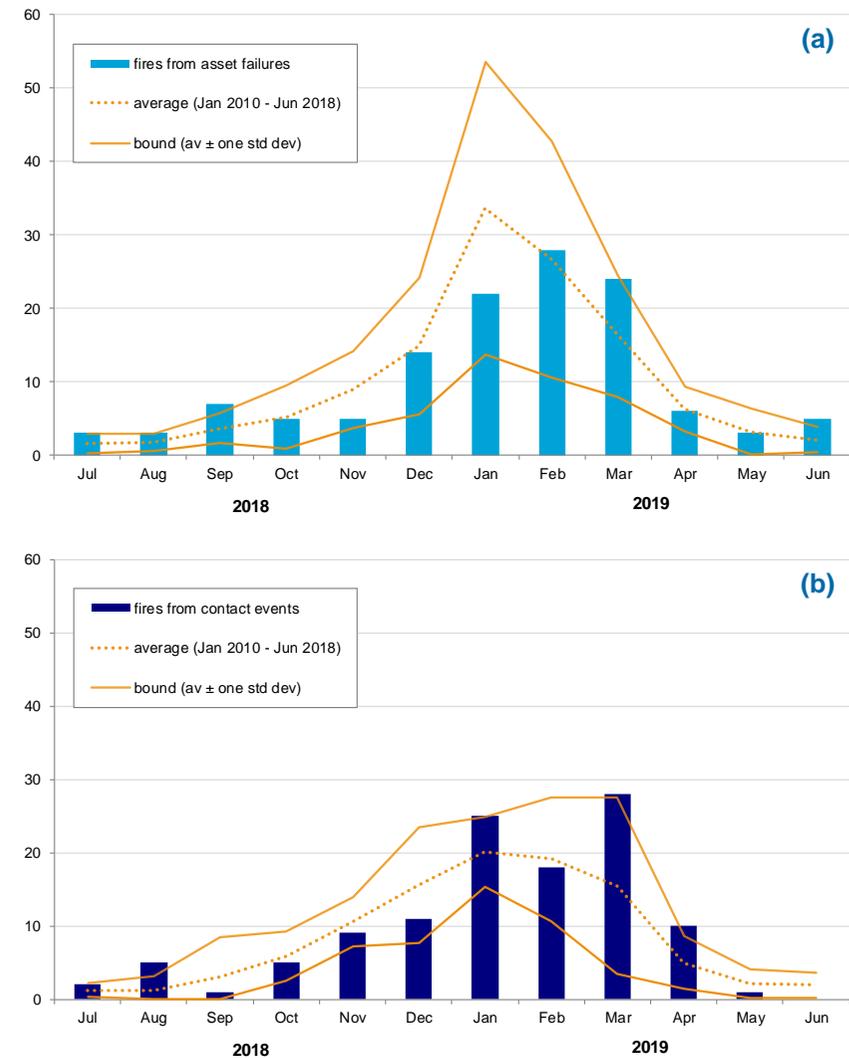


Figure 1 Ground fire incidents due to (a) asset failures and (b) contact events

<sup>7</sup> A detailed analysis of the 2018-2019 fire season can be found in ESV's End of Fire Season Summary ([esv.vic.gov.au/technical-information/bushfire-powerline-safety/fire-season-summary/](https://www.esv.vic.gov.au/technical-information/bushfire-powerline-safety/fire-season-summary/)).

The risk of a fire occurring, and spreading once initiated, depends on a number of variables such as time of year, weather, longer-term climate (e.g. drought), and type and curing of vegetation (among others). Inter-annual variability of these factors can unduly mask or emphasise the numbers of fires involving the electricity networks. Therefore, it is important that we consider data from similar years in making comparisons of performance.

The CFA issues fire declarations for municipalities when ground conditions are conducive to grassfires and bushfires; we can use these declarations as an indicator of fire risk. This allows us to compare inter-annual risks and place this fire season within a historic context.

The first declarations for this year's season started on 10 September 2018, several weeks earlier than all previous seasons (Figure 3); however, the escalation of declarations was in line with similar early summers. Declarations continued ahead of the Black Saturday fire season (2008-2009), and full declaration was achieved at the same time as the Black Saturday season.

At the end of the season, full declaration remained in force for longer than previous years. While declarations were then lifted faster than the Black Saturday fire season, this then plateaued and at 30 April there were still more municipalities under declaration than in previous years.

The indications at the start of the fire season were that 2018-2019 would be a problematic season for fires, and this state of alert persisted across the whole, extended fire season.

Despite ground conditions being conducive to bushfires, network asset failures and contact events only resulted in two ground fires larger than 10 hectares.

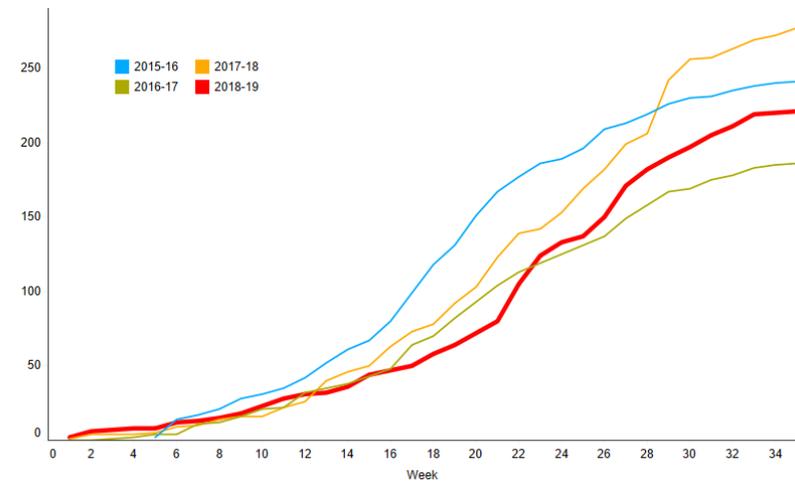


Figure 2 Cumulative fires across the fire season

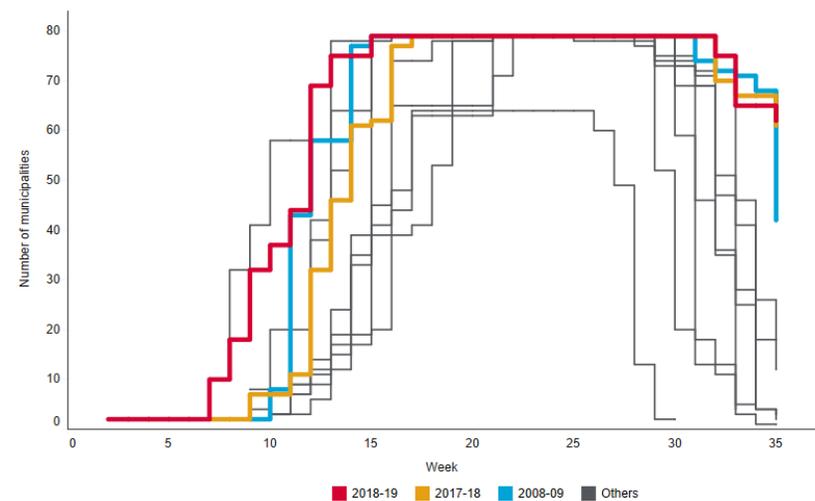


Figure 3 Summary of CFA fire declarations from 2008 to 2019

ESV has used advanced analytical techniques to identify which of 22 separate meteorological factors are most influential in predicting the number of fire events on the electricity networks.

The analysis has considered all fires reported to ESV between 1 January 2010 and 30 June 2018, with the data models being trained on 70 per cent of the data randomly selected between 2012 and 2019. The data from 2010 and 2011 was excluded from the training due to concerns about the quality of reporting in the early years of ESV's data collection.

The ground fires due to asset failures (Figure 4) were considered separately from fires due to contact events (Figure 5).

The algorithms predict the number of each type of incident based on daily weather observations from the nearest Bureau of Meteorology station. The actual numbers of ground fires are then aggregated by month and shown as orange bars in each of the figures; the prediction is shown as a blue line.

The blue line also differs between the two figures due to variations in the mix of weather factors driving each prediction.

Early results of this analysis were presented in last year's network safety performance report. This year we sought to obtain improved weather data for each specific fire event. Instead of allocating the fires to the nearest of six weather stations across Victoria, we obtained local weather data for each individual fire from the nearest weather station to the incident, with data now being used from 20 weather stations across Victoria.

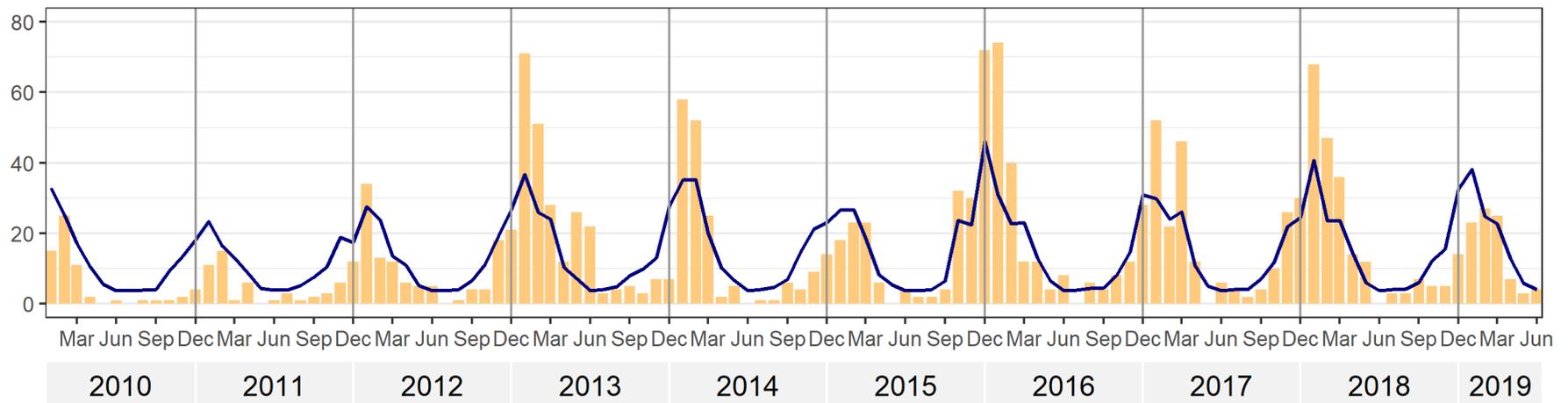


Figure 4 Influence of weather on ground fires due to asset failures

The main factor affecting asset-related fires (Figure 4) is air temperature, with a smaller contributions from morning wind speed, humidity, maximum gust speed and maximum temperature differential between days. For contact fires (Figure 5), the main contributions come from air temperature, maximum wind gust speed, afternoon wind speed and maximum temperature differential.

Both figures show a clear seasonal pattern of ground fires with peaks in summer and troughs in winter.

In general, the predictions reflect the shape and structure of the peaks in the incident data, and are close matches with the actual number of asset-related and contact fires. The differences between the actual and predicted numbers of fires have reduced from the predictions presented in last year's network safety performance report.

There are noticeable exceedances across both types of incident in 2012-2013 and 2013-2014, and for contact fires in 2017-2018. These variances may be due, in part or whole, to the practices of one or more of the distribution businesses or to causes other than direct weather influences.

The major exceedances in January to March 2018 were mainly due to vegetation contact (36 per cent), vehicle impacts (21 per cent) and encroachment events (20 per cent). The St Patricks Day weekend fires were the primary contribution to vegetation fires in March 2018.

Of note is that the numbers of asset-related and contact fires this season were lower than the number expected based on our modelling, with the exception of the contact events in March 2019.

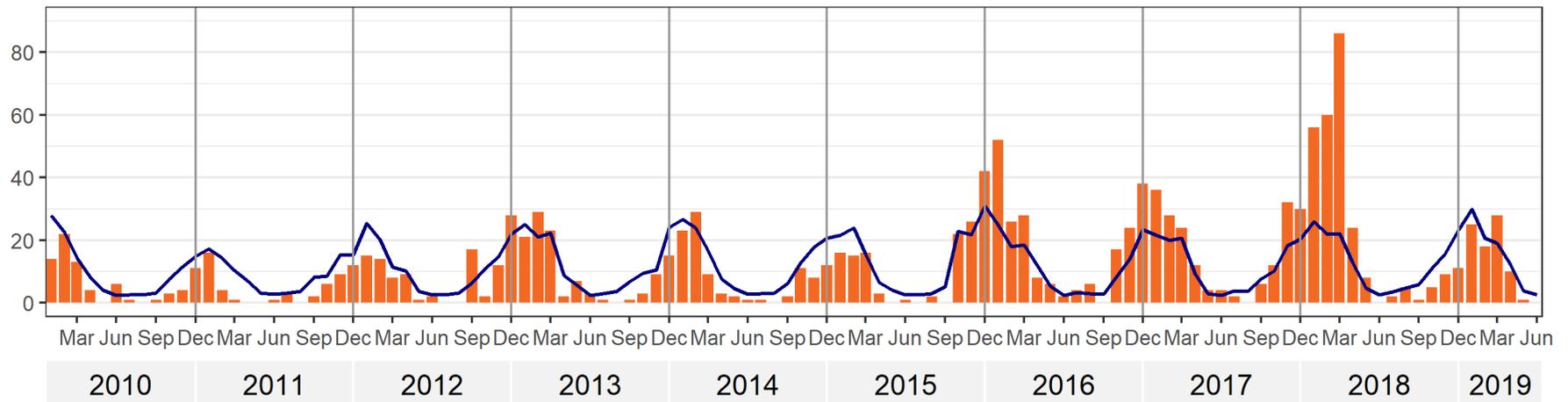


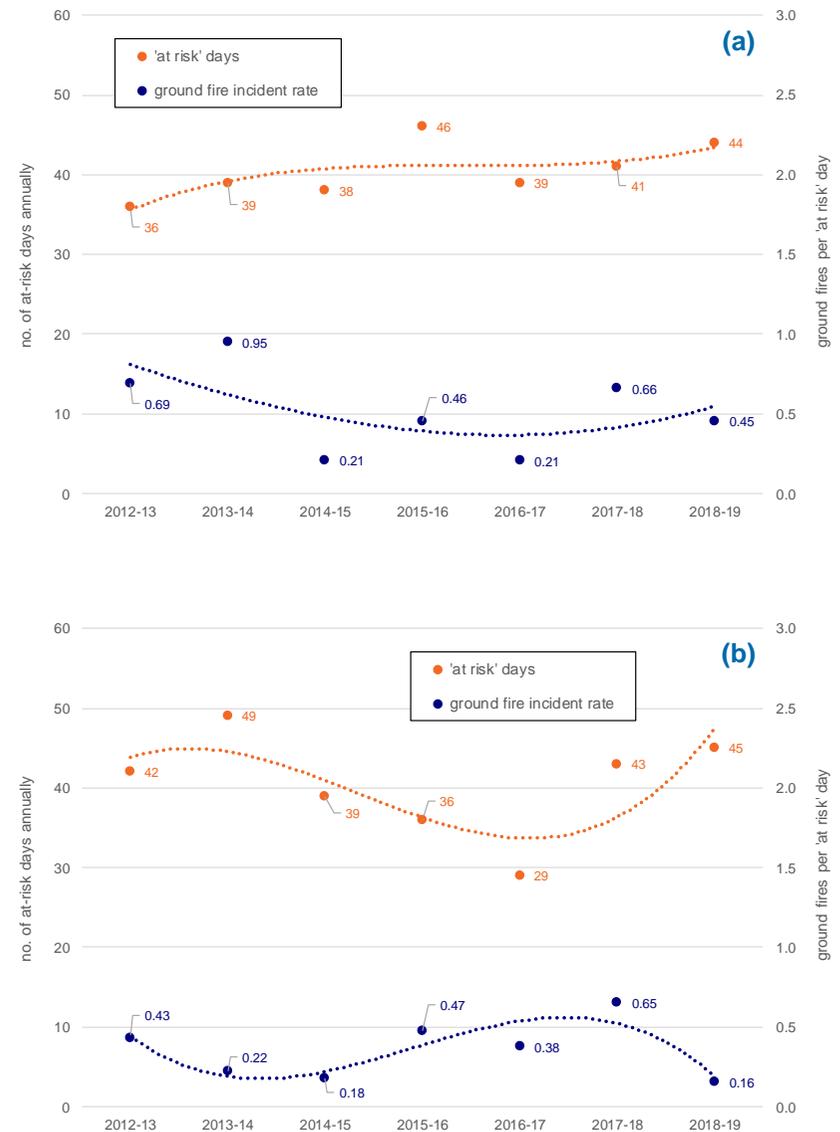
Figure 5 Influence of weather on ground fires due to contact events

While we are gaining insights into how weather influences ground fires due to asset failures and contact events throughout the year, the challenge posed by Black Saturday bushfires is to better understand how this influences fires on the “worst of the worst days” (that is, those days when the networks are most susceptible to fire ignitions due to weather).

ESV identified the days when the weather conditions exceeded the thresholds for the individual factors used to compile Figure 4 and Figure 5 — the days when there was the highest risk of ground fires being ignited. We then mapped the number of these ‘at risk’ days each year against the numbers of ground fires experienced on those days.

Figure 6(a) shows the numbers of ‘at risk’ days for ground fires due to asset failures against the number of fires per ‘at risk’ day in HBRA. This shows that the numbers of at-risk days for asset failure fires has been slowly increasing, whereas the rate of fires from asset failures has generally decreased.

Figure 6(b) shows the same for fires due to contact events. The numbers of contact-related ‘at risk’ days show greater variability. There may be a longer term cycle underpinning this, or the variability may be due to changes in vegetation management practices. This warrants further analysis.



**Figure 6 Numbers of ‘at risk’ days each year and the associated rate of incidents in HBRA on those days for (a) asset failures and (b) contact events**

Figure 7 shows the number of ground fire events on the Victorian networks from most common to least common (blue bars) relative to the long-term average for the 2010-2018 period (orange bars).

The four most common causes of fires were connection faults,<sup>8</sup> tree contact, animal contact, and other asset failures. All four events are largely within the control of the networks.

When compared to the long-term averages across the period from January 2010 to June 2018, fire numbers in 2018-2019 are elevated in four categories and reduced in nine categories.

Of particular note is that asset-related ground fires have fallen across all categories apart from connection faults. This is a generally positive result that is only marred by connection-related fires rising for a second year in a row to 91 per cent above the long-term average (Figure 8).

While tree contact fires are the second-most common fire event, the number of such incidents has halved over the last twelve months (Figure 8). This is due to the additional resourcing in the Line Clearance Assurance team, ESV’s recent enforcement actions and efforts by the distribution businesses to address issues on their networks.

Figure 8 shows the trend over the last nine years for the top four fire events above. This indicates that:

- fires from connection faults have been rising steadily for five years and are now well above the historic average (91 per cent higher)
- fires from tree contact have decreased markedly this year and are now twelve per cent below the historic average
- animal contact fires decreased this year and are thirteen per cent above the historic average
- fires due to other asset failures have increased but are still three per cent below the historic average.

<sup>8</sup> Connection faults include all faults attributed by the electricity companies to connections, terminations and joints when they report the incidents to ESV via our OSIRIS portal.

