

2016 Safety Performance Report on Victorian Electricity Networks

30 September 2016

Preface

This year ESV has refreshed its Safety Performance Reports to improve the look and readability of the reports; to focus more on trends and actual measures of performance. While highlighting performance of the networks since our last safety report in 2014, this sixth Performance Report includes more discussion of emerging issues that will need to be addressed in future years. One important change has been to align the safety reports with the financial year so that a full fire season is addressed within a single report.

The past 18 months has been a busy period for ESV. It has seen significant improvements in how we regulate infrastructure safety and meet the challenges of the future.

We have developed and deployed our new web portal and now capture incident data online. This improves the accuracy and quality of reporting and streamlines the process. The data is now placed in our database where it can be accessed by, and shared with, the relevant major electricity companies for their own analysis and for comparison with other publicly-available data such as that from the Bureau of Meteorology. Continuous improvements will increasingly rely on using data better to measure and report on the detailed safety performance of the major electricity companies, their networks and constituent assets and equipment.

This year our analysis confirms the strong correlation between the weather and the propensity for electricity assets to start fires. While intuitively obvious, this analysis lends support to the need for a substantial intervention to weaken the effect of weather on asset failures and fires and, therefore, achieve a measurable step change in performance. This is particularly important in the face of continued climate change and the need to reduce the risk of catastrophic bushfire.

The amendments made by the Victorian Government to the Electricity Safety (Bushfire Mitigation) Regulations on 1 May 2016 are an important part of that intervention. These regulations now require the distribution businesses to further minimise the possibility of their assets starting bushfires consistent with the recommendations of the 2009 Victorian Bushfire Royal Commission. The affected businesses will deploy, in designated areas:

- ▶ covered conductor
- ▶ automatic circuit reclosers (ACR)
- ▶ rapid earth fault current limiters (REFCL).

The introduction of covered conductor is in progress and the deployment of ACR is well underway. The deployment of REFCL has the potential to deliver the step change in performance required to break the correlation between fire starts and the weather. Deployment of these technologies has commenced and will accelerate. The impact of these measures will become apparent through our reporting as these technologies are rolled out. These programs are mandated for completion by 2023.

The electricity network environment is set to change dramatically during the coming decade. The cost of rooftop solar power has been falling steadily over a number of years, and the cost of local power storage is falling rapidly and becoming commercially viable. Practical electric vehicles are now upon us. As economies of scale and technological development cause prices to fall further, the uptake of these technologies by the public is likely to increase rapidly, maybe exponentially. When this happens it is likely to have significant impacts and opportunities for electricity markets, power quality, the behaviour of electricity retailers and that of the electricity companies that we regulate as well as new entrants. While much focus and discussion relates to market regulation, there are likely to be significant implications for electrical safety,

as well as reliability and security of supply. This may take the form of increased stress on some electrical assets and potential redundancy of others. Changes to investment and maintenance practices in response to market transformation may result in further safety issues. The new electricity paradigm places active generation and storage in homes and downstream of the meter where the load has historically been passive.

ESV has begun to deliberate on how this paradigm shift may manifest across the networks and how this may change the behaviour of the players in the industry. This will better position ESV to ensure it is prepared for these changes with appropriate regulations developed in concert with the other regulatory bodies to minimise risk and ensure safety is front and centre as this new energy uptake accelerates.



Paul Fearon
Director of Energy Safety

Executive summary

This report addresses the 18-month period from January 2015 to June 2016. It reviews the performance of the major electricity companies and analyses their performance over time, while looking for common themes and issues the industry faces.

There have been no fatalities attributable to electrical infrastructure during the 18-month period covered by this report.

The significant El Niño event in 2015 was anticipated to result in an extreme 2015-2016 bushfire season. While fires attributable to network assets began to rise earlier than previous years, these also peaked early and did not result in the extreme season expected.

The major electricity companies are performing well and, while there is room for improvement, ESV has not observed evidence of systemic failure to operate or maintain the safety of their networks or to mitigate bushfire risk. This is evidenced by the high levels of compliance observed during our audits of the line clearance, bushfire mitigation and work practice activities of the companies. Across the 1347 spans audited in Hazardous Bushfire Risk Areas and 1323 spans in Low Bushfire Risk Areas, we observed compliance rates of 96.9 per cent and 92.9 per cent respectively. We also identified only four noncompliances in our works practice audits of the five distribution businesses.

The area of some concern has been in the delivery of the safety programs. With the exception of AusNet Services, the distribution businesses significantly under-delivered parts of their programs. This indicates there is either an issue with forecasting of volumes of work for future asset replacement or some businesses over-estimated their future replacement works during the AER economic review. In time ESV's decision to increase its oversight of asset management practices within the businesses will improve clarity on this issue.

During the last year we have required the major electricity companies to develop detailed safety cases that require them to clearly explain how they identify the safety risks associated with their operations and other activities. The safety cases also need to explain how the companies manage, in some detail, their operations and assets to reduce these risks to an acceptable level.

Each company is required to provide a safety case in advance of submitting its Electricity Safety Management Scheme for approval. To assist the companies understand ESV's expectations as to what constitutes a full and acceptable safety case, ESV has developed a range of guidance material and assessment tools. This new safety case regime underpins our increased emphasis on validating, testing and seeking confidence that their asset management and other business activities are appropriate and deliver the best safety outcomes for Victorians.

ESV has, with the distribution businesses, developed a near real-time fire-start and bushfire preparedness reporting mechanism to enable it to report fire starts, preparedness and trends for each business to the Minister each week during the fire season. This report is now included in the Minister's Statement of Expectations of ESV.

The Electrical Safety and Technical Regulation division has enhanced its data capture and analysis capability. The major electricity companies now report performance data through our new web portal. This ensures quality and consistent data can be rapidly captured making for more meaningful and reliable analysis.

Improved data capture is also allowing ESV to investigate the development of new techniques for measuring the comparative performance of the major electricity companies. A working group will be convened with the distribution businesses to explore this further with the objective of identifying further ways of improving performance. A Consultation Paper outlining the approach is available on the ESV website.

Overall, there were fewer incidents annually than in the previous period and these reductions are occurring in those areas where the major electricity companies can exert the most influence. While this is a positive outcome that indicates overall improved network management, it has been offset by an increase in the number of fires in all causal categories except for crossarms.¹ The weather in the 2015-2016 period may be the cause of this increase.

The two most common forms of incidents on the networks are now contacts with network assets; firstly vehicle impacts and secondly the group of third-party contact events that includes vandalism, copper theft and No Go Zone infringements. Both of these have increased significantly when compared to the average across the 2010-2014 period (by 71 per cent and 10 per cent respectively).

The two most common causes of fire starts on the networks are contact with trees and connection failures. This report does not distinguish between fires of different scales. Fires caused by tree contacts have increased by 10 per cent and those caused by connection failures by 79 per cent compared to the average for the 2010-2014 period. While the number of connection² failures has fallen, the average number of connection fires in 2015-2016 has increased relative to the 2010-2014 period. This is probably due to weather influences rather than systemic poor management by the industry.

ESV has conducted an analysis of fire starts across the State. As would be expected, this demonstrates a strong correlation between fire events and weather conditions. The analysis found weather to be a dominating feature affecting the number of fire incidents experienced on the networks. In order to substantially reduce the risks of any particular fire start from electricity leading to catastrophic bushfire a substantial change of approach is required to affect a change large enough to disrupt this correlation and reduce fire starts over the longer term. This is especially so in the light of climate change and the increasing volatility of the weather.



Ian Burgwin
General Manager
Electrical Safety and Technical Regulation

¹ The reduction in crossarm fires is predominantly attributable to the replacement of wooden crossarms with steel crossarms.

² Connections predominantly comprise low voltage equipment such as fuse boxes and service lines to properties.

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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 reports to the Victorian Parliament annually on the functions and programs that it administers.

ESV is committed to the safe, efficient supply and use of electricity and gas. This is the sixth year that ESV has reported on the safety performance of the Victorian electricity distribution businesses and the fifth 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 the AER safety programs monitored by ESV
- ▶ progress of directions placed on each distribution company to meet the recommendations of the 2009 Victorian Bushfires Royal Commission
- ▶ operation of each company's Electricity Safety Management Scheme
- ▶ results of audits conducted on 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, parliament and industry of how the major electricity companies have performed when delivering their electricity network safety obligations.

Previous reports have been based on a calendar year. This report shifts onto a financial year cycle to prevent breaking the report in the middle of the summer bushfire season. As a result, this report covers an 18-month period from 1 January 2015 to 30 June 2016.

1.2 Objective

The objective is to analyse the broad range of safety-related information that ESV acquired during 2015-2016 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 2015-2016. Some interannual trends are also discussed.

2 REGULATORY CONTEXT

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

2.1 Major electricity companies

2.1.1 Description

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

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

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

ESV has begun to explore techniques for analysing the comparative performance of the distribution businesses with a view to incorporating comparative analysis in the 2017 Safety Performance Report on Victorian Electricity Networks. The aim of this is not to produce a league table, but rather to better understand the differences between the businesses and identify other ways to improve performance. ESV will convene a working group to develop these analytical techniques, and a consultation paper on this topic is available on the ESV website.

2.1.2 Regulatory requirements

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

- ▶ Electrical Safety (Management) Regulations 2009

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

In this review cycle ESV introduced the requirement to also submit a Safety Case as background on the company's operations and to inform how risk is identified, assessed and mitigated within each business. The Safety Case provides valuable information on risk management to inform ESV's review and audit functions.

- ▶ Electricity Safety (Bushfire Mitigation) Regulations 2013

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

- ▶ Electricity Safety (Electric Lines Clearance) Regulations 2015

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

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

Table 1 Electricity network statistics

transmission companies	
AusNet Services	
Voltages:	500kV AC and 220kV AC transmission across Victoria ³ 66kV AC sub-transmission across Victoria 330kV AC on interconnector to New South Wales 275kV AC on interconnector to South Australia
Powerline length:	6574 km
No. of towers:	13,000 approx.
Basslink	
Voltages:	500kV AC and 400kV DC link between Loy Yang power station in south east Victoria and George Town in northern Tasmania
Powerline length:	67 km total in Victoria 3.2km of 500kV AC overhead line 57.4km of 400kV DC overhead line 6.6km of 400kV DC underground cable
No. of towers:	142
Transmission Operations Australia	
Voltages:	132kV from Mt Mercer wind farm to Elaine Terminal Station.
Powerline length:	22 km
No. of towers/poles:	162

distribution businesses	
AusNet Services	
Customers:	685,194 (90% residential)
Service area:	80,000 km ²
Powerline length:	41,000 km (85% rural, 13% underground)
No. of poles:	383,000 approx.
CitiPower	
Customers:	325,917 (85% residential)
Service area:	157 km ²
Powerline length:	3190 km (25% CBD, 30% underground)
No. of poles:	58,200 approx.
Jemena	
Customers:	318,429 (89% residential)
Service area:	950 km ²
Powerline length:	6250 km (86% urban, 29% underground)
No. of poles:	104,700 approx.
Powercor	
Customers:	765,241 (85% residential)
Service area:	145,651 km ²
Powerline length:	67,000 km (92% rural, 11% underground)
No. of poles:	562,000 approx.
United Energy	
Customers:	658,453 (90% residential)
Service area:	1472 km ²
Powerline length:	12,900 km (25% urban, 20% underground)
No. of poles:	204,300 approx.

³ AC = alternating current. DC = direct current, kV = kilo Volt (or 1000 Volt).

2.2 Responsible persons

2.2.1 Description

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

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

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

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

2.2.2 Regulatory requirements

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

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

2.3 ESV regulatory program

As part of its regulatory program ESV undertakes the following:

- ▶ mandatory safety plan reviews for each major electricity company
 - Safety cases
 - Electricity Safety Management Schemes
 - Bushfire Mitigation Plans
 - Electric Line Clearance Management Plans
- ▶ review of ELCMP for responsible persons (at ESV request)
- ▶ audits
 - planned audits of safety plan implementation
 - planned and opportunistic audits of works practices
 - vegetation clearance audits in spring to ascertain readiness for the summer bushfire season.
- ▶ safety incidents
 - tracking and analysis of reportable safety incidents
 - investigation of major safety incidents
- ▶ safety programs
 - monitoring the implementation of programs agreed with the Australian Energy Regulator by the distribution businesses
- ▶ 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 Safety programs

In the 2011-2015 Electricity Distribution Price Review, the Australian Energy Regulator (AER) approved capital expenditure allowances that comprised of maintenance programs and several accelerated replacement programs (safety programs).⁴ The rationale for these capital programs was the perceived need to accelerate replacement activity to ensure network safety.

Some safety programs are unique to each distribution business, while there are also common programs across all of the businesses. Common programs include crossarm replacement, conductor replacement, services replacement and pole replacements. Other programs that are more specific to each distribution business include the installation of ground fault neutralisers (GFN),⁵ the installation of backup protection schemes and fuse replacement programs.

As part of the 2011-2015 Electricity Distribution Price Review final determinations for each business, the AER requested that ESV monitor the safety programs to completion as they are primarily driven by safety considerations.⁶ Therefore for the period from 2011 to 2015, ESV oversaw and reported on delivery of the programs. These programs were due for completion by 31 December 2015.

While coincident with the 2009 Victoria Bushfires Royal Commission, the AER-approved safety programs explicitly did not consider the Commission findings. Instead it was determined that these would be addressed through other regulatory processes (see Section 2.3.2).

Some of the distribution businesses have nominated additional safety programs subsequent to the AER price review. ESV reports on these programs separately.

These programs do not apply to the transmission businesses.

2.3.2 Directions

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

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

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

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

⁴ *Victorian electricity distribution network service providers : Distribution determination 2011-2015*. Final decision and appendices. Australian Energy Regulator, October 2010.

⁵ Ground fault neutraliser is a brand name. More generically these are known as rapid earth fault current limiters (REFCL).

⁶ In its final determination paper, issued in October 2010 (Section P.4 pp.645-681), the AER stated that "Further, as safety considerations are the primary driver of the need for these projects in the forthcoming regulatory control period, ESV will monitor [Distribution Business name]'s completion of these works."