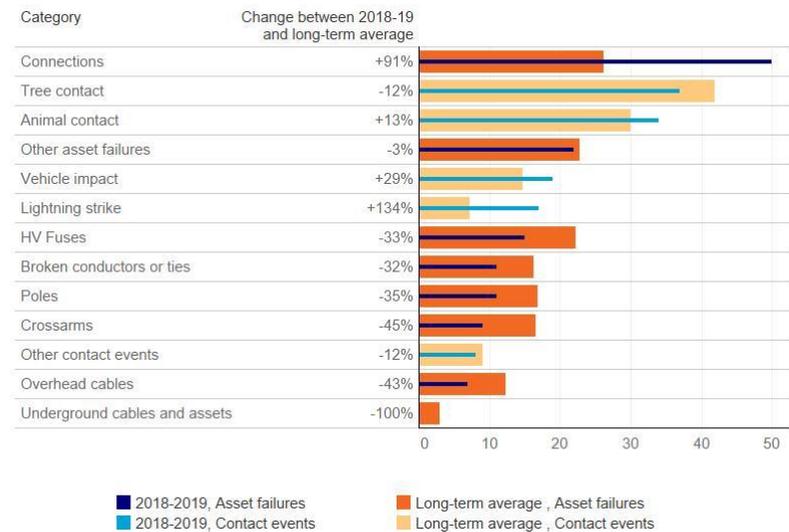


Figure 7 Ground fire-related incidents occurring on Victorian networks

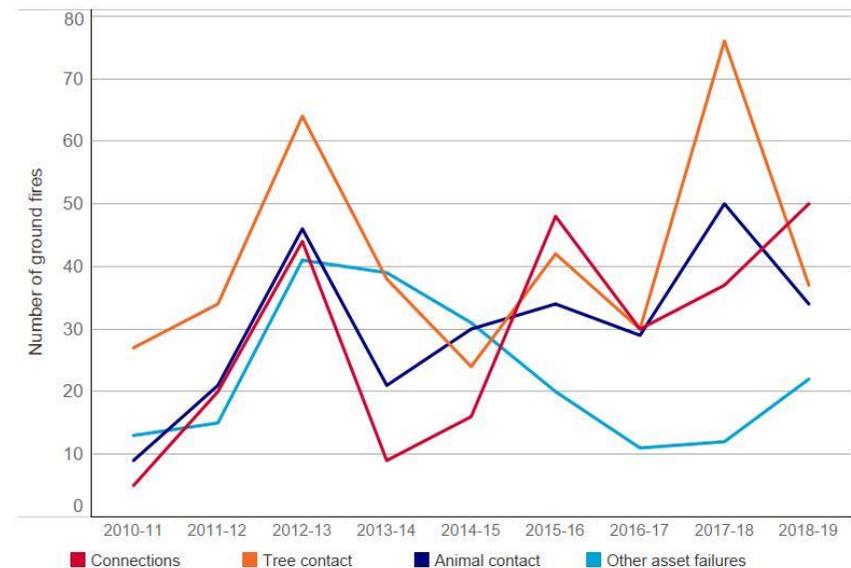


Figure 8 Historic trends for common ground fire events

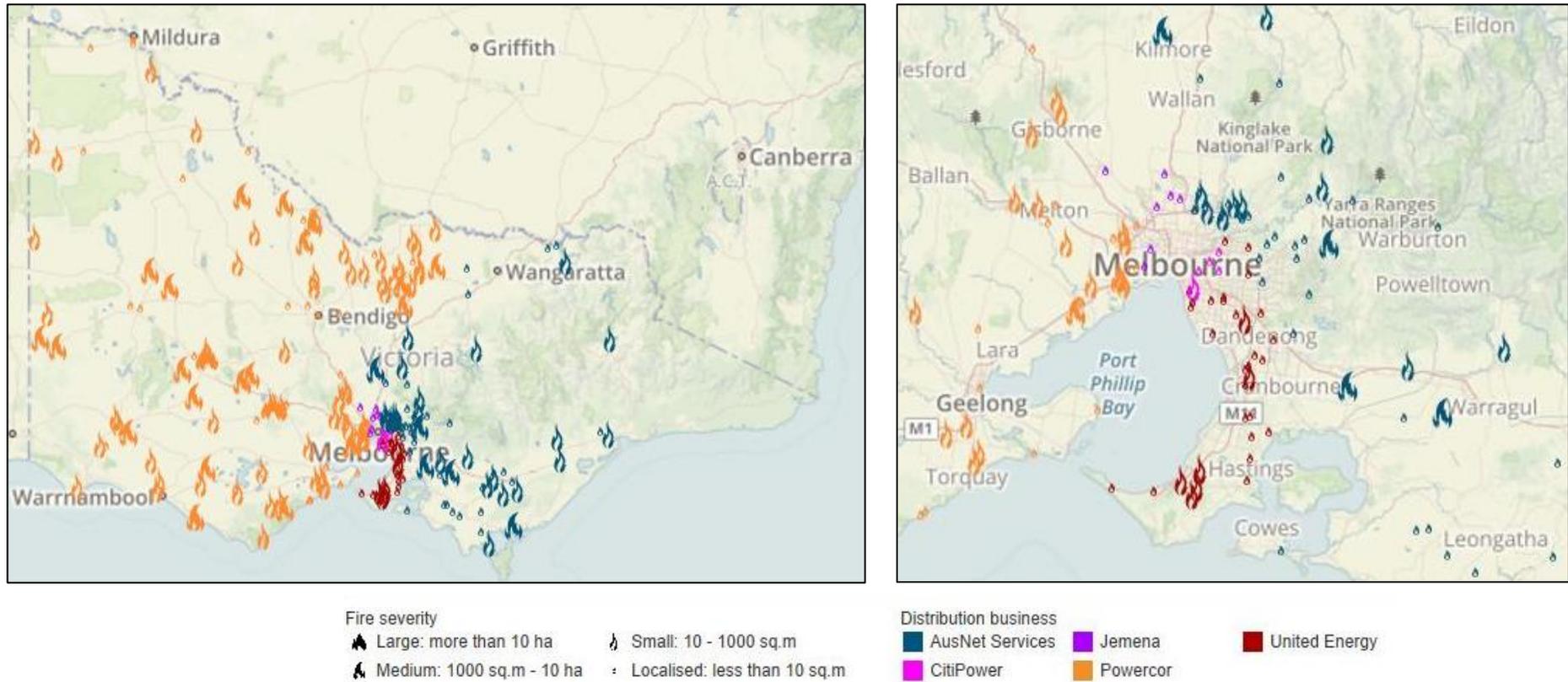


Figure 9 Distribution of ground fires across the Victorian networks

Figure 9 shows where ground fires occurred on the electricity networks across regional Victoria and within the Greater Melbourne region.

Of the 568 fires during the 2018-2019 period, there were only two network-related ground fires larger than 10 hectares this year (0.4 per cent); they occurred at Bulgana (outskirts of Ballarat) and Bunkers Hill (north of Ararat). There was also a third large fire at Longerenong (east of Horsham) due to a fault on a private overhead electric line.

There were also 25 fires (4.4 per cent) between 1000 m<sup>2</sup> and 10 hectares, 91 fires (16.0 per cent) between 10 m<sup>2</sup> and 1000 m<sup>2</sup>, and 124 fires (21.8 per cent) smaller than 10 m<sup>2</sup>. There were a further 326 fires (57.4 per cent) that only involved the asset and did not spread.<sup>7</sup>

## 5.2 Network trends

Figure 10 shows the number of network safety incidents on the Victorian networks. The numbers of asset failure incidents and contact events are reported separately.

The historical average for the period January 2010 to June 2018 shows a seasonal trend with increased asset failures over the summer period (Figure 10a). In general, the numbers of asset failures in the last year were well below the average. The annual peak that normally occurs in January and February did not occur; the “peak” in March was just below the historic average for this month.

In contrast, the numbers of contact events show less seasonality and more inter-month variability (Figure 10b). Contact events this year also showed a high degree of variability and were generally close to one standard deviation above the historical average. January, March, April and June saw the numbers of contact events exceed one standard deviation above the historical average.<sup>9</sup>

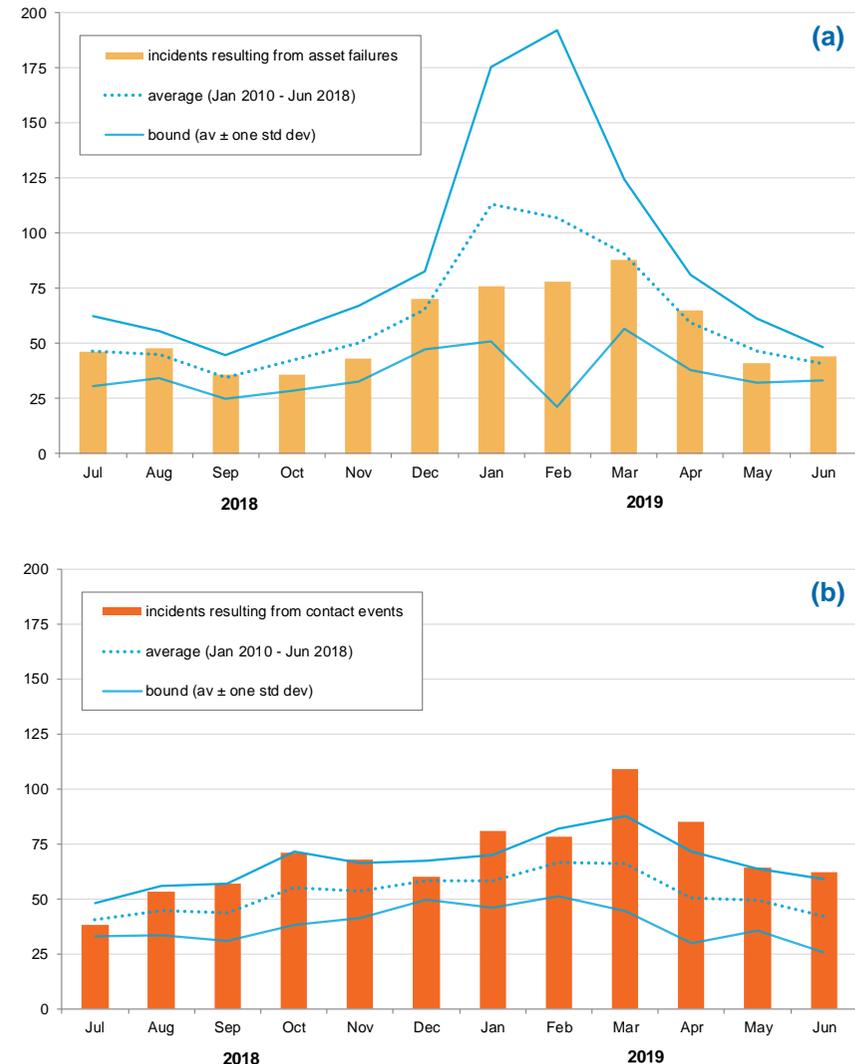


Figure 10 All incidents in the period due to (a) asset failures and (b) contact events

<sup>9</sup> We can normally expect 68 per cent of months to fall within one standard deviation either side of the average. Sixteen per cent of months should have incident numbers exceed one standard deviation above the average (or 1.9 months per year), and sixteen percent should have numbers less than one standard deviation below the average.

Figure 11 shows the number of incidents on the Victorian networks from most common to least common (blue bars) relative to the long-term average for the 2010-2018 period (orange bars).

The four most common incidents were other contact events, connection faults, vehicle impacts and tree contact. Two of these events are 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 5.3.

The other two events were within the control of the networks, namely connection faults and, to a degree, tree contact.

When compared to the long-term averages across the period from January 2010 to June 2018, the incidents in 2018-2019 are elevated in five categories, stable in three categories and lower in six categories.

Of particular note is that asset-related incidents have fallen across all categories apart from connection faults (22 per cent increase) and a marginal increase in faults on underground cables and ground assets (1.7 incidents). This is a generally positive result.

Also of note are the significantly elevated numbers of other contact incidents; last year’s numbers are 129 per cent higher than the long-term average. These events include copper theft, vandalism, intrusions into the No Go Zone, and are discussed further in Section 5.3.

Figure 12 shows the trend over the last nine years for the top four events above. This indicates that:

- other contact events have increased markedly this year
- connection faults have slightly increased and are at peak levels
- vehicle impacts<sup>10</sup> on overhead lines and poles have reduced for the third year in a row
- tree contact incidents have decreased this year.

<sup>10</sup> Vehicle impacts include collisions with poles and damage to overhead powerlines from road transport and farming and construction equipment.

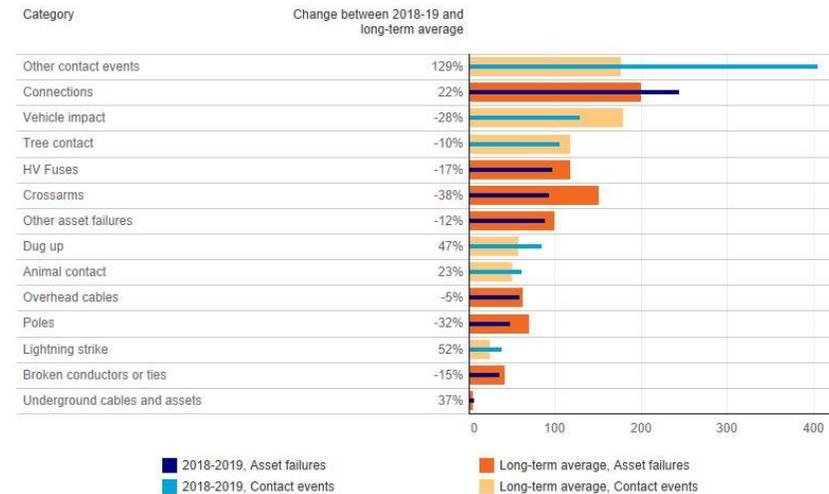


Figure 11 Incidents occurring on Victorian networks

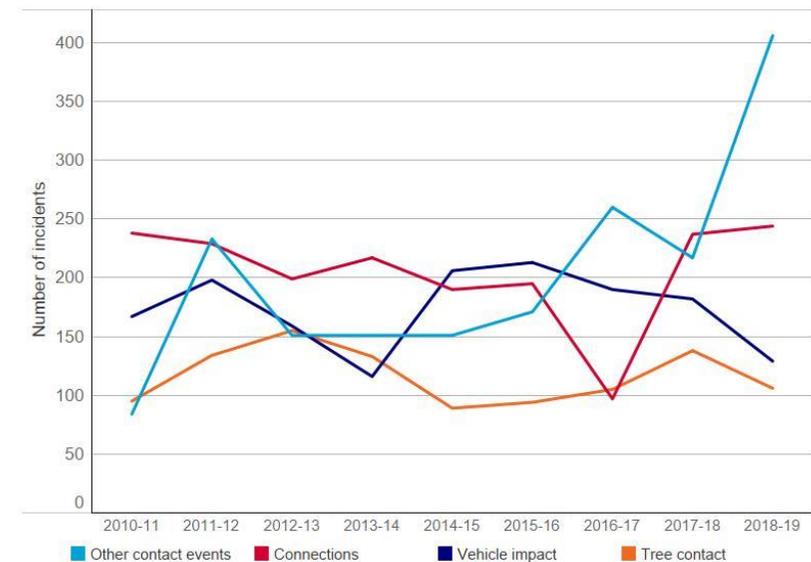


Figure 12 Historic trends for common incident events

### 5.3 Public safety

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

- 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.
- vehicles impacting electrical assets.

Figure 13 shows that the incidences of underground cables being dug-up or contacted during excavation works have increased this year.

Other encroachment and contact events was the most common category of events placing members of the public at risk last year. Figure 14 shows that these events have increased significantly since 2014-2015 and that last year's decrease was only temporary.

ESV and the distribution businesses have formed a working group to work on initiatives associated with No Go Zone infringements.

Vehicle impacts come from two main sources (Figure 15). The first is impacts from vehicles in transit, being either collisions with poles or large vehicles (trucks, rubbish trucks) snagging overhead lines.<sup>11</sup> The second source is cranes and other farming and construction equipment contacting overhead powerlines.<sup>12</sup> Such impacts have decreased for a third year in a row, while the numbers resulting in fires have increased this year.

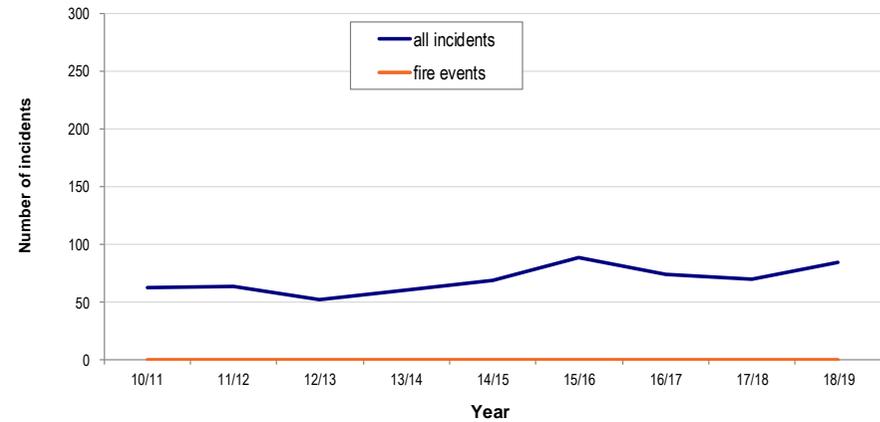


Figure 13 Dug-up cable incidents across the networks

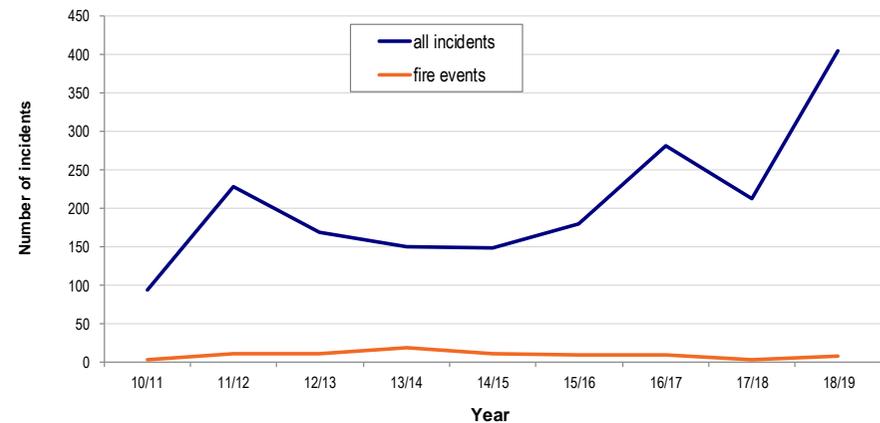


Figure 14 Other encroachment and contact events

These events include copper theft, vandalism, No Go Zone infringements

<sup>11</sup> Responsibility for managing and delivering road safety outcomes lies with VicRoads and local government; it is not the responsibility for the major electricity companies.

<sup>12</sup> 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.

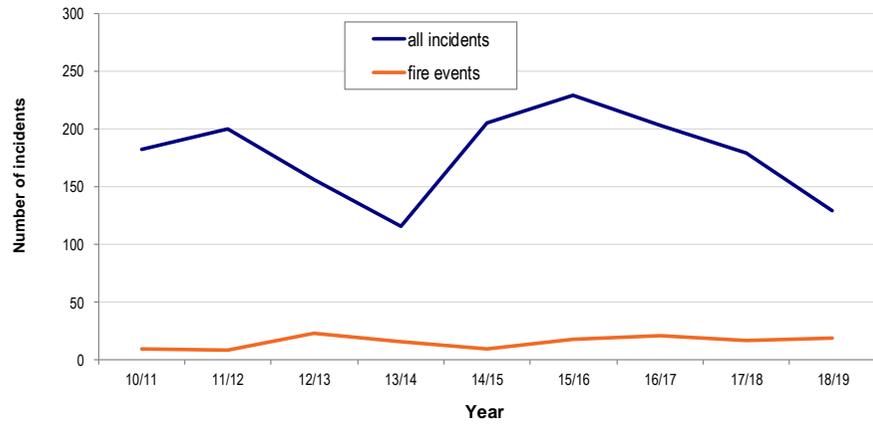


Figure 15 Vehicle impacts on electrical infrastructure

## 6. Network infrastructure performance

### 6.1 Transmission company performance

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

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 safety management of the transmission networks.

#### 6.1.1 ESMS evaluation and acceptance

AusNet Services, Basslink, TOA, TOA 2 and TransGrid have submitted ESMSs that are still being reviewed by ESV. Until the ESMSs are accepted by ESV, these companies will continue to operate under their existing ESMSs.

On 29 July 2019 TransGrid submitted an updated ESMS to include the Kiamal Terminal Station and the Berrybank Transmission Line and Terminal Station for acceptance. The updated TransGrid ESMS is currently under review.

### 6.2 Distribution company performance

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

#### 6.2.1 ESMS evaluation and acceptance

As part of the process to establish accepted ESMSs, ESV undertook extensive systems validation audits of all the distribution companies during the 2017-2018 year. The ESMS validation audits identified areas in the ESMSs that required improvement, and the distribution companies worked with ESV to achieve final acceptance of their ESMSs during 2018-2019.

#### 6.2.2 Bushfire mitigation regulations

The Electricity Safety (Bushfire Mitigation) Regulations 2013 were amended on 1 May 2016 to require major electricity companies to include additional details in their bushfire mitigation plans:

- All polyphase electric lines originating from 45 prescribed zone substations to meet the required capacity over three tranches by 1 May 2019, 1 May 2021 and 1 May 2023.<sup>13</sup> 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 ('extreme' areas in Figure 16). AusNet

<sup>13</sup> The required capacity relates to the ability to reduce voltages to specified levels within set timeframes in the event of a phase-to-ground fault. These levels and timeframes are specified in the Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016.

Services, United Energy and Powercor are trialling new covered-conductor technologies to achieve this requirement at a lower cost.

- 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. AusNet Services is the only business yet to complete installation of ACRs on its network.

### Rapid Earth Fault Current Limiters

AusNet Services and Powercor each 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.

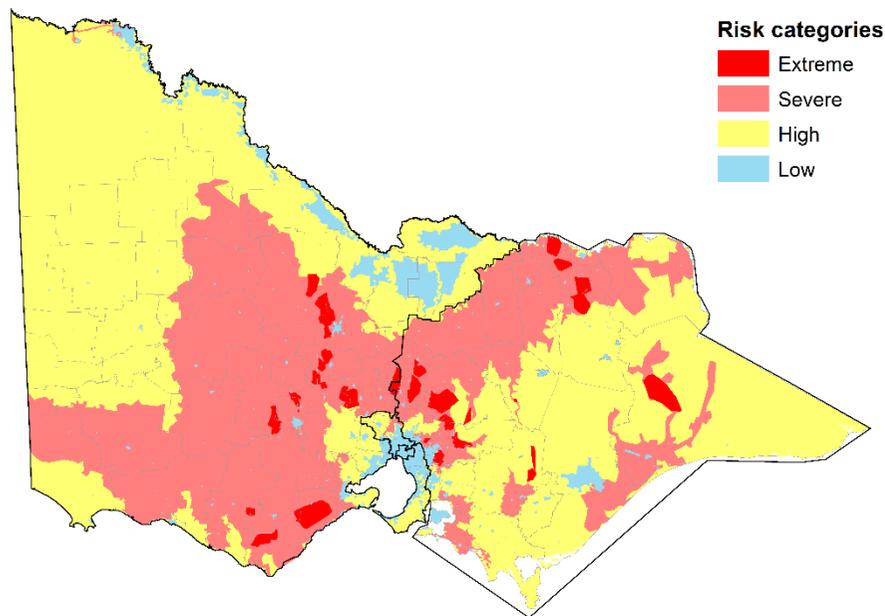


Figure 16 Risk areas across Victoria

By 30 April 2019, ESV had conditionally accepted six AusNet Services and seven Powercor zone substations as compliant, with acceptance being conditional on both companies demonstrating that the technical issues impacting compliance have been resolved prior to the 2019-2020 bushfire season.

On 12 July 2019, ESV granted a time extension for AusNet Services to achieve compliance for the Kinglake and Woori Yallock zone substations. AusNet subsequently presented an action plan to solve the technical issues impacting compliance.

In addition to the mandated REFCLs, Jemena has elected to install REFCL protection at the Sydenham zone substation.

United Energy has installed a REFCL at Frankston South zone substation and continues with the program for its installation at Mornington South and Dromana zone substations.

When a REFCL unit responds to a single phase-to-earth fault, the voltage on the remaining two unfaulted phases rises. Where equipment is not rated for such voltage excursions, it must be upgraded; this is known as hardening. In some cases, HV customers connected to REFCL-protected networks also need their assets to be hardened or isolated from these effects. In cases where hardening is impracticable, the distribution businesses may seek exemptions to allow the HV customers to be isolated; this is the most common solution for Tranche 1 sites.

Isolating transformers were already installed for several HV customers in both networks and more are still under construction.

It is expected that the REFCL program will be delayed for some of the zone substations due to works with HV customers running late.

### Conductor replacement

AusNet Services and Powercor each have approximately 1,600 km of conductor within electric line construction areas. These bare overhead powerlines are to be progressively replaced with insulated or underground solutions. Proactive replacements have been conducted as part of powerline replacement fund activities.

As of 30 April 2019, AusNet Services reports that 83 per cent of polyphase electric lines in Electric Line Construction Areas within its network consisted of bare overhead wire. This is expected to reduce to 81 per cent by 30 April 2020. Likewise Powercor reports 76 per cent bare overhead wire remaining; this is expected to reduce to 74 per cent by 30 April 2020.

### 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 31 July 2019, Powercor had installed 769 of the 1062 ACRs to be installed on its network, including 128 installed this year. The schedule was delayed at the beginning of 2019 due to procurement issues, but Powercor has since recovered any delays. ESV will continue to closely monitor Powercor's progress to ensure these works are completed by 2020 as outlined in its bushfire mitigation plan.

### Exemptions

AusNet Services and Powercor have sought multiple exemptions over the 2018-2019 period in relation to HV customers and fully-insulated cable network sections supplied from REFCL-protected substations. Further details on these exemptions can be found in Appendix B and Appendix F.

### 6.2.3 Technology

In addition to the new technologies being deployed to address the requirements of the amended bushfire regulations, there are also two other areas of note where new technologies are being tested by the distribution businesses to improve public safety.

#### Smart meter analytics

With high penetration of the Advanced Metering Infrastructure (AMI), or smart meters, comes an opportunity for the distribution businesses to utilise the data that is collected for purposes other than general power usage information and billing. The meters collect voltage and current data at regular intervals and, via data analytics, the meter's data can be used to find faults and recognise hazardous situations such as broken neutral conductors and overloaded networks. Once a hazard has been recognised action can be taken before a customer even realises there is a problem (for example, when a neutral is about to break or has just broken). The data analytics and immediate action prevents serious shocks from occurring.

#### Partial discharge on overhead lines

The distribution businesses are trialling devices that detect small electrical discharges (partial discharges) on a network that can be a pre-indicator of a fault. These small discharges are analysed to look at the 'signature' of the discharge to enable the early warning of pole-top fires, vegetation contact on high voltage lines, pollution build up on insulators, and discharges on transformer and protection equipment. The detection devices are being trialled to remotely monitor overhead lines across many kilometres on a 24/7 basis. If successful, the early detection can warn of potential failures that, when acted on, prevent an electrical fault that may otherwise have resulted in a bushfire.

### 6.2.4 F-factor scheme

The F-Factor Scheme Order 2016 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 Australian Energy Regulator (AER) manages the Scheme.

Under the Scheme, each distribution business is required to submit a fire start report to the AER by 30 September each year. Where required, the AER can request that ESV review these reports and submit individual draft validation reports to the AER by 30 November each year. These drafts are provided back to the businesses for comment, and final validation reports are to be provided to the AER by ESV by 28 February.

The 2018-2019 period was the second year for which ESV was requested to validate the distribution businesses' fire start reports.<sup>14</sup> These reports covered the period from 1 July 2017 to 30 June 2018. ESV found the fire start reports generally reflected the data in OSIRIS. This was not surprising given that the discrepancies reported in the 2016-2017 reports prompted all the businesses to undertake a reconciliation of their internal records against the ESV OSIRIS records before they produced their fire start reports this year.

<sup>14</sup> Copies of the distribution businesses' fire start reports and ESV's validation reports can be found on the AER website at [www.aer.gov.au/networks-pipelines/network-performance/victorian-electricity-distributors-fire-start-reports-for-the-july-2017%E2%80%93june-2018-reporting-period](http://www.aer.gov.au/networks-pipelines/network-performance/victorian-electricity-distributors-fire-start-reports-for-the-july-2017%E2%80%93june-2018-reporting-period).

## 6.3 Issues for attention

### 6.3.1 Emerging technologies

New technologies are emerging in the energy industry. Domestic solar and batteries are already here, as is grid-scale energy storage. The Internet of Things, electric vehicles, virtual power plants and peer-to-peer trading are quickly following. Plans for hydrogen to supplant natural gas as the energy source of the future are being investigated.

All these technologies (and more), as well as demographic changes locally and economic changes globally, are 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 business models enter the marketplace. Such a paradigm shift is likely to have significant impact on safety regulation as new safety risks emerge and old ones change.

The legislation that ESV administers reflects the world as it is, but not necessarily the world as it is becoming. ESV needs to be able to position itself and the regulations it administers to adequately respond to these changes, and often this needs to be done ahead of the change. In this, we need to ensure that safety risks are appropriately addressed while ensuring that there are no unwanted regulatory impediments to the adoption of new technologies. This was captured in recommendations 32 and 33 of the Review (see Section 3.1), whereby ESV was exhorted to develop a roadmap of emerging issues and proposed actions and to form an expert advisory committee to assist ESV in developing effective regulatory responses.

In 2018-2019, ESV undertook an exercise to consider the emerging risks led by an international consultancy group specialising in scenario planning. This brought together ESV, local and international experts to assess major global trends, identify four potential futures, and develop objectives, goals and strategies to address the risks posed.

This work is the first stage in articulating the roadmap recommended in the Review, and provides a strong foundation on which we can start developing proactive responses. The next stage of works will focus on developing actions that need to be implemented as different futures emerge, together with triggers for their instigation.

ESV is also in the process of establishing a Future Trends Advisory Committee to help ESV carry this work forward and monitor the emergence of the different future scenarios.

A report on the outcomes of the first stage of works is currently being finalised, and this will be published on the ESV website once it is completed.

### **6.3.2 Asset management**

ESV is now establishing a new team focused on risk and asset management practices to specifically test, challenge and expose the life-cycle sustainability of the systems, practices and controls of the major electricity companies. This new team will be led by a new engineering team leader, and include two qualified and experienced asset inspectors recruited to provide a greater field presence and enable increased inspections, audits and investigations.

ESV has commenced reviewing the asset management approach of each business and expects to continue by:

- reviewing critical control effectiveness
- benchmarking safety performance
- establishing what is acceptably safe.

Continuing this work will provide ESV assurance that the distribution businesses are adopting appropriate life cycle management practices. ESV's findings will be made available to the public at the conclusion of this work.

## 7. 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.

A review of these regulations commenced in 2019, with new regulations coming into effect the end of June 2020. No material changes are anticipated in the new regulations.

With the increased resources in the Line Clearance Assurance team (see Section 3.3), ESV has been able to conduct more thorough audits and plan evaluations, provide greater oversight of councils and other responsible parties, and undertake inspections at that is statistically representative of the broader network performance.

### 7.1 Performance of major electricity companies

#### 7.1.1 ELCMP evaluation and approval

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 electric line clearance objectives and the management strategies that will be used to comply with its regulatory obligations.

ESV evaluates the plans against established criteria to validate that the plans meet the minimum expectations of a quality plan and comply with the regulations. Where deficiencies are identified, feedback is provided and the company is then required to submit an amended plan addressing the

deficiencies. Resubmitted plans are re-evaluated and, when found to meet the minimum expectations, are referred to the General Manager of Electrical Safety and Technical Regulation for approval.

Each major electricity company submitted its plan for the 2018-2019 period. After some iterations, all of the ELCMPs for the major electricity companies were approved before the 2018-2019 fire season.

#### 7.1.2 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 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 vegetation remains compliant with the Code of Practice for Electric Line Clearance.

ESV completed audits and inspections of all major electricity companies to validate compliance with the regulations. The audit program was completed by two service providers acting on behalf of ESV. The MECs were required to submit inspection data to ESV to inform the audit activities.

The audit gauged the preparedness of the companies leading into the 2018-2019 declared fire danger period and compliance with their ELCMPs. The results of the audits are further described in the individual appendices for each company.

The audits completed for the major electricity companies with HBRA inspection responsibilities found clearance rates to be adequate.

### 7.1.3 Reporting over summer season

The major electricity companies were required to report to ESV on their preparedness for 2018-2019 fire danger period. The reporting period commenced on 10 September 2018 and concluded on 30 April 2019.

During the 2018-2019 fire danger period, each company was required to report the total number of noncompliant spans that were still to be cleared in HBRA leading up to and during the fire danger period.

ESV monitored the progress of the each company's vegetation clearing to establish an understanding of the performance of their vegetation management programs. This information provided ESV with insight into their preparedness for the fire danger period.

The submitted data was used to inform reports that ESV provided to the Minister for Energy, Environment and Climate Change each week during the fire season.

The main observations were compiled into the 2018-2019 End of Fire Season Summary. This was released publicly on the ESV website. The report can be found at [esv.vic.gov.au/technical-information/bushfire-powerline-safety/fire-season-summary/](https://www.esv.vic.gov.au/technical-information/bushfire-powerline-safety/fire-season-summary/).

Individual company performance is described further in the appendices.

### 7.1.4 Exemptions

Under Regulation 11, ESV may exempt a responsible person from any of the requirements of the regulations. Powercor and United Energy had exemptions in place during the 2018-2019 period. Details of the exemptions are included in their ELCMPs.

#### Powercor

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.

#### United Energy

In 2017 United Energy conducted a LiDAR survey of vegetation that found 196 noncompliant spans located in HBRA involving vegetation above the conductors. This noncompliant vegetation had not been identified by United Energy's ground-based visual assessment.

ESV required that United Energy manage these spans under a plan (accepted by ESV) until they were made compliant. ESV required that compliance be achieved by 30 November 2018 or the declaration of the 2018-2019 fire danger period in United Energy's network area, whichever is the earliest. United Energy achieved compliance ahead of either target.

ESV closely monitored United Energy's progress in making the spans compliant. ESV has since confirmed that all of these spans have now been made compliant.

### 7.1.5 Unannounced inspections

In the 2017-2018 period, ESV conducted a schedule of unannounced line clearance inspections in HBRA. The inspections focused on spans the distribution businesses are responsible for clearing. These unannounced inspections continued in 2018-2019 and were extended to include LBRA.

Unlike the outcomes audits described in the appendices to this report, ESV provides limited notice to the distribution companies of where or when such field inspections will occur. The notice was also sufficiently limited to prevent the business from undertaking remedial actions prior to the audit.<sup>15</sup>

<sup>15</sup> Performance results are typically better when the distribution businesses are given advanced notice of ESV regulatory activity such as that given for the outcome audits.

In the 2018-2019 period, ESV inspected approximately 10,000 HBRA and 6000 LBRA spans for which the distribution businesses are responsible for line clearance.

Note: A further 2000 spans were inspected during the pre-summer outcomes audits.

We are using the higher data volumes that we now capture to inform our future regulatory effort and enforcement actions.

Figure 17 and Figure 18 depict the results of these inspections for HBRA and LBRA respectively. This shows that Powercor had the best compliance in HBRA, while United Energy had the worst compliance. Jemena had the best compliance in LBRA, while Powercor and United Energy had unacceptable levels of noncompliance in LBRA. This is the subject of ongoing monitoring and potential enforcement action.

The high levels of Powercor’s LBRA noncompliance and United Energy’s HBRA and LBRA noncompliance was indicative of systemic problems that both businesses were having in managing their line clearance responsibilities during the reporting period.

ESV continues to monitor United Energy and Powercor as they rectify these issues. This poor performance is further discussed in Section 7.2.2.

It must be noted the Powercor compliance in HBRA was significantly improved from recent years. This is attributed to ongoing ESV investigation and enforcement action, and the subsequent actions by Powercor to rectify its poor vegetation management performance.

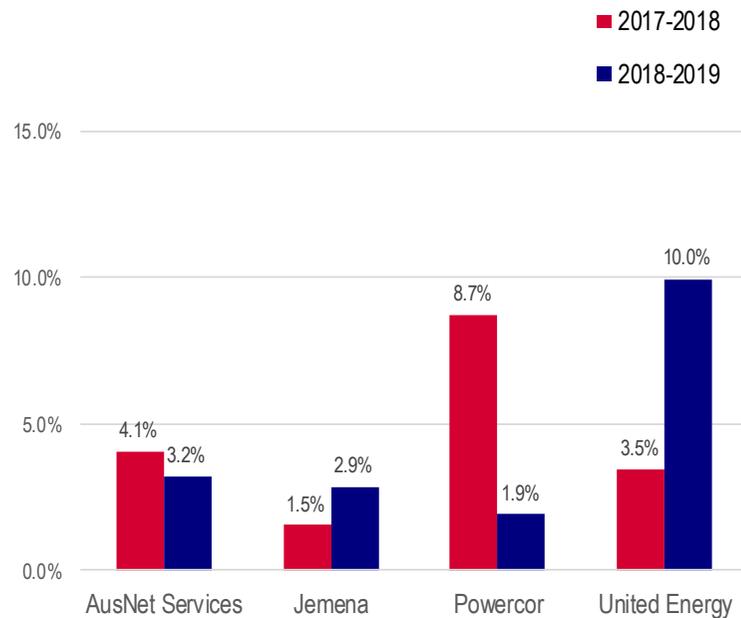


Figure 17 Noncompliance rates in HBRA

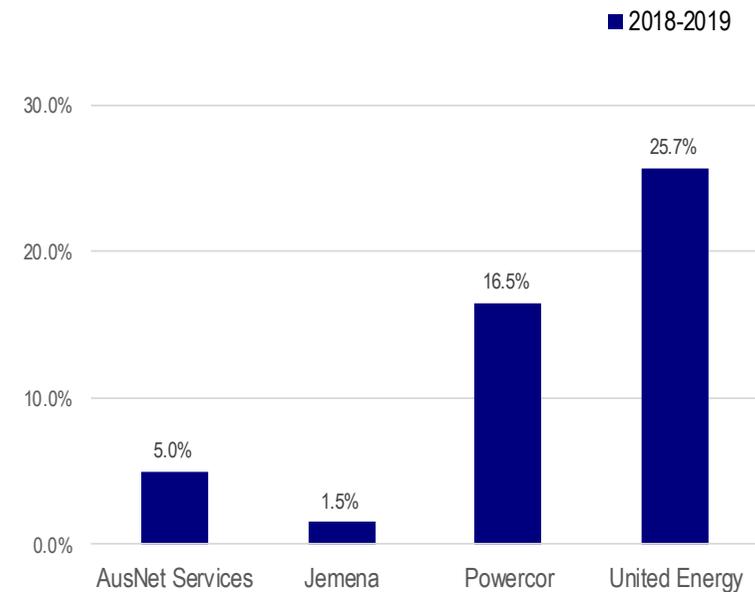


Figure 18 Noncompliance rates in LBRA

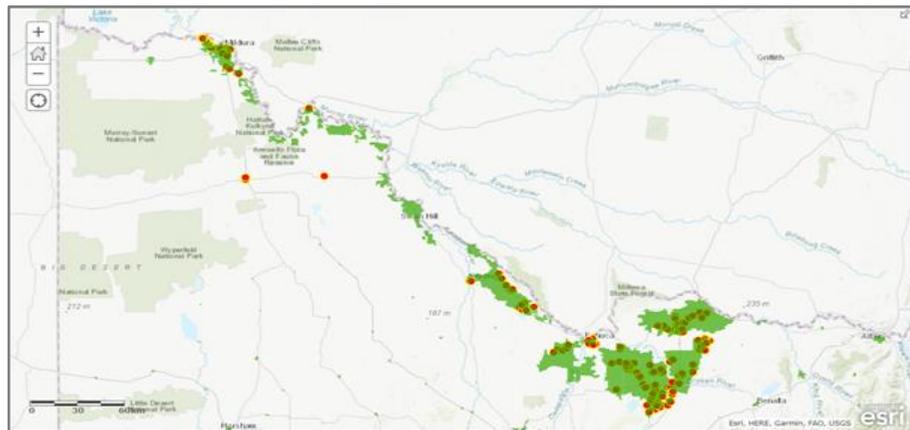
## 7.2 Enforcement actions

### 7.2.1 Powercor prosecution

In January 2018, three grassfires occurred near the townships of Rochester (6 January 2018), Strathmerton (20 January 2018) and Port Campbell (28 January 2018). The ESV investigation of these three fires concluded that ignition of each fire was most likely caused by tree branches coming into contact with high voltage power lines.

Concerns regarding observations made by ESV when investigating the fires prompted a broader inspection of vegetation clearances throughout northern Victoria, extending from Shepparton through to Mildura. Extensive and particularly unsafe noncompliant vegetation was identified by ESV during this inspection process.

The areas of LBRA affected by this issue are highlighted green in Figure 19.