2.3.3 Exemptions

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

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

3 RISK MANAGEMENT AND GOVERNANCE

Since the 2014 Network Safety Performance Report, ESV has been developing a range of initiatives to improve its risk management and governance processes. The outcome of these processes will be improved oversight of the major electricity companies, councils and other responsible parties.

3.1 Safety cases

Part 10 of the Act mandates all major electricity companies have in place an accepted ESMS, and that a revised ESMS is to be submitted to ESV every five years for acceptance. Each major electricity company, with the exception of Transmission Operations Australia, is operating under an ESMS that was accepted by ESV in late 2010. These, therefore, now require resubmission to ESV for assessment and acceptance. Until a new ESMS is accepted by ESV, the existing ESMS continues to operate.

This resubmission process is currently underway. As part of the process and prior to submitting its ESMS, ESV has required each major electricity company to articulate its understanding of the risks it faces and the systems and controls it has brought to bear to safely manage those risks. Each major electricity company is now required to produce a detailed Safety Case to demonstrate an ability to manage the whole breadth of risks faced by the business in an easy to read, non-technical narrative.

Once the Safety Case is deemed acceptable by ESV, the major electricity company can submit an ESMS with references to the Safety Case and that further expands on the key elements of the Safety Case. The ESMS must take a risk-focused approach addressing the requirements detailed in all relevant electricity safety regulations and in Australian standard AS 5577: 2013. ESV anticipates that all ESMSs will have been accepted early in 2017.

3.2 Bushfire reporting

Before the start of the 2015 bushfire season, the Bureau of Meteorology was forecasting a higher than average likelihood of a hot summer in part attributed to the ongoing El Niño event. The Country Fire Authority was also advising that the Victorian bush had dried out and grassland had cured much earlier in the season than usual.

As a result of this perceived greater risk of bushfire, ESV requested that each distribution business report its current bushfire mitigation index.⁷ ESV then used this, and the incident data reported to its telephone monitoring system to compile a weekly report throughout the fire season.

The report identified:

- ▶ fire starts attributed to electrical assets (date, location, cause and area burnt)
- ▶ the bushfire mitigation index of each distribution business
- ▶ an explanation of any variation from the target figure of zero
- ▶ any significant issues or incidents of which ESV was aware.

The report was provided weekly to the Minister for Energy and Resources (now Minister for Energy, Environment and Climate Change). ESV will provide the report again for the 2016-2017 fire season. The provision of the report is now a requirement of the Minister's Statement of Expectations of ESV.

⁷ The index is a calculation that provides an indication of the bushfire preparedness of the easements being managed by a distribution business.

3.3 Vegetation clearance

ESV is responsible for the administration of the Electricity Safety (Electric Line Clearance) Regulations inclusive of the Code of Practice for Electric Line Clearance. The focus of the regulations and the code is to ensure vegetation is maintained clear of overhead electric lines and, thereby, the risk of bushfire from contact events is reduced. To this end, they require responsible persons to have in place appropriate standards and management practices for tree cutting or removal in the vicinity of electric lines.

Responsibilities for electric line clearance lie with the major electricity companies, municipal councils and other organisations that own and/or operate overhead electric lines.

Line clearance is a complex issue that invokes considerable stakeholder and community debate. Trees are living organisms and need to be constantly monitored to ensure safe clearance. They are also integral to a healthy environment and the amenity of the state. In some areas, this amenity can significantly add to property values and rates payable to councils. Line clearance can become controversial due to a perception that it can have a negative impact on tree condition and the benefits trees provide. Failing to comply with the regulations, however, may result in situations of extreme consequence, such as bushfire.

ESV has recognised the need to take a more strategic approach to the administration of the line clearance regulations. To this end, a new Line Clearance Assurance team has been created with a new manager and two new staff. These new positions will provide:

- ▶ additional subject matter expertise for the oversight of programs and review of plans
- ▶ improved stakeholder engagement and education
- ▶ greater flexibility to more effectively resource audits and investigations over the critical spring/summer period.

In-house experts may be supplemented with experienced external service providers to improve line clearance compliance rates and the dialogue with stakeholders about competing needs regarding amenity trees. It also allows us to enhance our oversight of councils and other responsible persons through more efficient and effective deployment of resources.

The efficiency and effectiveness of this new approach will be reviewed over the next twelve months.

3.4 Consistent delivery

In line with improving the standard of the plans, processes and practices of the parties it regulates, ESV has also turned the light on itself and sought to improve the consistency and transparency of its own performance. To this end, the Electrical Infrastructure Division (now part of ESV's new Electrical Safety and Technical Regulation Division) developed an Operations Manual that identifies the core functions of the Division and provides guidance to staff on how to deliver those functions consistently.

3.5 Data analytics

ESV has embarked on a process of improving its data analytics capabilities to better inform its understanding of risks across the Victorian electricity networks. This will allow ESV to target specific issues to improve the performance of the major electricity companies and to identify and better regulate poor performance.

The first stage of this process saw the roll-out of ESV's new OSIRIS web portal for the reporting of electrical incidents on 1 October 2015. While currently being used just by the major electricity companies, ESV may have other reporting organisations brought onto OSIRIS in coming years (for example, Metro Trains Melbourne and Yarra Trams).

Through OSIRIS, incident data is now collected in a consistent manner across all networks using common terminology. This, in turns, allows ESV to ensure a minimum level of mandatory information is provided on all incidents in a format that allows for statistical analysis and comparative benchmarking of performance.

The next stage about to be finalised is the data analysis engine Conduit that will provide a dashboard environment where standard analyses can be performed on near real-time data. This will allow risks to be targeted and addressed.

The final stage will be to collate ESV's historical data and, where possible, bring it into Conduit so that longer-term analyses can be undertaken to expand the dataset available for analysis and to allow the effects of environmental factors to be quantified. Such factors may include climate, weather, vegetation density and land use. This analysis will require linking to other data sources to inform the analysis. These sources will include weather data from the Bureau of Meteorology and government spatial data.

Ultimately, improved data analysis will allow ESV to take a more proactive role in regulating safety performance on Victoria's electricity networks in a risk-focused manner.

3.6 Foresight

3.6.1 Emerging technologies

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

ESV has begun to investigate the potential impacts of 'New Energy' on Victoria's networks. To this end, we are:

- ▶ identifying emerging technologies and business models and participants that are challenging traditional electricity utility-based businesses
- ▶ identifying where and how potential New Energy developments may emerge
- ▶ exploring the implications for energy and safety
- ▶ considering the implications for safety regulation and how ESV may respond to the challenges posed by these changes.

These investigations will further ESV's understanding of how the future may develop and catalyse further engagement with industry, government and regulatory stakeholders.

3.6.2 Asset management

As ESV progresses its Safety Case and ESMS assessments, it will move into a period of audit and surveillance. ESV will then focus on improving its understanding of the asset management practices of the businesses it regulates. It is important that ESV secures comfort that the industry is using sound practice and process to ensure its asset base is being managed in a sustainable manner that does not place safety, reliability or security of supply at risk. This approach contributes to ensuring the ESV regulatory practice is proactive rather than reactive; an important attribute in a rapidly-evolving network environment.