**Figure 19 At-risk LBRA**

The areas highlighted in green show LBRA areas with elevated risk. The red icons show the locations where ESV identified noncompliant spans in LBRA.

In July 2018, Powercor was charged for each of the three fires and for 189 breaches of the Code of Practice for Electric Line Clearance. The charges for each fire included:

- breaching key provisions of the Code of Practice for Electric Line Clearance in contravention of section 90 of the *Electricity Safety Act 1998*
- failing to minimise the risks to property from a supply network [section 98(b) of the *Electricity Safety Act 1998*]
- failing to comply with a bushfire mitigation plan [section 113B(2) of the *Electricity Safety Act 1998*].

On 10 April 2019 at the Shepparton Magistrates Court, Powercor pleaded guilty to each of the charges associated with the three fires and a further 51 charges that incorporated the 189 Code breaches.

The Magistrate acknowledged the seriousness of the charges, but noted that Powercor had pleaded guilty at the earliest opportunity.

The Magistrate imposed on Powercor fines of \$374,000; consisting of \$200,000 for the line clearance breaches and \$58,000 for each of the three fires. The Magistrate also awarded \$165,000 in costs to ESV.

### 7.2.2 ESV investigation of United Energy

During the 2018-2019 period, ESV was not satisfied with the clearing standards achieved by United Energy in HBRA or LBRA. United Energy was directed to clear all noncompliant spans identified by ESV, and afterwards ESV confirmed all these spans had been made compliant and safe as required.

This matter is currently the subject of an ongoing investigation and enforcement action. As part of the ESV enforcement strategy, United Energy was required to commission an independent audit of its vegetation management functions and systems.

Due to their common ownership, Powercor, CitiPower and United Energy employ a combined vegetation management division. The findings of the independent audit have, therefore, been applied to all three businesses and

embedded in the ELCMPs for each business. As such, this makes implementation of the audit findings enforceable on each of these businesses.

This action was a specific requirement ESV placed on United Energy through its enforcement strategy.

ESV is closely monitoring the implementation of the independent audit findings to ensure they result in improved electric line clearance performance in HBRA and LBRA by the three companies. The enforcement position that ESV ultimately takes on this matter will be dependent on the performance outcomes observed through these new regimes.

Note: The independent audit also addresses poor LBRA clearance rates observed on the Powercor network (see Section 7.1.5).

United Energy (together with Powercor and CitiPower) have been proactively reporting to ESV on the progress in implementing the audit recommendations. Delivery of the recommendations is being progressed in a timely manner.

## 7.3 Performance of other responsible persons

### 7.3.1 ELCMP evaluation and acceptance

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

Unlike the major electricity companies, these responsible persons are not required to submit their plan to ESV annually; however, they must do so if requested by ESV. During 2018-2019, ESV evaluated and approved twelve plans submitted by municipal councils and four submitted by specified operators.

Extensive consultation occurred with councils and other responsible persons throughout the year. This was completed to improve their understanding of what is required to prepare a quality plan and to ensure

the plans comply with the requirements of the regulations and meets the minimum ESV expectation.

### 7.3.2 Compliance observations

#### Systems audits

ESV conducted system audits of ten municipal councils throughout 2018-2019 to monitor the effectiveness of their electric line clearance management plans in complying with the regulations.

The local government authorities audited were:

- Ballarat City
- Cardinia Shire
- Colac Otways Shire
- Darebin City
- Hobsons Bay City
- Maroondah City
- Monash City
- Northern Grampians Shire
- Surf Coast Shire
- Whitehorse City

Auditing of municipal councils found their vegetation management systems to be less mature than those of the major electricity companies.

Of particular note, a number of councils were found to have deficient management oversight of the contractors used to perform electric line clearance works. This included a lack of audits to ensure appropriate clearance standards are achieved when the contractors complete the electric line clearance work.

ESV has been working closely with the audited councils to implement more effective vegetation auditing regimes to drive improved standards of compliance. Typically all the audited councils showed a willingness to comply and engaged openly with ESV.

#### HBRA inspections

Fifty-two municipal councils are responsible for managing tree clearance around electric lines in HBRA. The number of spans for which councils are responsible is limited; some councils are responsible for less than ten spans (for example, Whittlesea Shire Council), while others are responsible for over 100 spans (for example, the Shire of Yarra Ranges).

ESV's increased resource has allowed it to better understand of how these HBRA spans are being managed by councils. An inspection program of these areas was completed in the 2017-2018 fire danger period; this was repeated in the 2018-2019 season.

Where ESV identifies noncompliant vegetation it requires the relevant Council to clear it to make it compliant and safe. It must also notify ESV when the clearing has been completed. ESV then undertakes a follow-up inspection to confirm that clearing has occurred as stated.

In the 2018-2019 fire danger period, ESV observed distinct improvements in the performance of all councils with HBRA clearing responsibilities; the average noncompliance find rate across councils inspected dropped by more than half (Figure 20).

The drop in noncompliance rates can be attributed to the additional resources employed by ESV that have allowed us to increase our engagement with councils across the state. This consultation identified that many councils were not aware of their vegetation clearance obligations

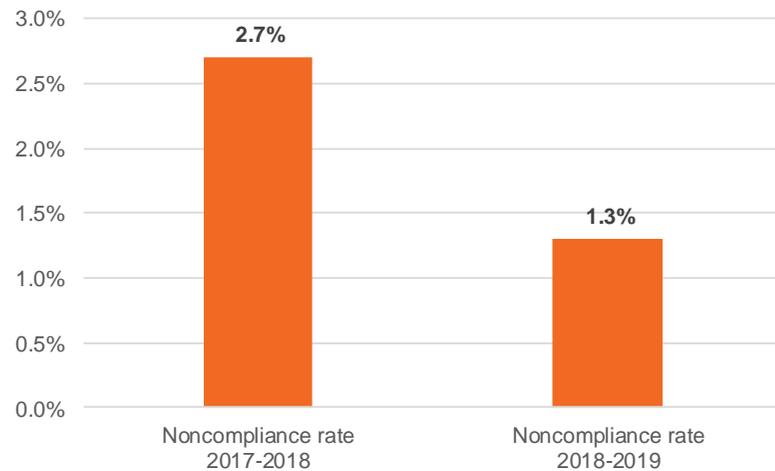


Figure 20 Comparison of noncompliance rates between years

under the Electricity Safety Act; most have responded positively to working with ESV once aware of these obligations.

During the year, there were a number of councils where noncompliance rates were significantly higher than their peers. Figure 21 shows the performance of the ten worst performing councils in the 2018-2019 period. ESV has continued to work with these councils to ensure they understand and address their line clearance responsibilities. They will be the specific focus of ESV inspection activity in the 2019-2020 period in the pursuit of continued improvement in electricity safety.

### 7.3.3 Issue of Section 86 notices to local government authorities

If a responsible person fails to keep the whole or any part of a tree clear of an electric line, Section 86 of the Act provides ESV with powers to require a responsible person to comply. This is to occur by means of a written notice specifying the actions necessary to comply.

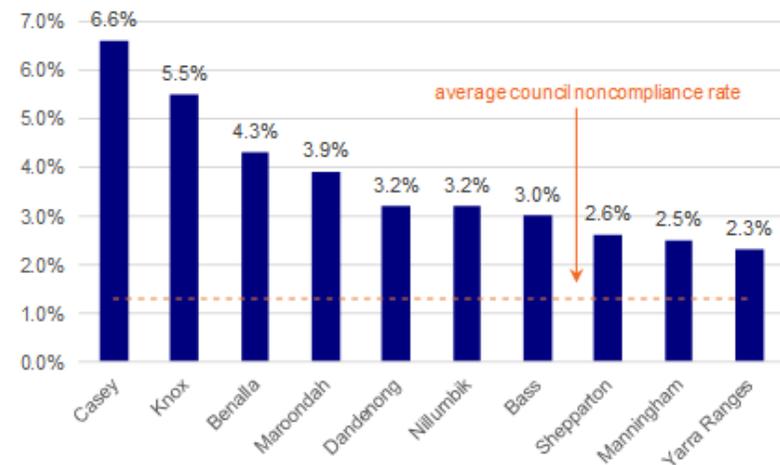


Figure 21 Top 10 worst performing councils in 2018-2019

If a responsible person is unable or refuses to comply with a Section 86 notice, ESV may direct the relevant distribution company to clear the noncompliant vegetation. The distribution company can then recover the costs of doing so from the responsible person.

When ESV identifies noncompliant vegetation, our preference in the first instance is to consult with the responsible person and have the vegetation cleared and made safe. When this process does not achieve the necessary safety outcome, or the responsible person fails to respond appropriately, ESV may formally advise it of its duties under the Act or issue a Section 86 notice.

The following municipal councils failed to respond and were subsequently issued with Section 86 notices in the 2018-2019 period:

- City of Casey
- City of Manningham
- City of Melbourne (November 2018)
- City of Melbourne (December 2018).

The two notices issued to the City of Melbourne related to two separate issues.

Since ESV undertook these enforcement actions, all three councils have responded to the satisfaction of ESV, despite the actions not always being implemented with an adequate sense of urgency. Where compliance was sought through means other than vegetation clearing (for instance, implementing an engineering solution), ESV has required that compliance plans are put in place and that these are supported by suitable risk management methodologies.

The following three municipal councils had compliance plans put in place during the 2018-2019 period:

- City of Boroondara
- City of Melbourne
- City of Manningham.

### 7.3.4 Consultation and education

Electric line clearance has been a long-standing responsibility of organisations such as, but not limited to, municipal councils, Melbourne Water, Yarra Trams and Defence Estates Victoria. 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:

- responsibility for oversight set at a level 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 access constraints.

In the 2018-2019 period, ESV continued to disseminate educational information to help the regulated entities better understand their electric line clearance responsibilities. This material interpreted aspects of the regulations and advised on how to prepare a quality ELCMP.

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

## 7.4 Issues for attention

### 7.4.1 HBRA / LBRA classification by the CFA

The Electricity Safety (Electric Line Clearance) Regulations seek to mitigate electricity safety risks by excluding vegetation from a predetermined clearance space around electric lines. The required clearance space is prescribed within the Code of Practice for Electric Line Clearance (the Code), a schedule to the regulations.

The Code makes a distinction between the clearance spaces required in HBRA and LBRA, with the clearances required in HBRA being greater due to the increased bushfire threat in these areas. That said, bushfire risk also exists in certain areas of LBRA throughout Victoria.

The CFA is responsible for assigning LBRA and HBRA where it is the designated fire control authority. Historically, it performed cyclic reviews of these boundaries; however, this program lapsed in 2013. The boundaries have not been reviewed since then. As a result, areas exist where the assigned fire hazard rating no longer represents the prevailing conditions.

Urban development can result in areas currently defined as HBRA being subsequently classified as LBRA by the CFA.

Conversely, in areas where land use has changed, such as irrigated pasture reverting to dry land farming, the LBRA classification no longer represents the fire risks that exist and these areas would be better defined and managed as HBRA.

The former may result in higher levels of management being performed than are warranted. The latter can result in a greater exposure of the public to the risk of bushfire as the management standards used do not align with the risks that prevail.

While the review of fire hazard boundaries is outside of the immediate remit of ESV, we have engaged with the CFA and the distribution businesses and reinstated the cyclic reviews by the CFA with the work funded by the distribution businesses. In the future, this will be incorporated into the ESV levy to ensure ongoing funding for this program.

Commencing in July 2019, the first year of the review will target the Powercor distribution network, including the area in northern Victoria discussed in Section 7.2.1.

#### 7.4.2 Council vegetation management contractor

In April 2019, ESV was notified by the cities of Glen Eira, Stonnington and Boroondara that their vegetation management contractor (the same contractor for each) had announced it would no longer service the three vegetation management contracts.

Having no vegetation management contractor in place for any extended period of time would greatly affect the ability of these municipal councils to meet their electric line clearance obligations and comply with the Code.

Not being able to comply with the Code may greatly affect electricity safety, particularly the reliability of electricity supply in these areas. For this reason ESV required each of these organisations to inform ESV of the impacts to their electric line clearance programs and how they will meet their compliance obligations.

The cities of Glen Eira and Stonnington were able to appoint a new vegetation management contractor in a short period of time. As a result, their clearing programmes were not significantly affected. ESV was satisfied the actions of the defaulting contractor had no material impact on the electricity safety standards in these municipalities.

The City of Boroondara has not been able to provide such an assurance to ESV and is yet to secure a vegetation management contractor to perform electric line clearance on its behalf. ESV has commenced an inspection of this municipality to better inform itself of any electricity safety risk that may exist.



# Appendix A : ESV regulatory program

## A1 Statutory plans

### A1.1 Electric Line Clearance Management Plans

All major electricity companies are required to submit an Electric Line Clearance Management Plan (ELCMP) to ESV by 31 March each year. Councils and other responsible parties are required to have updated their plans by 31 March, but there is no requirement to submit these plans to ESV unless requested to do so.

The numbers of ELCMPs received and approved by ESV each year are shown in Figure 22.

Historically ESV has struggled to process ELCMPs for councils and other responsible parties, and has had to focus on ensuring the ELCMPs for the major electricity companies are approved in a timely manner each year.

In this, ESV sought to deploy its limited resources to those businesses that had the largest clearance responsibilities and posed the greatest risk.

External resources were contracted to help the review of progress council plans in 2015-2016, with this work largely finalised in 2016-2017 when the first of the additional Line Clearance Assurances resources were appointed in 2016-2017.

While a lower risk, councils and other responsible parties pose two challenges for resourcing:

- the volume of material to be reviewed relative to the amount of line requiring clearance
- the additional effort required to ensure the adequacy of the plans due, in part, to the additional effort to educate these parties on their line clearance responsibilities and the levels of compliance expected by ESV.

With the additional resourcing in the Line Clearance Assurance team (see Section 3.3), the numbers of ELCMPs approved for councils and other responsible parties has increased in 2017-2018 and 2018-2019 to keep pace with the numbers received.

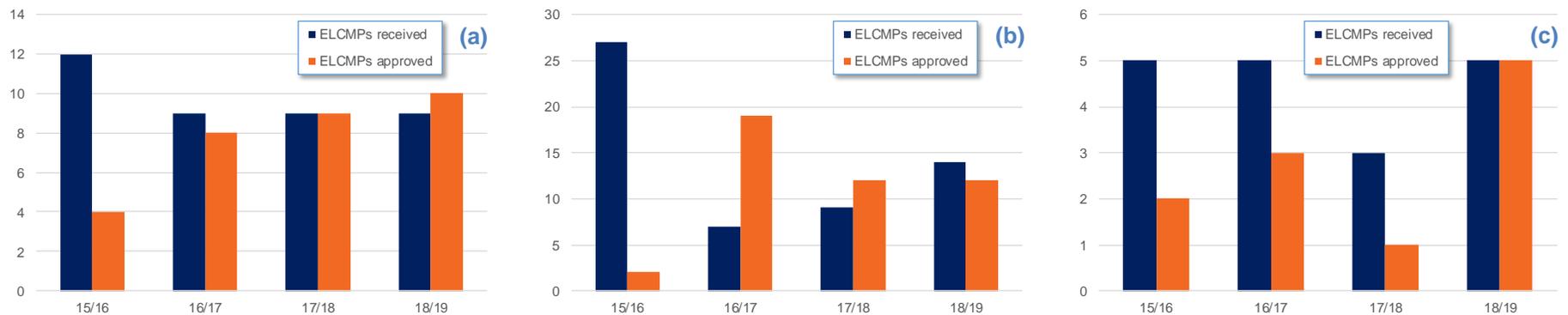


Figure 22 ELCMPs received and approved for (a) major electricity companies, (b) councils and (c) other responsible parties

### A1.2 Bushfire Mitigation Plans

All major electricity companies are required to submit a Bushfire Mitigation Plan (BMP) to ESV for acceptance every five years or after any changes to the regulations or company practices.

The numbers of BMPs received and approved by ESV each year are shown in Figure 23.

ESV has ensured that any BMPs received are reviewed and accepted promptly.

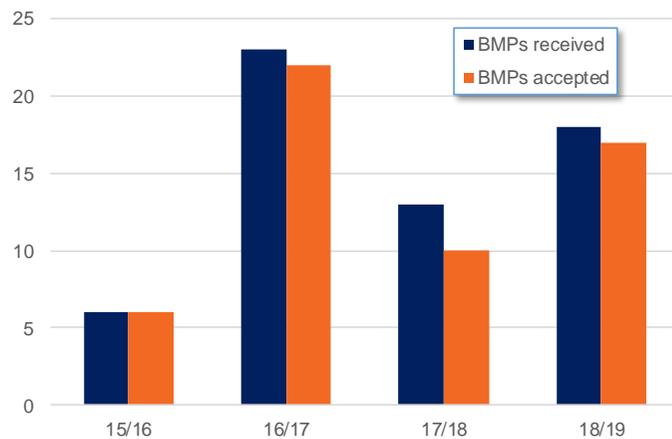


Figure 23 Bushfire Mitigation Plans received and accepted

### A1.3 ESMSs and safety cases

All major electricity companies are required to submit an Electricity Safety Management Scheme (ESMS) to ESV for acceptance every five years or after any changes to the regulations or company practices.

In 2015-2016, ESV introduced the requirement to produce a safety case for acceptance by ESV prior to production of the ESMS. These documents would provide additional background on the risk assessment processes underpinning the ESMS, and demonstrate the ability of the businesses to articulate and manage the breadth of safety risks they faced.

The large numbers of documents received in 2015-2016 and 2016-2017 reflects the numbers of iterations required to develop acceptable safety cases under the new regime. The higher number of acceptances to documents received shows that, after much effort, much of the work to implement the safety case/ESMS regime has been completed.

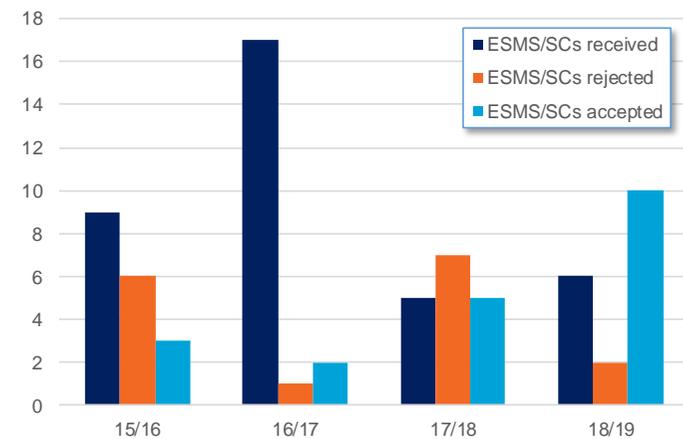


Figure 24 ESMSs and safety cases received and accepted

## A2 Exemptions

In 2018-2019, ESV received 23 requests for exemptions from the distribution businesses related to commitments in their Bushfire Mitigation Plans. Of these, eight were received from AusNet Services and fifteen were received from Powercor; all related to the supply of high-voltage customers from REFCL-protected substations.

With exemptions related to the REFCL program, the Governor in Council approves the exemption under section 120W of the Act based on an evaluation and analysis by ESV. ESV then grants matching exemptions to the relevant parts of the regulations. Both exemptions are subject to conditions.

ESV evaluated all of the exemption requests, and all were approved by the Governor in Council (Act exemptions) and ESV (regulation exemptions) subject to conditions. These conditions were monitored by ESV to ensure compliance. Details of the requests can be found in Sections B4 and F4.

Non-network parties wishing to install electric lines on public lands need an exemption from section 46 of the *Electricity Safety Act 1998*. The exemption is granted under an Order In Council subject to meeting specific conditions outlined in section 47 of the Act. ESV is responsible for assessing applications to ensure the required conditions have been met.

The number of such applications has fallen dramatically from its peak in 2016-2017. The bulk of applications received in recent years relate to the installation of the National Broadband Network (NBN); the applications have therefore tapered off as much of the network backbone has now been rolled out.

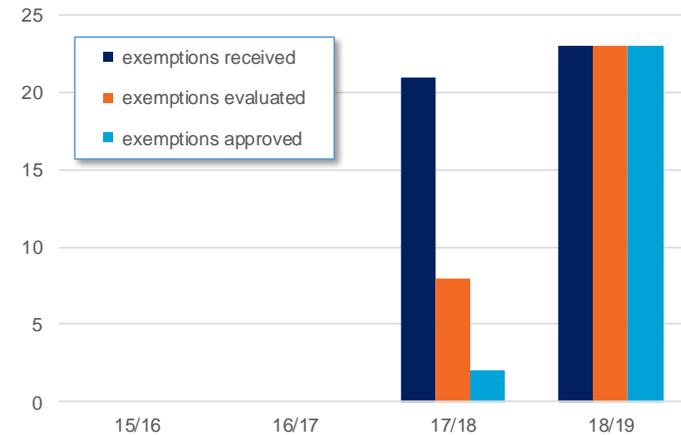


Figure 25 Bushfire Mitigation Plan exemptions

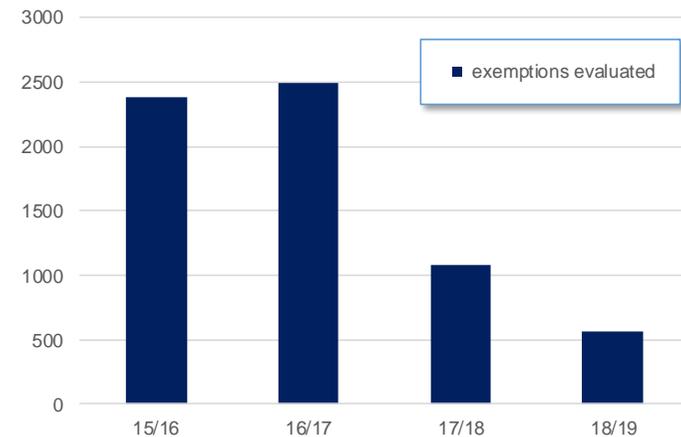


Figure 26 Electric lines on public lands exemptions

### A3 Audits, inspections and observations

This section provides details on the works undertaken by ESV in managing the audit and inspection program. Details of the individual audits can be found in Appendices B to I.

#### A3.1 Electric line clearance audits and inspections

Figure 27 shows the numbers of electric line clearance audits and inspections undertaken in the last four years. This clearly demonstrates the impact of the additional resources in the Line Clearance Assurance team.

While Figure 27(a) shows that the numbers of pre-summer audits have remained relatively stable over the last four years, these audits have been complemented by the unannounced inspections in 2017-2018 and 2018-2019 in Figure 27(b).

More significantly, the volume of spans inspected in these audits has increased from 2000-3000 spans in 2015-2016 and 2016-2017 to close to 18,000 spans in 2018-2019. This is a six-fold to nine-fold increase in the volumes inspected.

Our additional resources are providing ESV with much-enhanced oversight of the electricity networks. This, in turn, provides us with more information to ensure that the state's powerlines are maintained free of vegetation and, hence, a major bushfire risk is being managed properly.

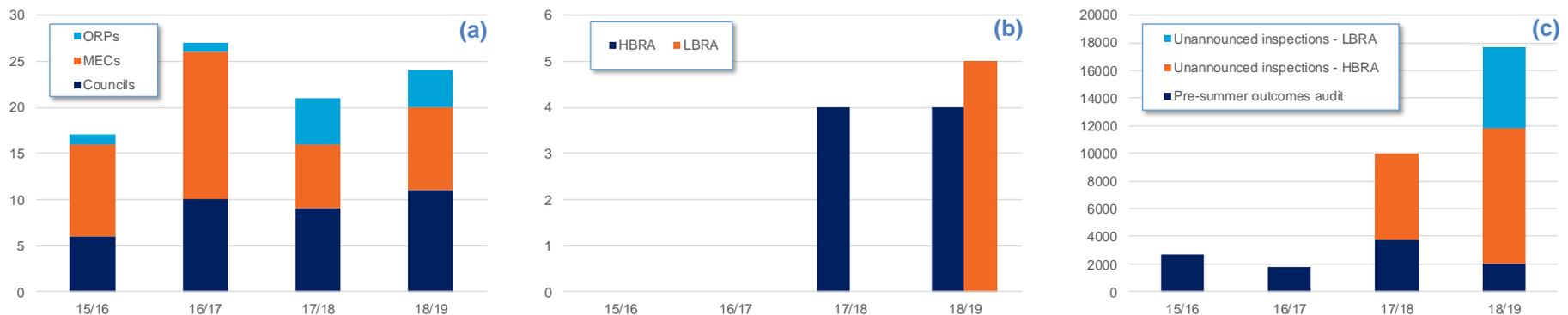


Figure 27 Electric line clearance audits and inspections showing (a) the number of pre-summer outcomes audits, (b) the number of unannounced inspections and (c) the volume of spans inspected during these audits and inspections

### A3.2 Bushfire mitigation audits

The major electricity companies and specified operators are required to have an ESV-accepted Bushfire Mitigation Plan in place. ESV regularly audits for compliance with the accepted plan.

Figure 28 shows the numbers of bushfire mitigation audits undertaken each year. Each of the nine major electricity companies is audited each year. The peak in 2017-2018 resulted from secondary pole audits of four of the distribution businesses due to stakeholder concerns.

While Figure 28 only identifies two audits of specified operators in the last four years. This is due to these businesses being regulated under multiple roles within the regulations. To reduce the regulatory burden on these businesses, ESV does not undertake separate bushfire mitigation audits but instead covers the elements of bushfire mitigation within broader audits of their specific installations.

### A3.3 Electricity Safety Management Scheme audits

Each of the nine major electricity companies are required to have an ESV-accepted Electricity Safety Management Schemes (ESMS) in place. ESV regularly audits for compliance with the accepted scheme.

Figure 29 shows the numbers of ESMS audits undertaken each year.

In 2015-2016, ESV introduced the requirement to produce a safety case as part of the ESMS acceptance process. Implementing this new regime extended into 2017-2018. Our efforts during this period were focused on implementing this new regime, so we chose to not undertake audits of already mature systems in 2015-2016 and 2016-2017.

The multiple audits of the electricity companies in 2018-2019 is due to the tail end of the validation audits of the new safety cases/ESMSs carrying into the start of the period, and routine ESMS audits occurring later in the period.

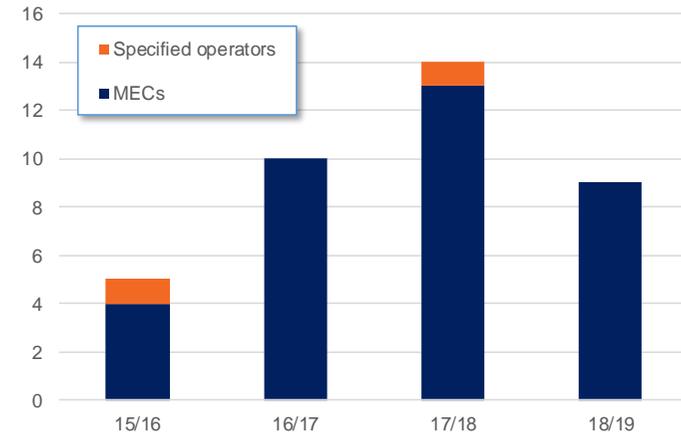


Figure 28 Numbers of bushfire mitigation audits

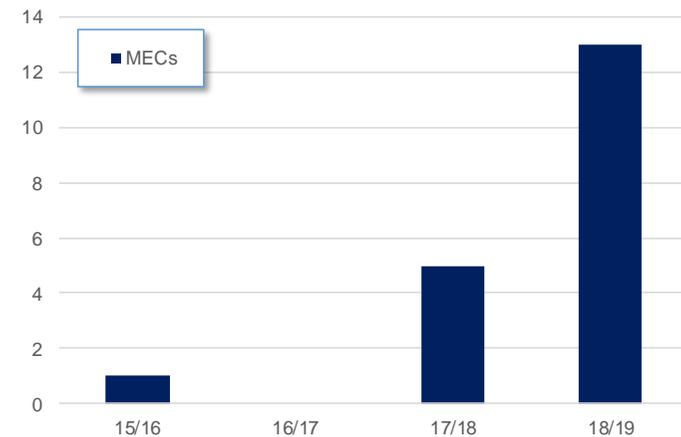


Figure 29 Numbers of ESMS audits

### A3.4 Works practice observations

Works practice observations provide key insights into the planning processes of the major electricity companies and their ability to deliver safe outcomes for the Victorian community. Any breakdowns in the process — be they inadequate job planning, lack of training and oversight, inappropriate/outdated processes or other faults — become evident when works in the field are monitored.

Figure 30 shows the number of works practice observations undertaken each year. ESV's two works practice advisors conducted a total of 23 field-based observations this year, interspersed with their education and consultation duties working with industry committees, urban and rural businesses, and other relevant organisations across the state.

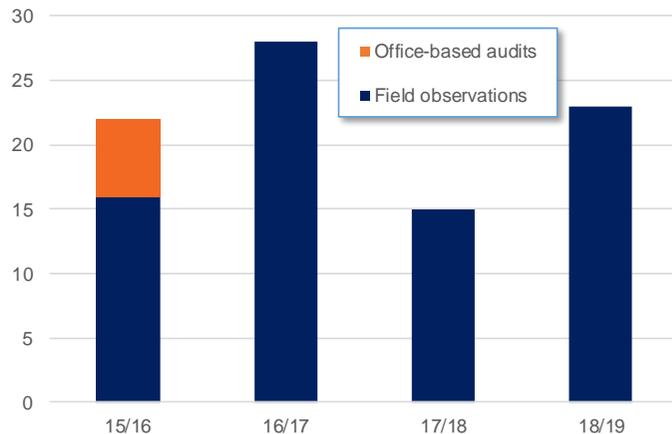


Figure 30 Numbers of works practice observations

### A4 Investigations

ESV undertakes assessment of all complaints or incidents raised with ESV. Detailed investigations are then undertaken when this assessment identifies that there is an egregious breach of the regulations or where multiple recurrences indicate systemic problems with how businesses and individuals are managing the safety risk for which they are responsible. These investigations are undertaken in sufficient detail to determine whether enforcement action is warranted and, if so, to support a successful outcome.

Figure 31 shows the numbers of new investigations opened each year and the number that have been completed. Given the level of detail required to support an enforcement action, many of these investigations may extend into subsequent years.

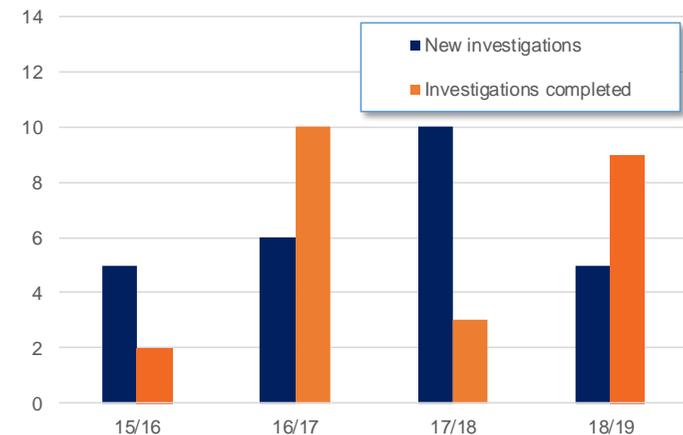


Figure 31 Numbers of new and completed investigations

## Appendix B : AusNet Services

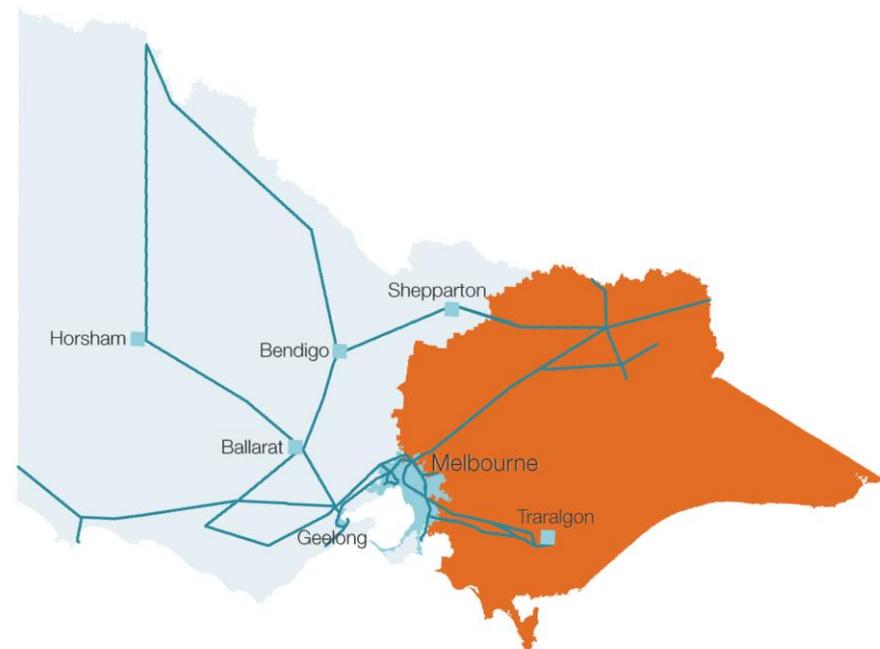
AusNet Services<sup>16</sup> has two shareholders with a significant investment and board representation, being Singapore Power (31.1 per cent) and State Grid of China (19.9 per cent). The remaining 49 per cent is publicly owned. The two major shareholders of AusNet Services also own 100 per cent ownership of Jemena and 34 per cent of 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 combines the two subsidiaries into a single entity for reporting purposes. Where the discussion relates to a specific area of the business, this is identified within the text.

AusNet Services is the only major electricity company in Victoria operating both transmission and distribution networks.<sup>17</sup>

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 6,560 km of transmission lines and 13,300 towers.

The distribution network covers an area of approximately 80,000 km<sup>2</sup>, and includes Melbourne's outer-eastern suburbs and runs north to the New South Wales border and south and east to the coast (Figure 32). It comprises approximately 38,200 km of overhead line, 6,900 km of underground cable, 334,400 power poles and 90,500 public lighting poles. Most of this network (93 per cent) is in rural areas.



**Figure 32 Service area for the AusNet Services distribution network (orange area) and transmission lines (dark blue)**

<sup>16</sup> AusNet Transmission Group Pty Ltd and AusNet Electricity Services Pty Ltd are the listed holders of the electricity transmission and distribution licences respectively.

<sup>17</sup> 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.

## B1 Plans and processes

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

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan; often revised plans have been accepted more frequently due to regular changes in the regulations or company practices
- Electric line clearance management plan by 31 March each year.

AusNet Services Distribution submitted its full safety case for assessment in July 2016, and ESV accepted this in December 2016. AusNet Services then submitted its draft Electricity Safety Management Scheme in May 2017 and, after assessment and validation, AusNet provided a final ESMS that ESV accepted in November 2018.

AusNet Services Transmission submitted its full safety case in July 2017, and after two iterations, the safety case was accepted by ESV in November 2018. Subsequent to the safety case acceptance, AusNet Services Transmission submitted an ESMS in November 2018 for review. ESV reviewed the draft ESMS in April 2019 and, after assessment and validation, AusNet submitted a final ESMS in August 2019. The final ESMS is under review for full acceptance by ESV.

AusNet Services submitted its transmission and distribution electric line clearance management plan to ESV in March 2019; the distribution ELCMP has been approved in advance of the fire danger period. ESV is currently working with AusNet Services to resolve a difference of opinion about the requirements of the transmission ELCMP. Until this is resolved, the existing ELCMP will continue to apply.

## B2 Directions

ESV has issued three directions to AusNet Services to:

- install armour rods and vibration dampers in highest risk areas within hazardous bushfire risk areas (HBRA) by 1 November 2015 and in remaining areas of HBRA 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 AusNet Services program for the installation of armour rods and vibration dampers is ahead of schedule with 87 per cent complete against a target of 66 per cent.

The direction to install spacers and spreaders was completed on time in both HBRA and LBRA.

AusNet Services was also directed to undertake sixteen projects for the Powerline Replacement Fund by 31 December 2015. All sixteen projects have been completed, with four delivered on schedule and 12 delivered late.

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. While some of the directions were delivered later than AusNet Services had originally proposed, they were completed ahead of the Commission's target date. ESV is satisfied with AusNet Services' progress in the delivery of these directions.

### B3 Bushfire mitigation regulations programs

To meet its bushfire mitigation obligations, AusNet Services plans to implement REFCL technology at 22 nominated zone substations in three delivery tranches.

By 30 April 2019, ESV had granted AusNet Services conditional acceptance for six zone substations<sup>18</sup> and granted a time extension for compliance for two zone substations<sup>19</sup>.

A number of technical issues are still to be solved, most of them involving equipment capabilities. Those issues are currently being addressed by Swedish Neutral.

AusNet Services is proposing to establish a new zone substation in the Kalkallo area, it is expected that the existing feeders supplied from the prescribed substation at Kalkallo will be transferred to the new zone substation. These feeders are mandated and, therefore, the new zone substation needs to be REFCL-capable by the date the feeders were mandated if they are to be transferred.

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.

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<sup>18</sup> Barnawartha (BWA), Kilmore South (KMS), Myrtleford (MYT), Rubicon-A (RUBA), Seymour (SMR), Wangaratta (WN).

<sup>19</sup> Kinglake (KLK) and Woori Yallock (WYK).

### B4 Exemptions

AusNet Services sought the following exemptions relating to the supply of HV customers from the following REFCL-protected substations:

- Barnawartha Nestlé Uncle Tobys and Woolworths
- Rubicon-A Pacific Hydro
- Wonthaggi Wonthaggi Wind Farm
- Wangaratta Australian Textile Mills and Pacific Hydro
- Seymour Puckapunyal Army Base (SMR1 and SMR 4)

ESV granted the exemptions on 7 November 2018, with four conditions of which one was that AusNet Services submit as-built documents to ESV within three months of the installation of each isolation transformer.

After AusNet Services submitted the required information, ESV completed the assessment of the compliance with the exemption conditions. In all the sites with the exception of Wonthaggi Wind Farm, AusNet Services satisfactorily installed the isolating transformers and ACRs as per the conditions of the exemption.

The installation of the isolating transformer for Wonthaggi Wind Farm has been postponed. AusNet Services has advised ESV that Wonthaggi will be delivered as part of Tranche 2.

## B5 Audit performance

### B5.1 Electricity Safety Management Scheme (ESMS)

As part of the process to establish an accepted ESMS, ESV undertook an extensive systems validation audit of the AusNet Services ESMS in March 2018. The validation audit found several areas in the ESMS that required further information and clarification. AusNet Services addressed all findings raised in the validation and produced a final acceptable ESMS.

During March 2019, ESV audited the AusNet Services Transmission and Distribution design and standards systems. ESV found that AusNet Services generally complied with the ESMS; however, there were three minor noncompliances and four areas that could be improved in the distribution system. The minor noncompliance findings were:

- a steel crossarm was installed that was not as per instructions
- a service was not replaced as per instructions
- a conical spring washer was not installed in accordance with AusNet Services standards.

During June 2019, ESV audited AusNet Services Transmission and Distribution on their asset management systems. Preliminary findings of the audit found that AusNet Services is compliant with the ESMS in asset management. ESV is reviewing evidence to finalise the audit.

### B5.2 Electric line clearance

#### Transmission and distribution network system audit

A system audit of the AusNet Services transmission and distribution networks was not conducted during the 2018-2019 period. The company's vegetation management systems, processes and procedures were tested through the ESMS validation process.

#### Distribution network outcomes audit

An electric line clearance outcomes audit of the AusNet Services distribution network was conducted in October 2018. The focus of the audit 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 370 randomly-selected spans in different HBRA regions of the network. A total of six noncompliant spans were identified, for a noncompliance rate of 1.6 per cent. ESV considered this noncompliance rate acceptable despite the slight increase from that observed in 2017-2018 (Figure 33).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of AusNet Services.

The inspection results indicate that, where AusNet Services is responsible for vegetation management, its processes and clearing activities are implemented according to its approved electric line clearance management plan.