3.6.3 Amendment of the bushfire mitigation regulations

On 1 May 2016 the Electricity Safety (Bushfire Mitigation) Amendment Regulations came into effect. These regulations require distribution businesses with assets in specified bushfire prone areas (codified areas⁸) to deploy:

- ▶ technologies to reduce the voltage on the faulty phase of a polyphase line to reduce the risk of fire starts⁹
- ▶ covered conductor or underground lines in specified areas where existing lines are scheduled for replacement or new lines constructed
- ▶ automatic circuit reclosers in specified areas.

REFCL is a technology that has been developed currently for near-instant reduction of voltage when a phase-to-earth fault is detected. The deployment of this new technology within the specified timelines may prove challenging in some locations. ESV is acting to ensure it has the necessary resources available to regulate this activity effectively within the timeframes set in the regulations.

3.6.4 Data sharing

The development and deployment of the OSIRIS web portal (see Section 3.5) now provides a mechanism for the capture of data from the businesses in a consistent manner. ESV's data analysis engine (Conduit) is the final repository for this data. The distribution businesses also subscribe to Conduit. This allows ESV to share (with agreement) data and analyses with the businesses and promote dialogue based on a single, agreed data source. This provides ESV with a tool to inform discussions with the distribution businesses around the adoption of best practice and the correlation of performance with external factors informed by other data sources such as the Australian Bureau of Meteorology.

3.7 Implementation of 2014 recommendations

The 2014 Annual Safety Performance Report made a number of recommendations to stakeholders. The recommendations made to the major electricity companies are discussed in brief in the relevant sections of Appendices A to G.

There were also recommendations for ESV to implement. ESV's response to these was to:

- ▶ restructure the EIS division and raised its capability through the appointment of Lines Clearance Assurance team to better manage relationships with councils and facilitate more effective engagement
- ▶ engage asset management expertise to better assure itself of the distribution businesses adoption of sustainable asset management practice
- ▶ develop the OSIRIS web portal to provide consistent quality data to improve visibility of the causes of fires on the assets of the major electricity companies and to enhance ESV's capacity to analyse and proactively manage such events.

⁸ The Electricity Safety (Bushfire Mitigation) Regulations 2013 refer to these as "electric line construction areas".

⁹ The Amendment Regulations set targets to be achieved by 1 May 2019, 1 May 2021 and 1 May 2023 in nominated areas.

4 SERIOUS ELECTRICAL INCIDENTS

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

No fatalities due to electrical infrastructure were reported between 1 January 2015 and 30 June 2016.

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

- ▶ January 2016: a third party telecommunications worker was hospitalised with burns to his hands after drilling into a 22kV high voltage underground cable
- ▶ February 2016: a major electricity company worker was hospitalised with minor oil burns to his wrists and face when a pole-top transformer failed and blew the lid off the transformer during commissioning.

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

4.1 Major investigations

4.1.1 *Coroner's Report - Murrindindi Fire*

On 27 November 2015 the State Coroner of Victoria published his finding without inquest into the probable causes of the Murrindindi fire. The Coroner found that the cause was failed AusNet Services electrical assets on Wilhelmina Falls Road, Murrindindi.

ESV subsequently wrote to the major electricity companies seeking assurance that a number of specified actions had been taken to prevent similar incidents from recurring. The responses generally indicated that appropriate controls were and are in place; however, ESV has identified and communicated some further opportunities for improvement towards industry best practice.

4.1.2 *Non-metallic screened HV ABC failures*

At the end of November 2015 a customer in Main Creek Road, Red Hill raised concerns regarding the condition of non-metallic screened high voltage (HV) aerial bundled conductor (ABC) along Main Creek Road, its history of causing vegetation fires and the preparedness of United Energy to replace the conductor in a timely manner to effectively manage the risk.

ESV worked with United Energy to develop a plan to replace all the underperforming non-metallic screened HV ABC with a new standard of metallic screened HV ABC for its entire hazardous bushfire risk area. As part of a broader two-year program, the Red Hill area is targeted to be completed prior to the 2016-2017 fire season.

ESV is working with all major electricity companies to ensure all non-metallic screened HV ABC still in service is safely managed.

4.1.3 Somerville Fire, Mornington Peninsula

On 23 February 2016 at 8:15pm ESV was requested by Victoria Police to assist in investigating a large grass fire that started in Somerville on the Mornington Peninsula close to electricity distribution business assets. ESV's investigation, which included forensic and electrical testing of the assets, concluded the most likely cause of the grass fire was a pole fire due to contact by a possum. The investigation also concluded that the assets concerned were appropriately designed, constructed and maintained to the correct standards.

4.1.4 Drilling into underground electrical cable

On 9 March 2016 a building contractor employee undertaking earthworks on a construction site in Flinders Street drilled through a live electrical cable. The worker mistook the cable for a pipe despite having cable location plans on site. He received a shock and burns to both hands, was taken to hospital by ambulance, and then discharged the following day. He made a full recovery.

The investigation by ESV highlighted the need for further educational literature covering how to interpret electrical cable location plans, and how to identify differing types/standards of underground electrical cables.

4.1.5 Richmond Terminal Station current transformer explosion

On 7 June 2016 a 220kV current transformer at Richmond Terminal Station failed causing an explosion and fire with pieces of porcelain found up to 50m from the transformer. Other equipment was also damaged by debris in the explosion. There were no switching or other activities being undertaken in the yard at the time, and no one was injured.

There was also no loss of supply to any customers, although the rail network experienced a dip in voltage causing some issues with a part of the network.

In 2011 AusNet Services commenced a program to replace this type of current transformer across the Victorian transmission network. Prior to this incident, 171 transformers (57 sets) had been replaced state-wide, with only twelve (four sets) remaining at Richmond Terminal Station.

The remaining four sets at Richmond Terminal Station were replaced within two weeks of this incident to eliminate further risk.

4.2 Public safety trends

Three of the major areas where members of the public impact the networks or are impacted by the networks are vehicle collisions, other contact events and dug-up cables.

As noted in Section 5.4, vehicle impacts are the most common incident on the electricity networks reported to ESV. There is a large interannual variation in vehicle collisions with electrical infrastructure (Figure 1),¹⁰ but no apparent trend in incidents observed between 2010 and 2016.

Other contact events include copper theft, vandalism and No Go Zone infringements. Excluding the peak in 2012, there has been an upward trend in such events between 2010 and 2016 (Figure 2). ESV has particularly noticed a high level of such events, particularly copper theft, within the Powercor network (see Section E6).

While less common than the other two events, dug-up cable events have been increasing since 2010 (Figure 3). Ongoing brownfield development in Melbourne and Geelong continues to expose underground cables to the risk of impact during foundation excavation and service trenching. The upward trend is therefore likely to continue.

¹⁰ This predominantly is due to car collisions with electricity poles, but it also includes truck and farm/construction equipment with overhead powerlines.

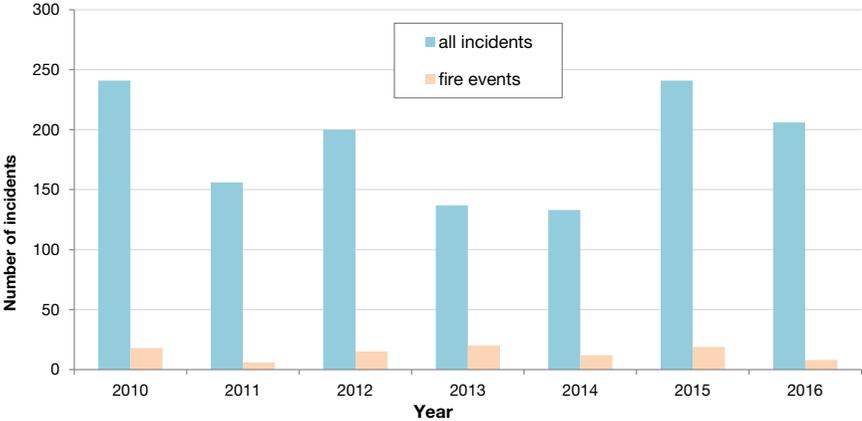


Figure 1 Vehicle collisions

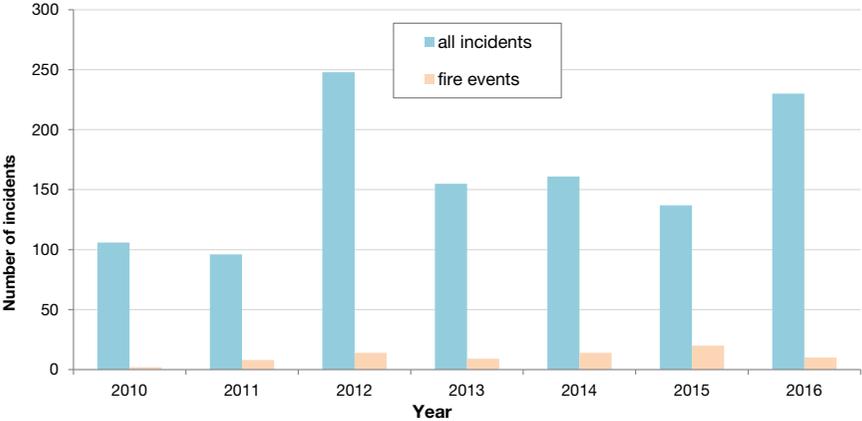


Figure 2 Other contact events

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

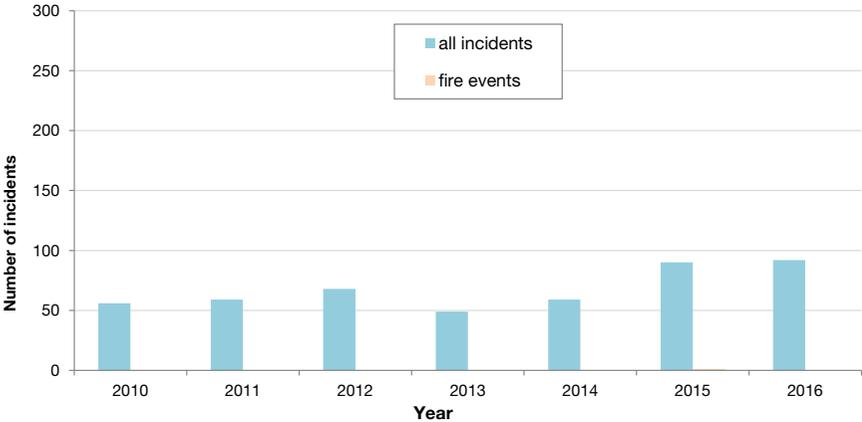


Figure 3 Dug-up cables

5 PERFORMANCE OF MAJOR ELECTRICITY COMPANIES

5.1 Transmission company performance

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

All three transmission companies had approved safety management plans and are in the process of reviewing and updating their Electrical Safety Management Systems and developing accompanying Safety Cases.

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 areas of concern regarding the transmission networks.

5.2 Distribution company performance

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

Figure 4 shows all the electrical infrastructure safety incidents reported to ESV between January 2015 and June 2016 for all the distribution businesses (namely AusNet Services Distribution, CitiPower, Jemena, Powercor and United Energy). It differentiates the non-fire events from those resulting in a fire.

In general, the incidents reported are slightly lower than the historical average from the previous five years (2010-2014). Figure 4 also shows the following general trends:

- ▶ most incidents do not result in a fire, even over summer
- ▶ there is a propensity for fire-related events to increase over the spring/summer period
- ▶ there is also seasonality exhibited in the non-fire events, albeit with a larger degree of month-by-month variability.

Figure 5 provides further detail on the subset of incidents that resulted in a fire event. This shows a pronounced spring/summer increase in such events, with performance in the 2015-2016 period generally within one standard deviation of the historical average from the previous five years.

There is also a difference between the 2014-2015 and 2015-2016 summers. Generally incident levels peak in January and February; however, the peak in 2014-2015 was delayed until February/March and brought forward into December/January in 2015-2016. The early summer in 2015-2016 saw monthly incident levels exceed one standard deviation from the historical average, although this was below the normal summer peak.