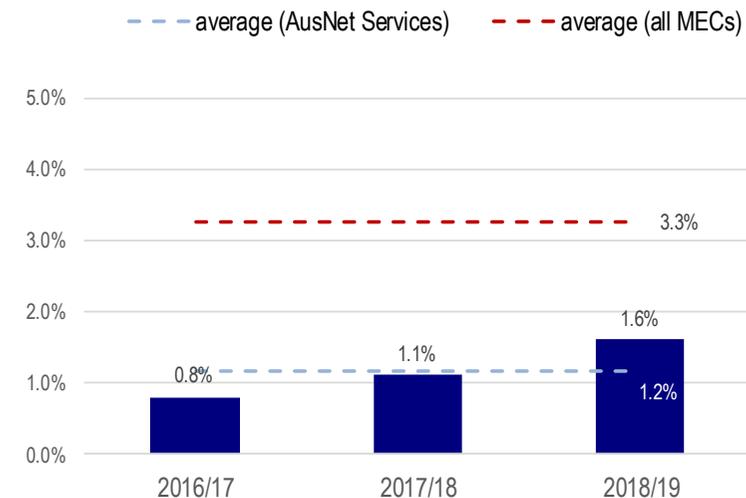


Figure 33 Noncompliance rates for AusNet Services Distribution

Overall the accuracy of the AusNet Services vegetation management data and the line clearance compliance standards was acceptable and compliant with the approved electric line clearance management plan.

No recommendations were made as a result of the audit.

#### Transmission network outcomes audit

An electric line clearance outcomes audit of the AusNet Services transmission network was conducted in October 2017, with the same focus as the audit of the distribution network.

A total of 472 electricity spans were inspected during the audit; all of the spans were located in HBRA. No noncompliant spans were identified, for a noncompliance rate of 0.0%. ESV considered this noncompliance rate to be very good given the decrease from that observed in 2017-2018 (Figure 34).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of AusNet Services.

The inspection results indicate that, where AusNet Services is responsible for vegetation management, its processes and clearing activities are implemented according to its approved electric line clearance management plan.

The electric line clearance outcome audit recommended that AusNet Services reviews the vegetation inspection coding on its database to ensure it accurately reflects that contained in its electric line clearance management plan.

AusNet Services provided an appropriate response to the recommendation made by ESV and acted to address this issue.

Overall the accuracy of the AusNet Services vegetation management data and the line clearance compliance standards was acceptable and compliant with the approved electric line clearance management plan.

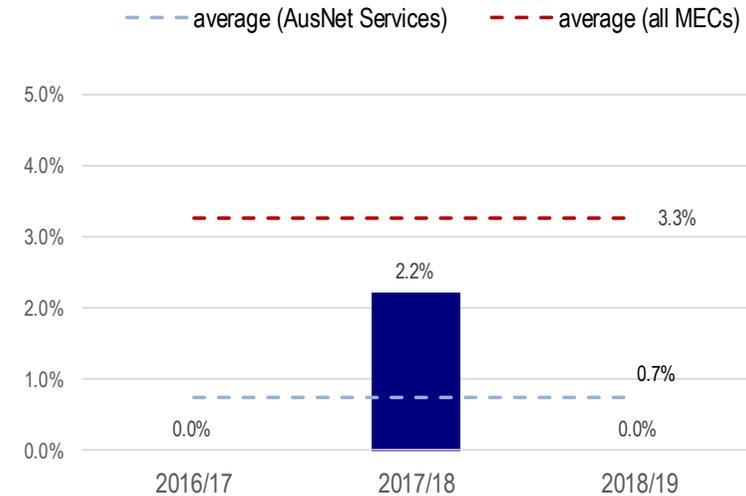


Figure 34 Noncompliance rates for AusNet Services Transmission

### B5.3 Bushfire mitigation

#### Transmission network

ESV inspected 53 towers on three transmission lines in the Ballarat, Terang and Heywood areas.

The inspections found no serious issues and eighteen minor issues, including missing and loose line hardware, birds' nests on towers, damaged signage and minor tower damage.

The visual inspection found the transmission assets to be generally in very good condition. The issues found were very minor in nature and would be repaired as part of routine maintenance. ESV recommended that AusNet Services ensures 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 Maffra, Bairnsdale, Woori Yallock, Officer and Belgrave areas. A total of 218 sites were inspected.

While the inspections found the data provided for the inspection matched the condition of assets in the field (with defect items accurately recorded and coded for action as required), 26 items were identified that were not recorded in the AusNet Services database. None of the new items were considered serious; they included:

- missing /disconnected spreaders
- deteriorated/damaged services
- one missing armour rod
- chipped insulators and bushings
- deteriorated/obsolete EDO tubes.

ESV recommended that AusNet Services rectify the issues found. ESV also recommended that AusNet Services continues 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 its system and assets.

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

#### B5.4 Work practices

In 2018-2019, ESV undertook eight observations of AusNet Services' work practices across eight sites. Four observations were on AusNet Services Transmission and four were on AusNet Services Distribution. One of the Distribution observations was an opportunistic observation. The findings of these observations were as follows:

• AusNet Services Distribution	
– noncompliances	0
– minor noncompliances	3
– opportunities for improvement	8
• AusNet Services Transmission	
– noncompliances	0
– minor noncompliances	2
– opportunities for improvement	9

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

- drop-zone management
- understanding and referencing of safe work method statements
- accuracy of information included on job safety assessments
- checking and use of appropriate personal protective equipment, tools and equipment
- operating and access permit issuing practices.

ESV recognised that AusNet Services has implemented an internal work practices observation program in line with ESV recommendations from previous years. ESV recommended that AusNet Services continues to develop its internal observation program to ensure its work practices specifically 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.

## B6 Safety indicators

Figure 35 shows the number of all serious electrical incidents reported to ESV by AusNet Services during the 2018-2019 period, with the data sorted from most frequent to least frequent (blue bars). Figure 36 shows the same for those incidents that result in a ground or vegetation fire. Both graphs also show the change in incident numbers from the 2010-2018 averages (orange bars).

The most common incidents on the AusNet Services network in 2018-2019 were HV fuse failures, other asset failures, connection faults and tree contact. The numbers of all incidents were lower in 2018-2019 than the long-term average, with the exception of other asset failures, animal contact and lightning strikes. Two of these three items are not within the control of the AusNet Services.

Tree contact, animal contact, connection failures and other asset failures were the most common causes of network-related fires. In all four instances, the numbers of fires in the period were higher than the long-term average. While the likelihoods of these incidents occurring have reduced, the proportions of these incidents that result in fires have increased.

Connections and other asset failure are within the control of AusNet Services to manage, and tree and animal contact was partially within its control.

Of the 70 ground fires on the AusNet Services network this year, 65 were smaller than 1,000 m<sup>2</sup> (93 per cent), five were between 1,000 m<sup>2</sup> and 10 hectares (7 per cent) and none were larger than 10 hectares. A further 87 fires were contained to the network assets and didn't result in a ground fire.

The high likelihood that a tree contact incident will result in a fire is of concern. Given the high tree density close to assets in the AusNet Services and Powercor regions,<sup>20</sup> there is a higher probability of trees growing into the clearance space, trees falling across powerlines from outside the clearance space or branches blowing onto powerline from outside the clearance space. Vegetation management is vital for minimising the bushfire risk from the network. In addition to its line clearance and asset management works, AusNet Services maintains a hazard tree removal program to identify and remove vegetation from outside the prescribed clearance space that may present increased risk to overhead powerlines. It is also progressively replacing bare overhead lines with insulated cables within the highest fire loss consequence areas (see Section 6.2.2).

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

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<sup>20</sup> Tree density across Victoria is shown in Appendix J.



Figure 35 Incidents on the AusNet Services network

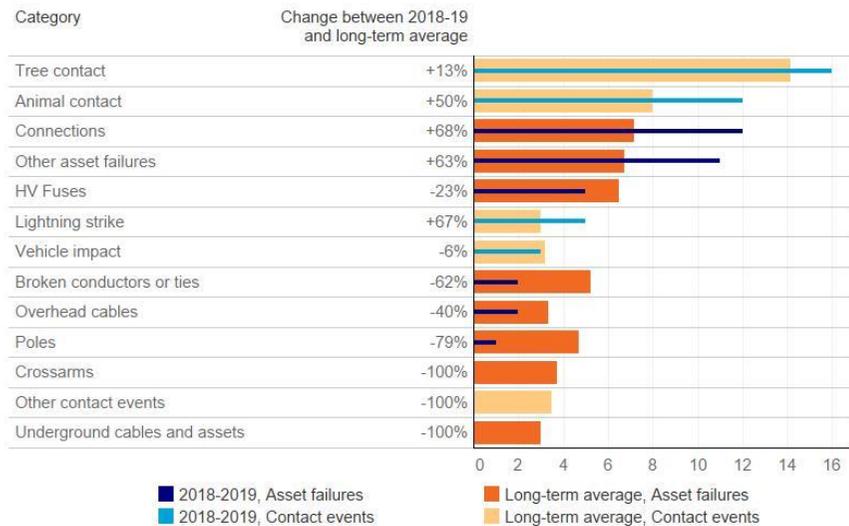


Figure 36 Incidents on the AusNet Services network resulting in ground fires

## Appendix C : Basslink

Basslink is owned by Keppel Infrastructure Trust, an entity listed on the Singapore stock exchange. Basslink 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 37). 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 37 Location of Basslink transmission assets (dark blue line)

## C1 Plans and processes

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

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan
- Electric line clearance management plan by 31 March each year.

Basslink submitted its full safety case to ESV in July 2017 and, after a detailed review, ESV accepted the full safety case in October 2018. Basslink provided an ESMS in March 2019 and ESV is currently reviewing the ESMS.

Basslink submitted its electric line clearance management plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## C2 Directions

ESV has not had cause to issue directions to Basslink.

## C3 Exemptions

Basslink has sought no exemptions from regulations.

## C4 Audit performance

### C4.1 Electricity Safety Management Scheme (ESMS)

As part of the process to establish an accepted ESMS, ESV carried out an extensive system validation of Basslink's ESMS during July 2019. Basslink is currently reviewing ESV's findings and will update the ESMS for ESV's final review.

### C4.2 Electric line clearance

An electric line clearance outcomes audit of the Basslink transmission network was conducted in October 2018. The focus of the audit was to validate the accuracy of its vegetation management data and obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at 58 randomly selected spans on the network easement, which exists entirely in HBRA. No noncompliant spans were identified, for a noncompliance rate of 0.0%. ESV considered this noncompliance rate to be excellent, particularly given this has been repeated three years in a row (Figure 38).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of Basslink.

The inspection results indicate that, where Basslink is responsible for vegetation management, its processes and clearing activities are implemented according to its approved electric line clearance management plan.

No recommendations were made as a result of the audit.

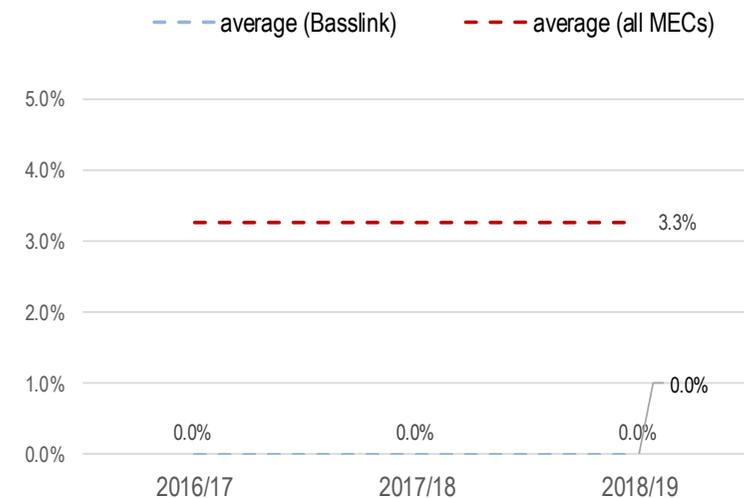


Figure 38 Noncompliance rates for Basslink

### C4.3 Bushfire mitigation

ESV inspected the 400kV DC powerlines running between the Loy Yang convertor station and the coastal transmission station. A total of 58 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 2017
- two items of minor maintenance were noted (a missing locknut and OPGW cables rubbing where they crossed each other) and Basslink will manage this via its maintenance management processes.

The inspection found the transmission assets to be generally in very good condition. 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.

### C4.4 Work practices

The Basslink transmission line is operational almost continually, with scheduled maintenance occurring every two years.

ESV did not conduct any observations of Basslink work practices this year as there was no planned work undertaken on the Basslink transmission line in the period.

## C5 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 concentrated in fewer, larger and better defined easements 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 2018-2019 period.



## Appendix D : CitiPower

CitiPower/Powercor<sup>21</sup> 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 has resulted in some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls. Of most relevance from a safety perspective was the introduction into United Energy of CitiPower/Powercor procedures for vegetation management.

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 D4.1) and the work practices observations audits (Section D4.3) 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 km<sup>2</sup>, and includes Melbourne's central business district and inner suburbs (Figure 39). It comprises approximately 2,560 km of overhead line, 2,670 km of underground cable, 49,000 power poles and 9,100 public lighting poles. Most of this network (75 per cent) is in the central business district.



**Figure 39 Service area for the CitiPower distribution network (orange area)**

Jemena and United Energy service boundaries are shown in orange

<sup>21</sup> CitiPower Pty Ltd is the listed holder of the electricity distribution licence.

## D1 Plans and processes

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

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan; often revised plans have been accepted more frequently due to regular changes in the regulations or company practices
- Electric line clearance management plan by 31 March each year.

CitiPower submitted its full safety case, incorporating feedback from the preliminary safety case assessment, to ESV in December 2016. After two further iterations, ESV accepted the full safety case in August 2017. CitiPower submitted an ESMS in November 2017 and, after assessment and validation, ESV accepted the ESMS in December 2018.

CitiPower also submitted its electric line clearance management plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## D2 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 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.

The installation of armour rods and vibration dampers in LBRA areas has been completed ahead of schedule.

Design for the installation of spreaders and spacers in LBRA areas has commenced, construction is due to commence in 2020 and the project is planned to be completed by 1 November 2020.

## D3 Exemptions

There are no outstanding exemptions applicable to CitiPower.

## D4 Audit performance

### D4.1 Electricity Safety Management Scheme (ESMS)

As part of the process to establish an accepted ESMS, ESV undertook an extensive systems validation audit on CitiPower's ESMS during March 2018. The validation audit found several areas in the ESMS that required further information and clarification. CitiPower worked with ESV to amend the ESMS to achieve a final acceptable ESMS in December 2018.

During November 2018, ESV audited the CitiPower/Powercor design and standards systems. ESV found that CitiPower complied with the ESMS. However there were two noncompliances, a minor noncompliance and seven areas that could be improved in their systems. The noncompliances and minor noncompliance findings were:

- an inability to confirm if emergency work is completed in line with their technical standards
- an inability to determine where they have phase to phase clearance issues
- an inability to confirm if work considered part of an opportunistic program is completed in line with their technical standards.

In May 2019, ESV audited the CitiPower/Powercor asset management systems. Preliminary findings of the audit found that CitiPower is compliant with the ESMS. ESV is reviewing evidence to finalise the audit.

## D4.2 Electric line clearance

### Network system audit

A system audit of the CitiPower distribution network was not conducted during the 2018-2019 period. The company's vegetation management systems, processes and procedures were tested through the ESMS validation process.

### Network outcomes audit

An electric line clearance outcomes audit of the CitiPower distribution network was conducted in September 2018. The focus of the inspection was to validate the accuracy of its vegetation management data and obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at 208 randomly selected spans, which are entirely in LBRA. A total of 53 noncompliant spans were identified, for a noncompliance rate of 25.5 per cent. ESV considered this noncompliance rate to be very poor, which is a significant increase from that observed in 2017-2018 (Figure 40).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of CitiPower.

The inspection results indicate that, where CitiPower is responsible for vegetation management, its processes and clearing activities are not implemented according to its approved electric line clearance management plan.

The electric line clearance outcome audit recommended that CitiPower:

- clears the noncompliant vegetation identified by ESV
- reviews and confirms appropriate actions are in place to clear vegetation inside the minimum clearance space
- reviews its vegetation management database and confirms noncompliant spans can be accurately identified
- confirms appropriate plans are in place to ensure vegetation in these remains clear of the minimum clearance space.

The vegetation management practices of CitiPower were the subject of ESV investigation throughout the 2018-2019 period, including an independent audit of its vegetation management processes and systems as part of the review ESV required of United Energy's clearance practices (see Section 7.2.2).

The recommendations identified through the ESV outcomes audit were addressed through the independent audit. ESV is monitoring the implementation of the independent audit recommendations through its reporting, audit and inspection regimes.

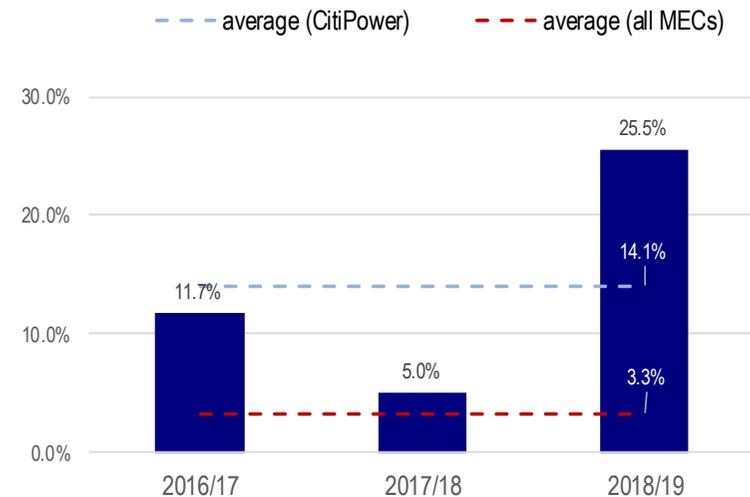


Figure 40 Noncompliance rates for CitiPower

### D4.3 Work practices

In 2018-2019, ESV undertook two observations of CitiPower work practices across six sites. The findings of these observations were:

- noncompliances 5
- minor noncompliances 6
- opportunities for improvement 4

These findings were consistent with some those of previous observations, where the key areas of concern related to:

- checking and use of appropriate personal protective equipment, tools and other equipment
- operating and access permit issuing practices
- quality of job safety assessments
- job planning.

Of particular note was:

- the lack of appropriate information on an Electrical Access Permit (EAP) resulting in many breaches of the Green Book
- failure to complete JSAs
- lack of adequate job planning.

ESV recommended CitiPower's work practices specifically focus on ensuring all workers:

- comply with the Green Book in all instances
- have a detailed understanding of the job safety assessment process and know the contents of relevant safe work method statements
- 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.

### D5 Safety indicators

Figure 41 shows the number of all serious electrical incidents reported to ESV by CitiPower during the 2018-2019 period, with the data sorted from most frequent to least frequent (blue bars). Figure 42 shows the same for those incidents that result in a ground or vegetation fire. Both graphs also show the change in incident numbers from the 2010-2018 averages (orange bars).

The most common incidents on the CitiPower network in 2018-2019 were other contact events, connection faults, dug-up cables and vehicle impacts. Apart from connection faults, all these items are not within the control of the CitiPower. The numbers of incidents were higher in 2018-2019 than the long-term average in six categories, and lower in eight categories.

Connection faults and tree contact were the cause of all ground fires on the CitiPower network this year. The numbers of both were higher than the long-term average.

Of the five ground fires on the CitiPower network this year, all five were smaller than 1,000 m<sup>2</sup> (100 per cent); none were larger than 1000 m<sup>2</sup>. A further seven fires were contained to the network assets and didn't result in a ground fire.

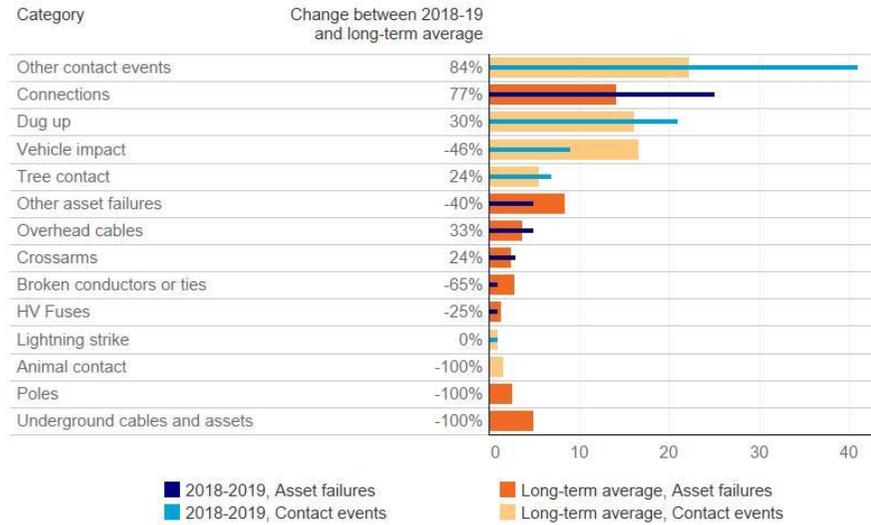


Figure 41 Incidents on the CitiPower network

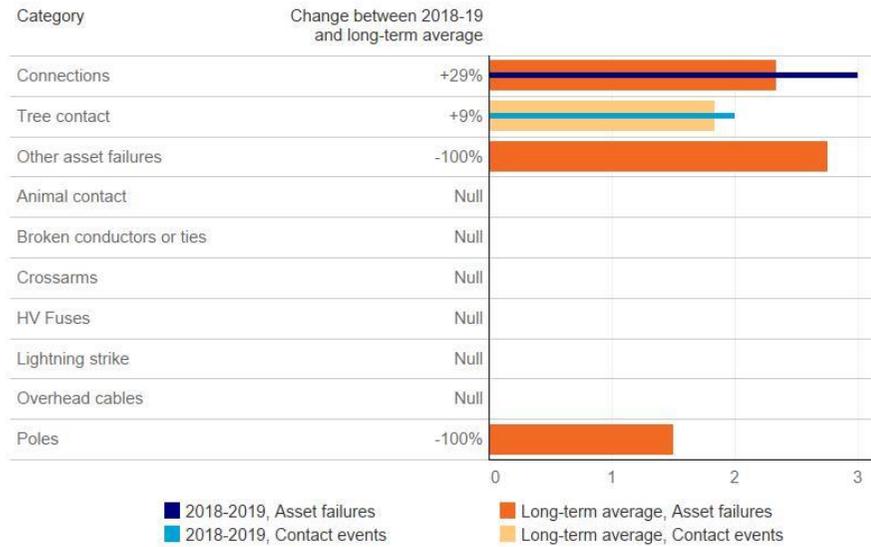


Figure 42 Incidents on the CitiPower network resulting in ground fires



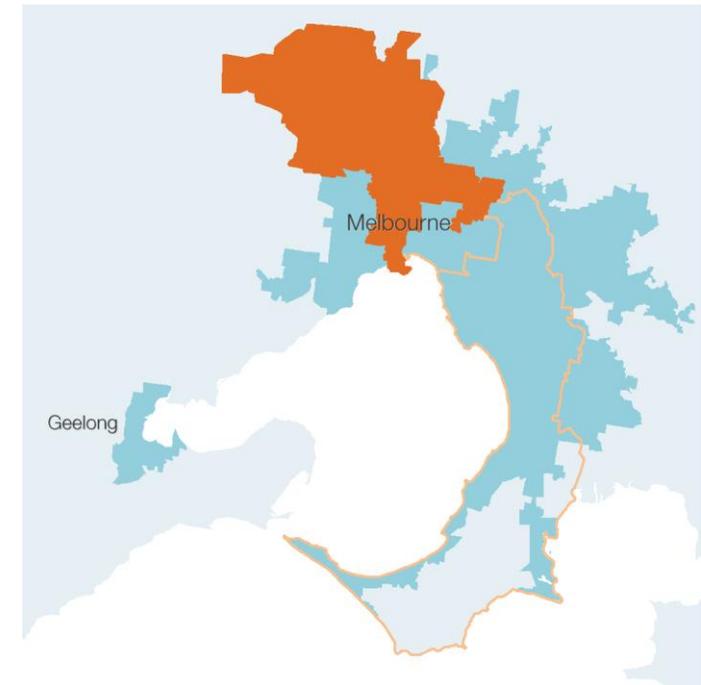
## Appendix E : Jemena

Jemena<sup>22</sup> 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 51 per cent of AusNet Services.

The Jemena AC distribution network covers any area of approximately 950 km<sup>2</sup>, across Melbourne's northern and western suburbs, including Melbourne International Airport (Figure 43). It comprises approximately 4,500 km of overhead line, 2,080 km of underground cable, 91,400 power poles and 26,800 public lighting poles. Most of this network (74 per cent) is in urban areas.



**Figure 43 Service area for the Jemena distribution network (orange area)**

CitiPower and United Energy service boundaries are shown in orange

<sup>22</sup> Jemena Electricity Networks (Vic) Ltd is the listed holder of the electricity distribution licence.

## E1 Plans and processes

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

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan; often revised plans have been accepted more frequently due to regular changes in the regulations or company practices
- Electric line clearance management plan by 31 March each year.

Jemena submitted its full safety case to ESV in March 2017, and ESV accepted the full safety case in January 2018. Jemena submitted an ESMS to ESV in January 2018 and, after assessment and validation, ESV accepted the ESMS in June 2019.

Jemena also submitted its electric line clearance management plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## E2 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 in HBRA 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 in HBRA 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, with retrofitting of vibration dampers and armour rods over two years — 135 spans in 2019 and 136 spans in 2020. As of June 2019, Jemena has yet to report on progress towards completion.

## E3 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 is yet to commence.

Jemena is proposing to establish a new zone substation at Craigieburn to accommodate load growth. It is expected that the existing Jemena feeders supplied from AusNet Services' prescribed substation at Kalkallo will be transferred to Craigieburn. These feeders are mandated and, therefore, the Craigieburn substation needs to be REFCL-capable by the date the feeders were mandated if they are to be transferred. AusNet Services and Jemena are working collaboratively to ensure the required capacity is achieved on these feeders by the time that AusNet Services is due to deliver the required capacity for the Kalkallo zone substation. While the Craigieburn substation has been deferred beyond 2020, it may need to be brought forward due to Jemena's bushfire mitigation obligations.

## E4 Exemptions

There are no exemptions currently applicable to Jemena.

## E5 Audit performance

### E5.1 Electricity Safety Management Scheme (ESMS)

As part of the process to establish an accepted ESMS, ESV undertook an extensive systems validation audit on the Jemena ESMS in June 2018. The validation audit found several areas in the ESMS that required further information and clarification. Jemena worked with ESV to amend the ESMS to achieve a final acceptable ESMS in June 2019.

In November 2018, ESV audited the Jemena design and standards systems. ESV found that Jemena complied with the ESMS. ESV did not find any noncompliance and recommended eight areas that could be improved in their systems.

In June 2019, ESV audited the Jemena asset management systems. ESV found that Jemena is compliant to the ESMS with only a single minor noncompliance.

### E5.2 Electric line clearance

#### Network system audit

A system audit of the Jemena distribution network was not conducted during the 2018-2019 period. The company's vegetation management systems, processes and procedures were tested through the ESMS validation process.

#### Network outcomes audit

An electric line clearance outcomes audit of the Jemena distribution network was conducted in October 2018. The focus of the inspection was to validate the accuracy of its vegetation management data and obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at 239 randomly-selected spans; all of the spans were located in HBRA. A total of six noncompliant spans were identified, for a noncompliance rate of 2.5 per cent. ESV considered this noncompliance rate to be acceptable despite the increase from that observed in 2017-2018 (Figure 44).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of Jemena.

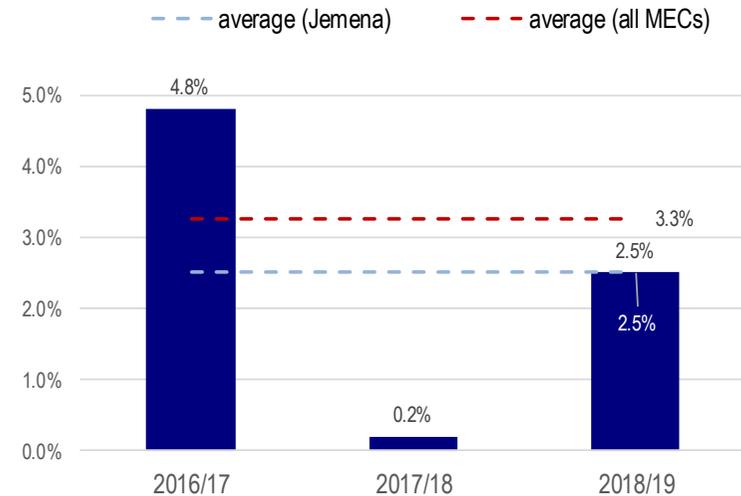


Figure 44 Noncompliance rates for Jemena

The inspection results indicate that, where Jemena is responsible for vegetation management, its processes and clearing activities are implemented according to its approved electric line clearance management plan.

The electric line clearance outcome audit recommended that Jemena:

- clears the noncompliant vegetation identified by ESV
- ensures its vegetation assessment processes are making adequate allowances for sag and sway of conductors
- ensure its vegetation management systems ensure spans are cleared to maintain the minimum clearance space requirements
- review the definitions for assessment codes to ensure the definitions clearly reflect the applicable intention for HBRA.

Jemena provided an appropriate response to the recommendations made by ESV and acted to address these issues.

Overall the accuracy of the Jemena vegetation management data and the line clearance compliance standards was acceptable and compliant with the approved electric line clearance management plan.

### E5.3 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 Sunbury, Bulla, Diggers Rest and Campbellfield areas. Inspections were carried out at 158 sites randomly selected in these areas.

The inspection found five sites with defects and fifteen with observations for follow-up that were not shown in the Jemena records. The new defects included:

- two unacceptable Expulsion Drop Out fuses (EDOs) on concrete poles
- one deteriorated insulation on LV fuse box leads in HBRA
- one rusty HV tie in HBRA
- one LV bushing cover in HBRA that was not secure.

The observations were items that were past their completion dates or were recorded in Jemena's systems as having been completed.

### E5.4 Work practices

In 2018-2019, ESV undertook three observations of Jemena work practices on Jemena work crews. The findings of the observation were as follows:

- |                                 |   |
|---------------------------------|---|
| • noncompliances                | 1 |
| • minor noncompliances          | 8 |
| • opportunities for improvement | 4 |

These findings were consistent with those of previous observations, where the key area of concern related to checking and use of appropriate PPE, tools and equipment.

ESV recommended that Jemena's work practices specifically focus on ensuring:

- the actions of the safety observer and communications between the work crew and the safety observer
- all workers check the condition of equipment and tools prior to use
- all workers, including contractors, be involved in the on-site Job Safety Assessment process
- the work planning processes ensure that adequate pre-site job planning, including consultation with work crew leaders, and that the correct documentation is on-site.

## E6 Safety indicators

Figure 45 shows the number of all serious electrical incidents reported to ESV by Jemena during the 2018-2019 period, with the data sorted from most frequent to least frequent (blue bars). Figure 46 shows the same for those incidents that result in a ground or vegetation fire. Both graphs also show the change in incident numbers from the 2010-2018 averages (orange bars).

The most common incidents on the Jemena network in 2018-2019 were other contact events, connection faults, vehicle impacts and tree contact. Two of these items are within the control of the Jemena — connection faults and, to a degree, tree contact. The numbers of incidents were lower than

the long-term average in all categories apart from other contact events and dug-up cables.

Seven separate causes were responsible for the seven fires on the Jemena network this year. Six were lower than the long-term average and one was equal with the long-term average. Four of the causes were largely or partly within the control of the Jemena to manage. Jemena is to be commended for the reduction in fires on its network.

Of the seven ground fires on the Jemena network this year, all five were smaller than 10 m<sup>2</sup> (100 per cent); none were larger than 10 m<sup>2</sup>. A further twelve fires were contained to the network assets and did not result in a ground fire.



Figure 45 Incidents on the Jemena network



Figure 46 Incidents on the Jemena network resulting in ground fires



## Appendix F : Powercor

CitiPower/Powercor<sup>23</sup> 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 has resulted in some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls. Of most relevance from a safety perspective was the introduction into United Energy of CitiPower/Powercor procedures for vegetation management.

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 F5.1) and the work practices observations audits (Section F5.4) 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 km<sup>2</sup>, and includes Melbourne's Docklands Precinct, west from Williamstown to the South Australian border, north to the Murray and south to the coast (Figure 47). It comprises approximately 68,800 km of overhead line, 8,070 km of underground cable, 489,700 poles and 87,700 public lighting poles. Most of this network (92 per cent) is in rural areas.



Figure 47 Service area for the Powercor distribution network (orange area)

<sup>23</sup> Powercor Australia Ltd is the listed holder of the electricity distribution licence.

## F1 Plans and processes

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

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan; often revised plans have been accepted more frequently due to regular changes in the regulations or company practices
- Electric line clearance management plan by 31 March each year.

Powercor submitted its full safety case to ESV on 22 December 2016. After two further iterations, ESV accepted the full safety case in August 2017. Powercor submitted an ESMS in November 2017 and, after assessment and validation, ESV accepted the ESMS in December 2018.

Powercor also submitted its electric line clearance management plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## F2 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.

The installation of all armour rods and vibration dampers in HBRA was completed ahead of schedule, and the installation of spacers and spreaders in HBRA was completed on time.

The installation of armour rods and vibration dampers in LBRA areas has been completed ahead of schedule.

Design for the installation of spreaders and spacers in LBRA areas has commenced, construction is to commence in 2020 and the project is planned to be completed by 1 November 2020.

Powercor was directed to undertake 19 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) for acceptance as an ACR, and ESV reviewed the product and deemed that it met the requirements as an ACR under the regulation. Powercor plans to install 1062 FuseSavers on its network by 2020. This work is on schedule, with Powercor installing ACRs at 768 sites to date.

## F3 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.

By 30 April 2019 Powercor was granted by ESV conditional acceptance for seven zone substations.<sup>24</sup>

A number of technical issues are still to be solved, most of them involving equipment capabilities. Those issues are currently being addressed by Powercor with support from Swedish Neutral.

ESV continues its engagement with Powercor to understand and develop pragmatic solutions to the technical challenges being encountered that will provide the greatest bushfire risk reduction to Victorians.

<sup>24</sup> Camperdown (CDN), Castlemaine (CMN), Eaglehawk (EHK), Gisborne (GSB), Maryborough (MRO), Winchelsea (WIN) and Woodend (WND)

In relation to the SWER ACR program, Powercor experienced some delays at the beginning of 2018 due to procurement issues, but has since recovered the shortfall from the 2018 program in the first half of 2019 (Table 2). While this delayed delivery of the 2019 program, Powercor aims to be fully back on schedule by the end of October 2019.

**Table 2 Powercor ACR delivery progress**

ACR program	2016	2017	2018	2019	2020	Total
Planned delivery	117	265	265	265	150	1062
Actual installed	118	144	379	128	-	769

## F4 Exemptions

Powercor sought the following exemptions relating to the supply of HV customers from the following REFCL-protected substations within its network:

- Winchelsea two network underground cable sections
- Castlemaine Flowserve, George Western Foods and AGL Hydro
- Eaglehawk Bendigo Health, Coliban Water, Parmalat, Hoffman Engineering, Thales, Keech Castings and Motherson Elastomers
- Colac AKD Softwoods (three sites), Australian Lamb, Bulla, Regal Cream

ESV granted the exemptions on 7 November 2018, with four conditions of which one was that Powercor submit as-built documents to ESV within three months of the installation of each isolation transformer.

After Powercor submitted the required information, ESV completed the assessment of the compliance with the exemption conditions. ESV found that Powercor's exemption conditions were not being met. Powercor provided further details about the work in progress to meet the conditions, and ESV is currently monitoring their progress.

## F5 Audit performance

### F5.1 Electricity Safety Management Scheme (ESMS)

As part of the process to establish an accepted ESMS, ESV undertook an extensive systems validation audit on Powercor's ESMS in March 2018. The validation audit found several areas in the ESMS that required further information and clarification. Powercor worked with ESV to amend the ESMS and achieve a final acceptable ESMS in December 2018.

During November 2018, ESV audited the CitiPower/Powercor design and standards systems. ESV found that Powercor complied with the ESMS. However there were two noncompliances, a minor noncompliance and seven areas that could be improved in their systems. The noncompliances and minor noncompliance findings were:

- an inability to confirm if emergency work is completed in line with their technical standards
- an inability to determine where they have phase to phase clearance issues
- an inability to confirm if work considered part of an opportunistic program is completed in line with their technical standards.

In May 2019, ESV audited the CitiPower/Powercor asset management systems. Preliminary findings of the audit found that Powercor is compliant with the ESMS. ESV is reviewing evidence to finalise the audit.

### F5.2 Electric line clearance

#### Network system audit

A system audit of the Powercor distribution network was not conducted during the 2018-2019 period. The company's vegetation management systems, processes and procedures were tested through the ESMS validation process.

### Network outcomes audit

An electric line clearance outcomes audit of the Powercor distribution network was conducted in September 2018. The focus of the inspection was to validate the accuracy of its vegetation management data and obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at 467 randomly-selected spans in different HBRA regions of the network. A total of 27 noncompliant spans were identified, for a noncompliance rate of 5.8 per cent. ESV considered this noncompliance rate to be acceptable; however, this result warranted additional observation through the ESV HBRA inspection program. The rate indicated a significant increase from that observed in 2017-2018 (Figure 44).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of Powercor.

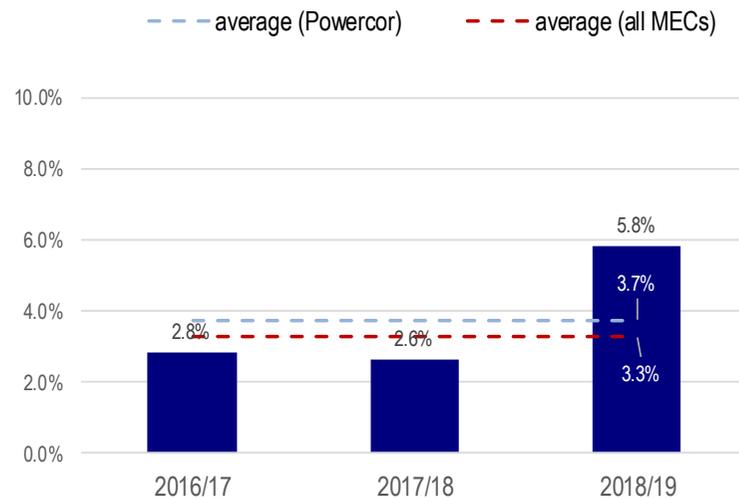


Figure 48 Noncompliance rates for Powercor

The inspection results indicate that, where Powercor is responsible for vegetation management, its processes and clearing activities are not always implemented according to its approved electric line clearance management plan.

The electric line clearance outcome audit recommended that Powercor:

- clears the noncompliant vegetation identified by ESV
- reviews its vegetation management data base to ensure it is maintained as current and up to date
- reviews how its systems account for unanticipated regrowth
- confirms appropriate actions are in place to clear and maintains the minimum clearance space for spans identified for clearing
- confirms the currency of information and that its vegetation management processes accurately record the data needed to enable effective management of vegetation in relation to the minimum clearance space.

The LBRA vegetation management practices of Powercor were the subject of ESV investigation throughout the 2018-2019 period. During the period, an independent audit of its vegetation management processes and systems was conducted as part of the review ESV required of United Energy's clearance practices (see Section 7.2.2).

The recommendations identified through the ESV outcomes audit were addressed through the independent audit. ESV is monitoring the implementation of the independent audit recommendations through its reporting, audit and inspection regimes.

### F5.3 Bushfire mitigation

The bushfire mitigation field inspection assessed compliance with legislation and internal business process with a focus on asset condition in the Cobden, Warrnambool, Koroit, Ararat and Stawell areas. Inspections were carried out at 274 sites randomly selected in these areas.

The inspection found thirteen sites with additional items that were not recorded in the Powercor asset inspection records.

Some of the additional items identified during the inspection included:

- a missing nut on an LV shackle
- a junction box cover coming away at the pole end
- two instances of broken strands on HV dead-ends
- a broken HV conductor tie
- a junction box coming away at the pole end.

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

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

#### F5.4 Work practices

In 2018-2019, ESV undertook four observations of Powercor's work crews across eight sites. The findings of these observations were as follows:

- |                                 |   |
|---------------------------------|---|
| • noncompliances                | 2 |
| • minor noncompliances          | 2 |
| • opportunities for improvement | 5 |

These findings were generally consistent with those of previous observations; however, this was the first time that ESV had observed a crew failing to apply earthing when working on overhead lines. The key areas of concern related to:

- failure to apply earthing and short circuiting when working on a HV overhead line
- management of the drop zone
- failure to identify all risks on the JSA
- failure of the work crew to completely understand the standards being applied.