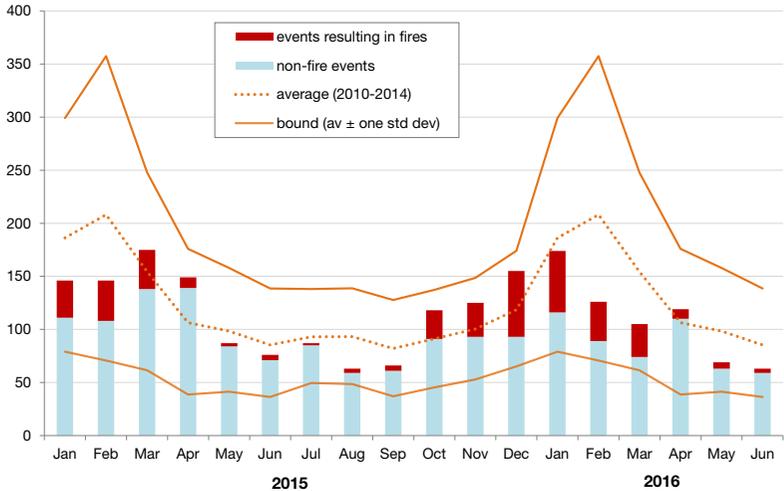


Figure 4 Fire and non-fire events by month

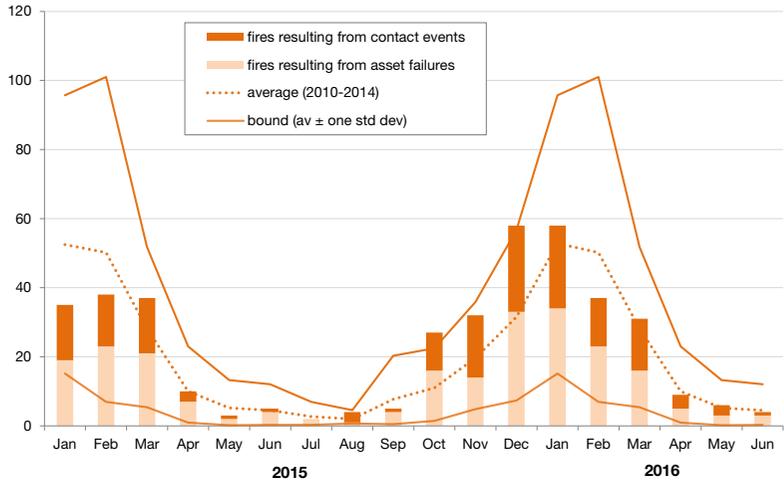


Figure 5 Contact and asset fire events by month

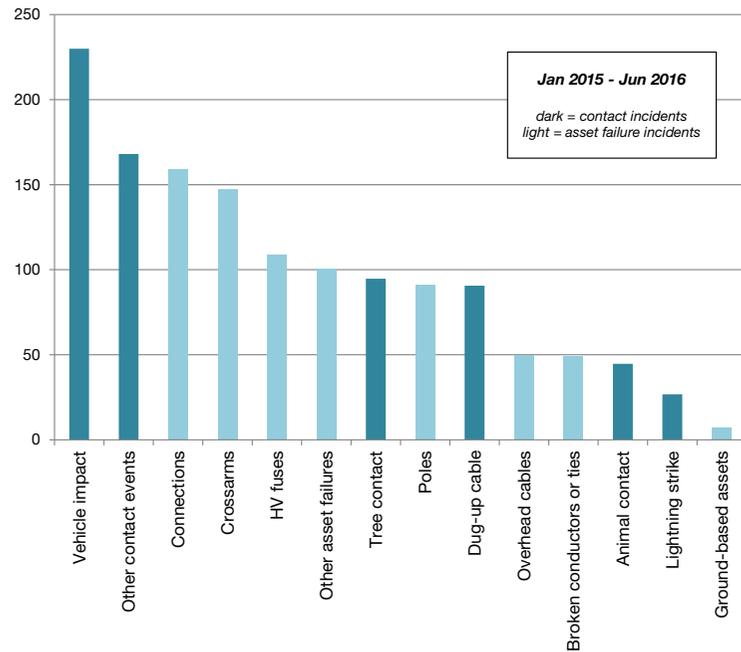


Figure 6 Incidents occurring on Victorian networks (per year)

Figure 6 shows the annualised number of incidents on the Victorian networks from most common to least common. Figure 7 does the same for those incidents that result in fires.

Over the 2015-2016 period, two of the five most common events were outside the direct control of the networks to manage. Vehicle collisions with power poles and street lights has escalated to the most commonly reported event from fifth place in 2010-2014. The number of other contact events annually (including vandalism, copper theft and No Go Zone infringements) has increased in 2015-2016, pushing this into second place.

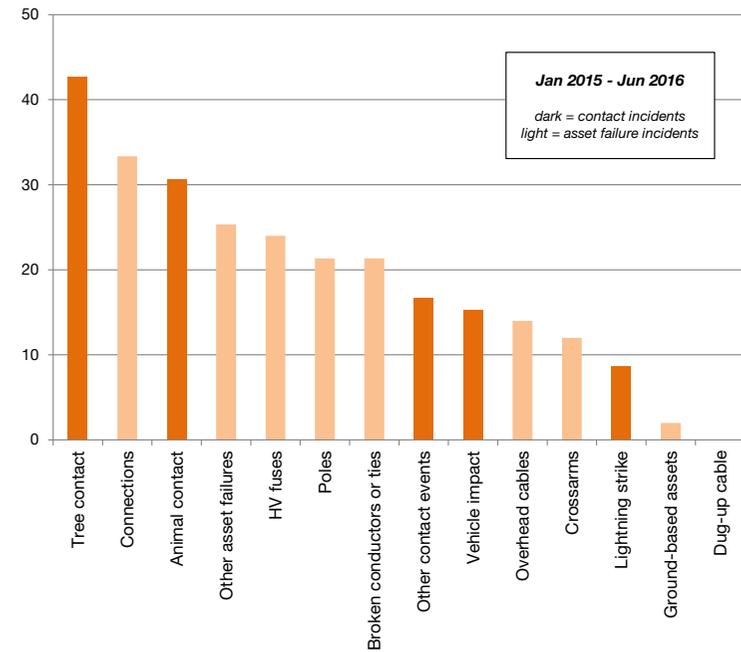


Figure 7 Fire-related incidents occurring on Victorian networks (per year)

Connection failure, the most common incident in 2010-2014, has fallen back to third position and the number of events annually has fallen by 31 per cent. Crossarm and fuse incidents have also dropped from second to fourth place and fourth to fifth respectively, with reductions of 20 per cent and 19 per cent respectively.

Tree contact continues to be the most common fire event, with average annual incidents increasing 11 per cent between the 2010-2014 and 2015-2016 periods. Fires from connection failures have increased by 75 per cent, lifting this into second place. Animal contact in third place has also experienced an increase of 32 per cent. All of the five most common events are controllable.

While the fire events for these three incident categories are higher than the average for 2010-2014, the peaks in tree contact fires (Figure 8), connection failure fires (Figure 9) and animal contact fires (Figure 10) indicate that the elevated levels observed in the 2015-2016 period are similar to the maximum level in the 2010-2014 period. This could be due to the influence of weather on network assets and the environment. This is discussed further in Section 5.3.

The more benign weather conditions from April 2010 to December 2011 (see Figure 12) may have contributed to lower levels of incidents in this period. In turn, this has lowered the annual average for the 2010-2014 period relative to the 2015-2016 period. The increased levels of the aforementioned fire incidents are more likely to be due to the effect of the weather than of the operation and maintenance of the networks. ESV is seeking to better understand these influences on the electricity networks so that it can regulate the electricity networks more effectively, including being informed about what outcomes can reasonably be achieved.