ESV recommended that Powercor's work practices specifically focus on ensuring all workers (including contractors):

- ensure compliance with the Green Book at all times
- adequately manage the drop zone
- have a detailed understanding of the JSA process and know the contents of relevant Safe Work Method Statements
- fully understand the construction standards they are applying
- 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.

## F6 Safety indicators

Figure 49 shows the number of all serious electrical incidents reported to ESV by Powercor during the 2018-2019 period, with the data sorted from most frequent to least frequent (blue bars). Figure 50 shows the same for those incidents that result in a ground or vegetation fire. Both graphs also show the change in incident numbers from the 2010-2018 averages (orange bars).

The most common incidents on the Powercor network in 2018-2019 were other contact events, connection faults, crossarms and vehicle impacts. Two of these items are not within the control of the Powercor. The numbers of incidents were lower in 2018-2019 than the long-term average in six categories, stable in two categories and higher in six categories.

Connection faults, animal contact, tree contact and lightning strike were the most common causes of network-related fires. In two instances (connection faults and lightning strike), the numbers of fires in the period were higher than the long-term average. The numbers of fires this year across most of the other categories were also lower than the long-term average.

Three of the four most common fire-related incidents are within, or partially within, the control of Powercor, the exception being lightning strike (the fourth-most common event).

Given the recent problems that Powercor has had in maintaining clearances around its overhead powerlines (see Section 7.2.1), it is commendable that the numbers of tree contact events are stable against the long-term average and that fires from tree contact is lower this year than the long-term average.

Given the high tree density close to assets in the Powercor and AusNet Services regions,<sup>20</sup> there is a higher probability of trees growing into the clearance space or trees failing into or branches being blown in from outside the clearance space. Vegetation management is vital for minimising the bushfire risk from the network. Continued vigilance and implementation of programs under the amended bushfire mitigation regulations is needed to minimise opportunities for contact events to result in fires. Powercor needs to ensure that the recent issues in managing its electric line clearance responsibilities do not recur.

Of the 127 ground fires on the Powercor network this year, 105 were smaller than 1,000 m<sup>2</sup> (83 per cent), twenty were between 1,000 m<sup>2</sup> and 10 hectares (16 per cent) and two were larger than 10 hectares (1.6 per cent). A further 151 fires were contained to the network assets and didn't result in a ground fire.

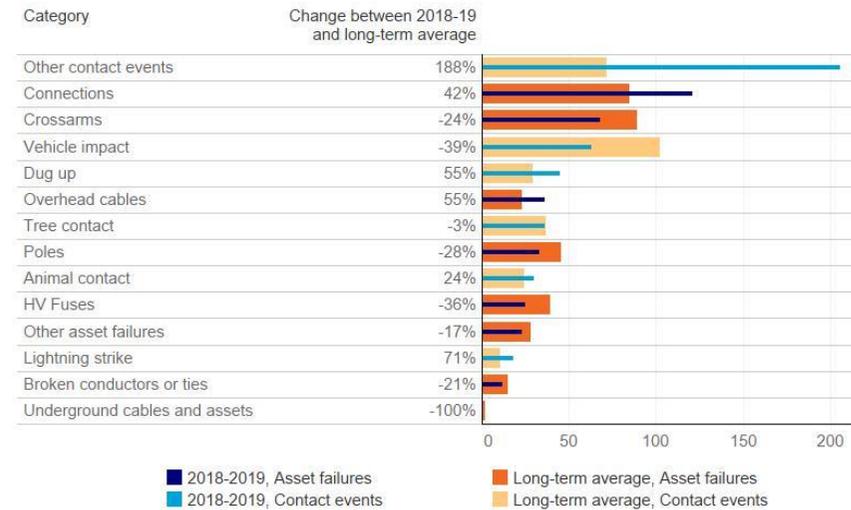


Figure 49 Incidents on the Powercor network



Figure 50 Incidents on the Powercor network resulting in ground fires

## Appendix G : Transmission Operations Australia

Transmission Operations (Australia)<sup>25</sup> (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 51). 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 51 Location of TOA transmission assets (orange square)

<sup>25</sup> Transmission Operations (Australia) Pty Ltd is the listed holder of the electricity transmission licence.

## G1 Plans and processes

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

- Electricity 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 bushfire mitigation plan
- Electric line clearance management plan by 31 March each year.

TOA submitted a joint TOA/TOA2 ESMS for review in May 2019. ESV is currently reviewing this joint ESMS.

TOA submitted its electric line clearance management plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## G2 Directions

ESV has not had cause to issue directions to TOA.

## G3 Exemptions

TOA has sought no exemptions from regulations.

## G4 Audit performance

### G4.1 Electricity Safety Management Scheme (ESMS)

As 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, ESV determined there is greater merit in deploying resources to audits of the other distribution and transmission ESMSs.

### G4.2 Electric line clearance

An electric line clearance outcomes audit of the TOA transmission network was conducted in October 2018. 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 96 randomly-selected spans in different HBRA regions of the network. A total of six noncompliant spans were identified, for a noncompliance rate of 6.4 per cent. ESV considered this noncompliance rate to be acceptable despite the increase from that observed in 2017-2018 (Figure 52). This position is partially informed by the large clearance distances that must be applied to trees to keep them clear of transmission lines.

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of TOA.

The inspection results indicate that, where TOA is responsible for vegetation management, its processes and clearing activities are not always implemented according to its approved electric line clearance management plan.

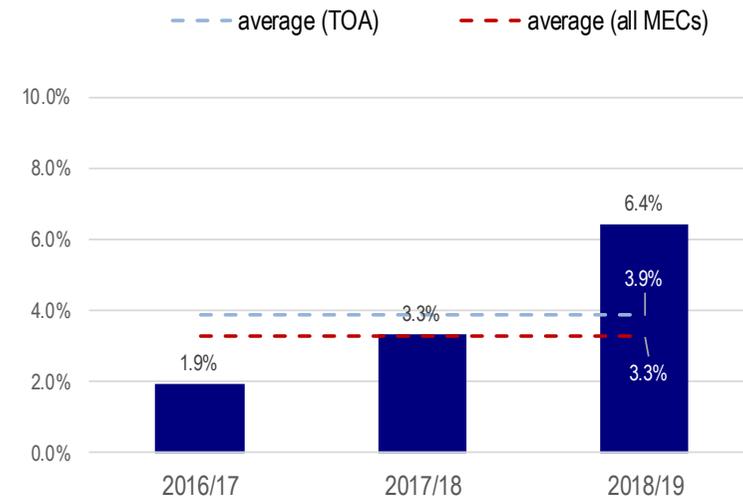


Figure 52 Noncompliance rates for TOA

The electric line clearance outcome audit recommended that TOA:

- clears the identified noncompliant spans
- reviews inspection codes to ensure its database accurately reflects the most current inspection data
- ensures assessment processes are accurately recording span clearances and appropriate allowances for regrowth are being applied.

TOA provided an appropriate response to the recommendation made by ESV and acted to address these issues.

Overall the accuracy of the TOA vegetation management data and the line clearance compliance standards was acceptable and compliant with the approved electric line clearance management plan.

#### **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 sites along 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). One maintenance items was 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.

#### **G4.4 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.

## **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 concentrated in fewer, larger and better defined easements 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 2018-2019 period.



## Appendix H : Transmission Operations Australia 2

Transmission Operations (Australia) 2<sup>26</sup> (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 53). 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 53 Location of TOA2 transmission assets (orange square)

<sup>26</sup> Transmission Operations (Australia) 2 Pty Ltd is the listed holder of the electricity transmission licence.

## H1 Plans and processes

TOA2 is scheduled to submit the following documents to ESV for review and acceptance/approval:

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan
- Electric line clearance management plan by 31 March each year.

While TOA2 was not due to resubmit its ESMS to ESV until June 2021, TOA2 submitted a joint TOA/TOA2 ESMS for review in May 2019. ESV is currently reviewing this joint ESMS.

An electric line clearance management plan is to be submitted by 31 March each year. TOA2 submitted its plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## H2 Directions

ESV has not had cause to issue directions to TOA2.

## H3 Exemptions

TOA2 has sought no exemptions from regulations.

## H4 Audit performance

### H4.1 Electricity Safety Management Scheme (ESMS)

As 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, ESV determined there is greater merit in deploying resources to audits of the other distribution and transmission ESMSs.

### H4.2 Electric line clearance

An electric line clearance outcomes audit of the TOA2 transmission network was conducted in October 2018. 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 69 randomly-selected spans in different HBRA regions of the network. No noncompliant spans were identified, for a noncompliance rate of 0.0 per cent. ESV considered this noncompliance rate to be excellent, and a decrease from that observed in 2017-2018 (Figure 54).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of TOA2.

The inspection results indicate that, where TOA2 is responsible for vegetation management, its processes and clearing activities are implemented according to its approved electric line clearance management plan.

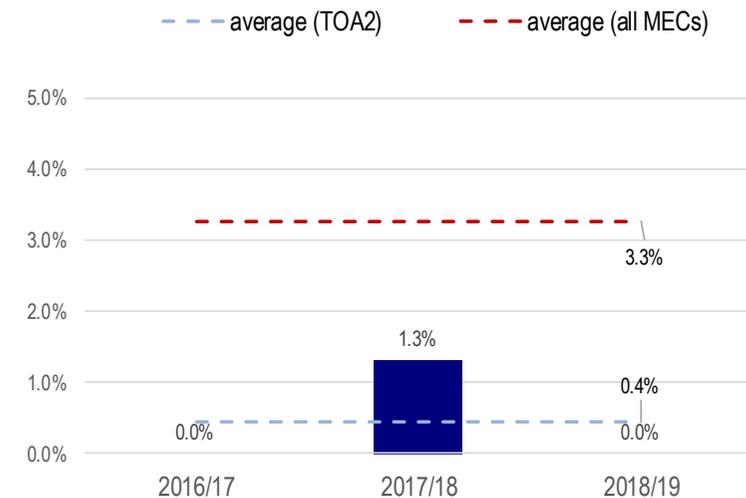


Figure 54 Noncompliance rates for TOA2

The electric line clearance outcome audit recommended that TOA:

- reviews inspection codes to ensure their database accurately reflects the most current inspection data
- reviews its database to ensure recorded span lengths are accurate.

TOA2 provided an appropriate response to the recommendation made by ESV and acted to address these issues.

Overall the accuracy of the TOA2 vegetation management data and the line clearance compliance standards was acceptable and compliant with the approved electric line clearance management plan.

#### H4.3 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 69 sites along 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). One line defect/maintenance item was identified.

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.

#### H4.4 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.

## H5 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 concentrated in fewer, larger and better defined easements 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 2018-2019 period.



## Appendix I : United Energy

United Energy<sup>27</sup> is jointly owned by Cheung Kong Infrastructure (66 per cent) and SGSP (Australia) Assets Pty Ltd (34 per cent).

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.

SGSP (Australia) Assets owns 100 per cent of Jemena. The two companies forming SGSP (Australia) Assets Pty Ltd also own 51 per cent of AusNet Services.

With Cheung Kong Infrastructure purchasing the DUET Group in May 2017 and gaining majority ownership of United Energy, there has been some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls. Of most relevance from a safety perspective was the introduction into United Energy of CitiPower/Powercor procedures for assessing vegetation clearance at height.

At the start of the 2017-2018 period, United Energy engaged EDI Downer and Zinfra as subcontractors to manage aspects of its operations and maintenance services. Towards the end of 2017, United Energy consolidated all these services with Zinfra. Any reference to United Energy within this section also encompasses EDI Downer and Zinfra operations on United Energy assets.

The distribution network covers an area of approximately 1,470 km<sup>2</sup> across Melbourne's eastern and south-eastern suburbs and the Mornington Peninsula (Figure 55). It comprises approximately 9,930 km of overhead line, 3,920 km of underground cable, 168,800 poles and 34,700 public lighting poles. Most of the network is urban and semi-rural (68%).



**Figure 55 Service area for the United Energy distribution network (orange area)**

Jemena and CitiPower service boundaries are shown in orange

<sup>27</sup> United Energy Distribution Pty Ltd is the listed holder of the electricity distribution licence.

## I1 Plans and processes

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

- Bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan; often revised plans have been accepted more frequently due to regular changes in the regulations or company practices
- Electric line clearance management plan by 31 March each year.

United Energy submitted its full safety case for assessment in July 2016. After two iterations, the full safety case was accepted by ESV in June 2017. An ESMS was submitted to ESV in June 2017 and, after assessment and validation, was accepted in December 2018.

United Energy submitted its electric line clearance management plan to ESV in March 2019, and the plan was approved in advance of the fire danger period.

## I2 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 HBRA directions on time and, in the case of the armour rods and vibration dampers direction, installed a greater number than originally estimated. As of June 2019, United Energy has yet to report on progress towards completion.

## I3 Bushfire mitigation regulations programs

### I3.1 Rapid Earth Fault Current Limiters

United Energy has no regulatory obligation under the amendments to the Electricity Safety (Bushfire Mitigation) Regulations 2013. Even so, United Energy has elected to install REFCLs at Frankston South, Mornington and Dromana.

The Frankston South REFCL was installed as part of a trial that assisted in the development of the amended regulations. It has been in service for several years at a reduced level of sensitivity. This REFCL is of an earlier model and United Energy has advised ESV of its intention to upgrade this REFCL following completion of the Mornington and Dromana installation program.

The Mornington REFCL is of a similar version as those being installed by AusNet Services and Powercor. Due to the size of the Mornington network, it is unlikely that the capacity specified in the regulations will be achieved; however, this REFCL is not mandated and the specification, therefore, does not apply. That said, United Energy is making its best endeavours to achieve the highest practicable performance and, thus, bushfire risk reduction. United Energy completed the installation of the Mornington REFCL in January 2019.

Having successfully completed the Mornington REFCL, design and procurement for the Dromana REFCL are underway.

## I4 Exemptions

There are no exemptions currently applicable to United Energy.

## 15 Audit performance

### 15.1 Electricity Safety Management Scheme (ESMS)

As part of the process to establish an accepted ESMS, ESV undertook an extensive systems validation audit of United Energy’s ESMS in April 2018. The validation audit found several areas in the ESMS that required further information and clarification. United Energy worked with ESV to amend the ESMS to achieve a final acceptable ESMS in December 2018.

During February 2019 ESV audited the United Energy design and standards systems. ESV found that United Energy generally complied with the ESMS; however, there was a minor noncompliance found and ten areas that could be improved in their systems. The minor noncompliance related to the installation of a crossarm that did not meet the United Energy technical standards.

### 15.2 Electric line clearance

#### Network system audit

A system audit of the United Energy distribution network was not conducted during the 2018-2019 period. The company’s vegetation management systems, processes and procedures were tested through the ESMS validation process.

#### Network outcomes audit

An electric line clearance outcomes audit of the United Energy distribution network was conducted in October 2018. The focus of the inspection was to validate the accuracy of its vegetation management data and obtain oversight of the electric line clearance standards being achieved.

Inspections occurred at 68 randomly-selected spans in different HBRA regions of the network. A total of three noncompliant spans were identified, for a noncompliance rate of 4.4 per cent (Figure 56).

This information relates specifically to noncompliant spans identified during the audit that were the management responsibility of United Energy.

The inspection results together with the independent audit (see below) indicate that, where United Energy is responsible for vegetation management, its processes and clearing activities are not always implemented according to its approved electric line clearance management plan.

The electric line clearance outcome audit recommended that United Energy:

- clears the noncompliant vegetation identified by ESV
- updates its vegetation management data to ensure it is accurate and current
- reviews inspection codes to ensure its database accurately reflects the most current inspection data.

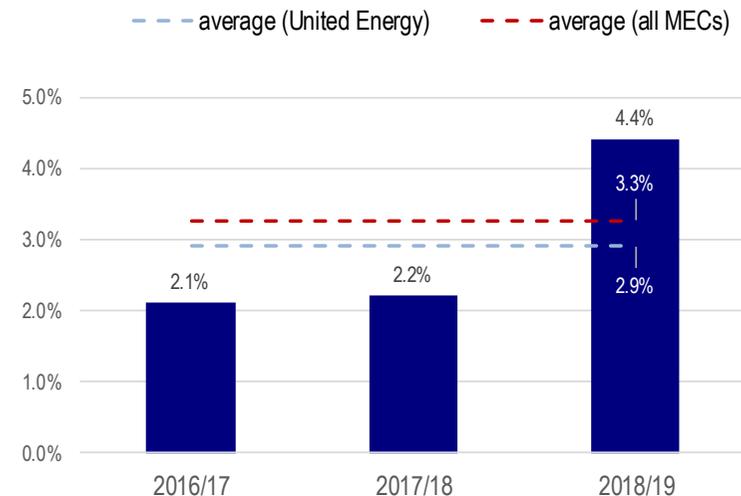


Figure 56 Noncompliance rates for United Energy

The LBRA vegetation management practices of United Energy were the subject of ESV investigation throughout the 2018-2019 period. During the period, ESV required United Energy to commission an independent audit of its vegetation management processes and systems (see Section 7.2.2).

The recommendations identified through the ESV outcomes audit were addressed through the independent audit. ESV is monitoring the implementation of the independent audit recommendations through its reporting, audit and inspection regimes.

### 15.3 Bushfire mitigation

The bushfire mitigation field inspection assessed compliance with legislation and internal business processes, with a focus on asset condition. Field audits were carried out on 122 poles across the United Energy network in the Frankston, Hastings and Mornington areas.

The field inspection found twelve items that were not recorded in the United Energy records system. Some of the higher priority items identified included:

- two sites with armour rods missing
- one site with a deteriorated crossarm
- three sites with loose LV insulator nuts
- three sites with missing hardware
- one site requiring animal proofing was recorded as complete but it wasn't
- two sites using incorrect hardware.

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.

The auditor recommended that United Energy review actions in relation to the additional maintenance items observed, determine whether any corrective actions were required and report the findings to ESV.

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

### 15.4 Work practices

In 2018-2019, ESV undertook three observations of United Energy work practices across three sites. The findings of these observations were as follows:

- |                                 |   |
|---------------------------------|---|
| • noncompliances                | 0 |
| • minor noncompliances          | 0 |
| • opportunities for improvement | 8 |

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

- covering LV conductors when applying HV Earth and Short Circuit
- proving equipment (LV tester) prior to use
- ensuring safety observers remain in place while people are working up a pole
- appropriate pre-site job planning to consider all variables
- traffic control not being applied when it is required.

ESV recommended United Energy's work practices specifically focus on ensuring:

- the work planning processes ensure adequate pre-job site planning, including consultation with work crew leaders
- ensuring all safety measures are correctly implemented during a job.

## 16 Safety indicators

Figure 57 shows the number of all serious electrical incidents reported to ESV by United Energy during the 2018-2019 period, with the data sorted from most frequent to least frequent (blue bars). Figure 58 shows the same for those incidents that result in a ground or vegetation fire. Both graphs also show the change in incident numbers from the 2010-2018 averages (orange bars).

The most common incidents on the United Energy network in 2018-2019 were connection faults, other contact events, tree contact and vehicle impacts. Two of these items are not within the control of the United Energy. The numbers of incidents were lower in 2018-2019 than the long-term average in four categories, stable in three categories and higher in seven categories.

Connection faults, vehicle impacts, broken conductors/ties and tree contact were the most common causes of network-related fires. Fires from connection faults and tree contact have reduced from the long-term average, whereas fires from vehicle impacts and broken conductors/ties have increased significantly (178 per cent and 23 per cent respectively). The numbers of fires this year across most of the other categories were also lower than the long-term average.

Two of the four most common fire-related incidents are within the control of United Energy (connections and broken conductors/ties). Vehicle impacts (the second-most common event) are largely outside the control of United Energy, and tree contact is partially within its control.

Of the 33 ground fires on the United Energy network this year, all were smaller than 1,000 m<sup>2</sup> (100 per cent); none were larger than 1000 m<sup>2</sup>. A further 69 fires were contained to the network assets and didn't result in a ground fire.



Figure 57 Incidents on the United Energy network



Figure 58 Incidents on the United Energy network resulting in ground fires



## Appendix J : 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.