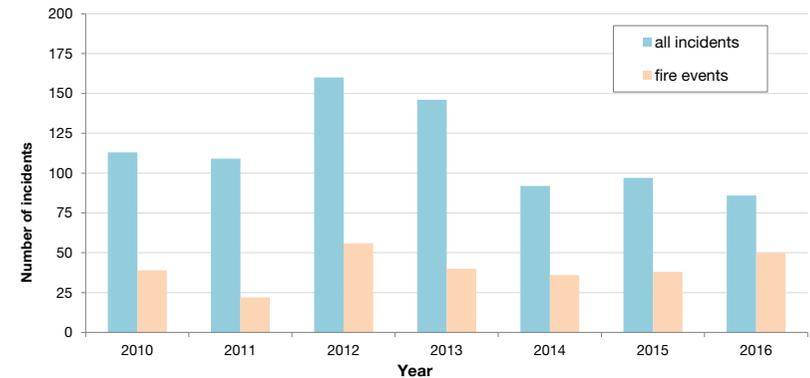


Figure 8 Tree contact events and fires

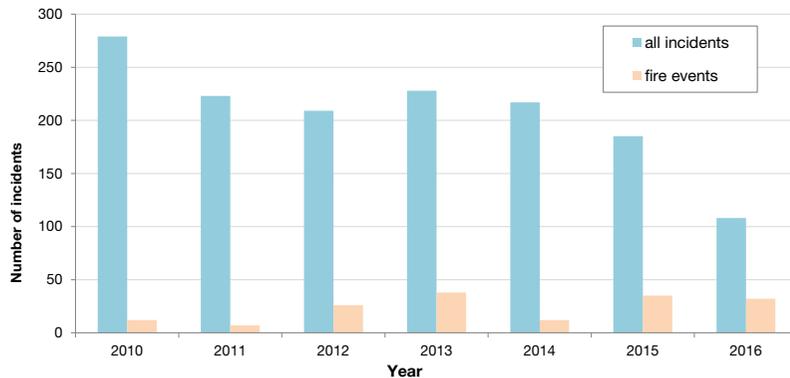


Figure 9 Connection failures and fires

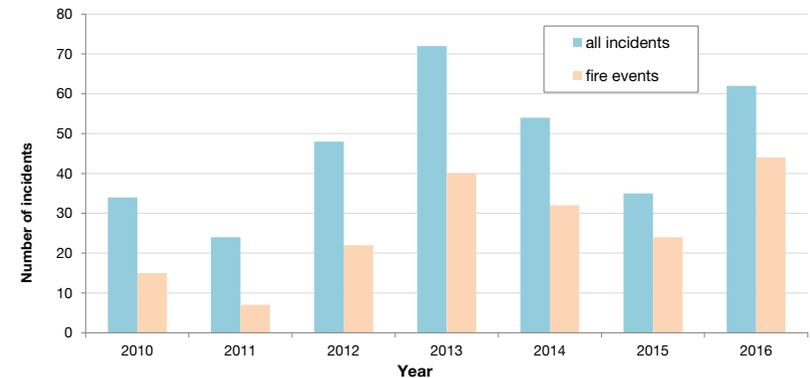


Figure 10 Animal contact events and fires

Figure 11 provides more details on the changes in annual incident rates between the 2010-2014 and 2015-2016 periods. Of the seven types of event that experienced an increase in frequency, four are outside the direct control of the distribution businesses. This includes three of the four largest increases. Those events that are within management control include pole failures, broken conductors and ties, and a very small increase in ground-based asset failures.

It would appear that targeted works have reduced the incidence of tree contact (a potential bushfire risk) and connection and crossarm failures (the two most common events in the 2010-2014 period).

Figure 11 also shows that fires resulting from asset failure and contact events have increased for all events except for crossarm failures. Unfortunately while connections failures have seen the largest decrease since 2010-2014, connection-related fires have seen the largest increase in fire incidence. As stated earlier, this may be due to the influence of weather conditions in increasing fire risks on the networks and to the relatively benign conditions in 2010-2011 (Figure 12) reducing the average number of incidents in the 2010-2014 period. The smart meter roll-out has helped reduce the number of connection failures and should reduce the number of connection fires below the levels that would have occurred without the roll-out. This is discussed further in Section 5.5.

ESV will continue to work with the distribution businesses to understand the causes of these increases and to identify ways in which fire-related events can be reduced.

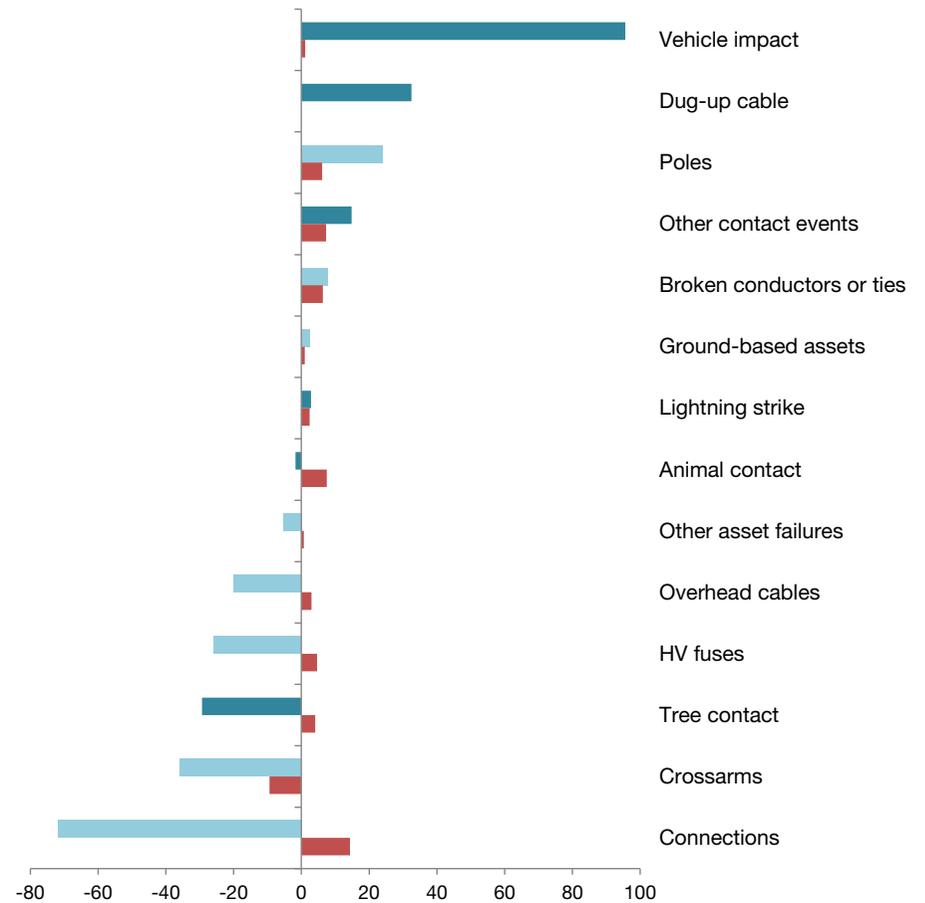


Figure 11 Changes in numbers of incidents by event type
 Blue = all incidents, red = incidents resulting in fires

5.3 Influence of weather on fire incidents

Figure 12 shows the monthly fire incidents between 2010 and 2016 broken into those resulting from contact and asset failure events (column data). This shows a clear seasonal pattern driven by higher temperatures and lower rainfall over the summer period.

In general, the incidence of fire events peaks in January and February, except for the 2015-2016 summer which peaked in December.

Figure 12 includes a weather function curve that is a simple measure of the monthly averaged maximum temperature across six sites, with these adjusted for the average monthly rainfall. This provides a reasonable correlation ($R^2 = 0.72$) to the fire events on the Victorian networks. Even so, further investigation of other influences (such as wind speed and multiple days with high temperatures) is needed to account fully for the 2013, 2014 and 2015/2016 peaks.

An improved analysis of the correlation between weather and network fire events will also help understand the potential vulnerability of the existing networks to more extreme weather conditions resulting from climate change.

Figure 12 confirms that weather is a dominating feature affecting the number of fire incidents experienced on the network. It is potentially affecting not just the likelihood of a fire spreading once on the ground, but that likelihood a fire is even initiated on the assets themselves.

The implications of this are that there will always be an underlying level of fire risk associated with operating electricity networks unless there is a major reconfiguration of Victoria's electricity supply infrastructure. The REFCL program mentioned in Section 3.6.3 is one such measure. Other steps may involve significant network infrastructure upgrades or the targeted roll-out of renewables and energy storage and further investigation of at-risk distribution assets. ESV will engage in further dialogue with stakeholders about this over the next twelve months.

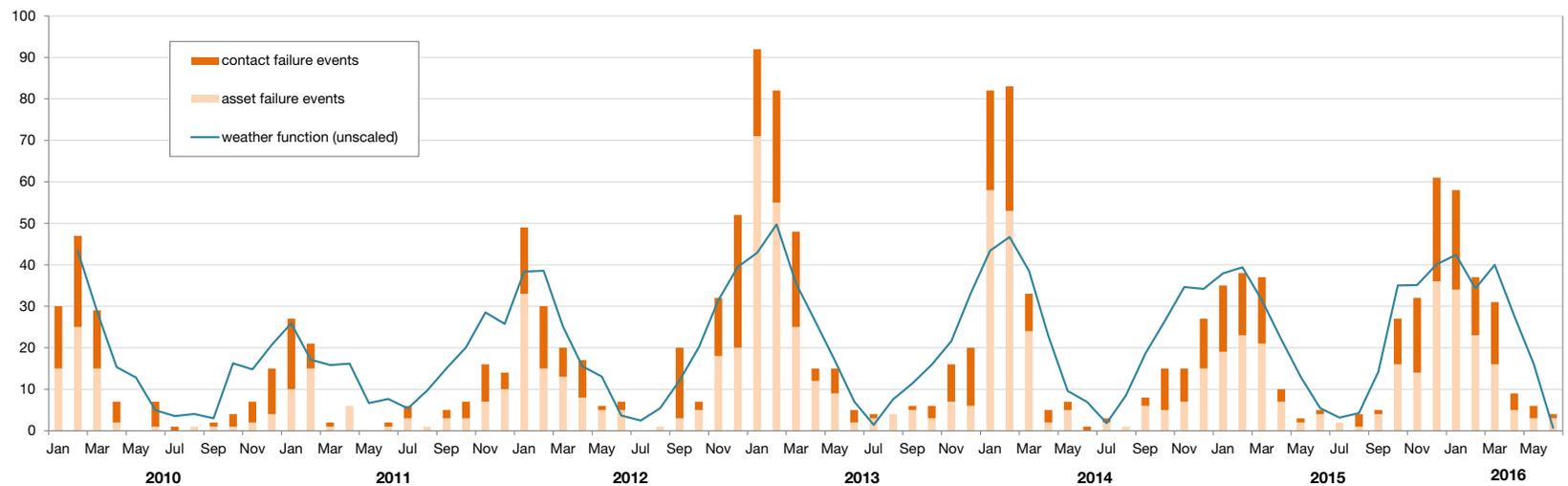


Figure 12 Monthly fire incidents from 2010 to 2016

5.4 Vehicle impacts : a case study in risk management

As shown in Figure 6, the most common incident occurring on the Victorian distribution networks is vehicle collision with distribution and lighting poles.

Appendices A, C, D, E and G also show this to be the most common incident occurring on the CitiPower, Jemena and Powercor networks, and third most common incident on the AusNet Services network. It is only the sixth most common incident on the United Energy network, possibly due to higher incidences of other failure events.

Apart from the potential loss of life that is addressed by VicRoads and the Victorian Police, there is also a risk to the networks with the potential loss of supply and the cost for repair or replacement of poles.

The Australian Energy Regulator has taken a position not to fund capital works designed to reduce impacts with electricity infrastructure, noting that the primary purpose of such works is to improve road safety and is, therefore, more appropriately funded from the relevant Government road management authorities. ESV recognises this position, but also notes that this does not preclude the distribution businesses from identifying multiple impacts and flagging these with the relevant agencies. While recognising that control and funding of any protective works may sit with a third party, prudent risk management should involve assessing such risks and flagging multiple events with the responsible authority.

The distribution businesses participate in roads coordination committees that address planning and coordination of works within road reserves.

United Energy has also provided ESV with a report investigating vehicle collisions with its assets, including identification of black-spot locations from a network perspective and engineering works that could be implemented to mitigate these impacts.

United Energy is to be commended for its proactive approach to better understand the risk to its assets from vehicle collisions. ESV will be further discussing this risk with the other businesses to ensure the businesses are proactively highlighting black-spot areas to the relevant road management authority.

The safety case regime ESV is promoting across the major electricity companies should encourage a greater focus on risk-based decision-making; identifying key risks, through assessing and quantifying their impacts and then developing engineering solutions. Regardless of whether the solutions are actioned by the business or a third-party, it is the approach of taking ownership of the risks affecting or due to a specific network that ESV is seeking to encourage. As a result, we should see more proactive solutions developed for these high frequency events. The same will apply for any high impact, low likelihood events.

The implementation of enhanced data management and data sharing (see Section 3.6.4) will also allow ESV to undertake spatial analyses to identify areas experiencing higher incident rates. This may lead to the development of predictive models to better understand the causal relationships driving network incidents, and thereby allow preventative approaches to be identified.

5.5 Connections failures : a good news story

In 1999, an Order in Council was issued requiring that the integrity of earthing systems be tested every ten years. At that time, such testing would require physically undertaking a neutral supply test on individual systems located at each electricity customer's premises.

Between 2009 and 2014, the distribution businesses installed smart meters at the premises of all residential and small commercial customers across Victoria. As part of the roll-out, a neutral supply test was conducted at every installation leading to rectification of a number of existing hazards.

Since the deployment of smart meters, the distribution businesses have been investigating and developing metrics that allow imminent safety hazards to be identified prior to them impacting the community. The types of hazards now able to be detected remotely include:

- ▶ Mains degradation due to bad connections and insulation breakdown^{11,12}
- ▶ Broken conductors and live HV wire down events^{11,12}
- ▶ Canded fuses¹²
- ▶ Incorrect meter wiring¹¹
- ▶ Meter bypass events^{11,12,13}
- ▶ Over-voltage events¹²
- ▶ Overload events¹²
- ▶ Non-compliant solar installations.¹²

By using remote monitoring and combining this with increased levels of automated analysis, smart meters are already allowing the distribution businesses to more efficiently and effectively reduce the number of network incidents that could impact on community safety.

These reductions are already tangible, with observed reductions in connection and fuse failures (see Figure 11) being attributable (at least in part) to the improved monitoring made possible by the smart meter program.

In addition, the information provided by smart meters is allowing the distribution businesses to better monitor loads across the networks to a level and detail previously not possible. This will allow improved network planning and subsequently improved reliability of supply to all customers, including network management as solar PV and battery storage technologies become more prevalent.

¹¹ Potential for shock or electrocution.

¹² Potential to result in fires at the premises or in surrounding vegetation.

¹³ A common occurrence at premises being used to illegally grow marijuana.

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APPENDIX A : AUSNET SERVICES

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

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

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

The AC 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 6574km of transmission lines and 13,000 towers.

The AC distribution network covers any area of approximately 80,000km², and includes Melbourne's outer-eastern suburbs and runs north to the New South Wales border and south and east to the coast (Figure 13). It comprises approximately 35,000km of overhead line, 6000km of underground cable and 396,000 poles. Most of this network (85 per cent) is in rural areas.

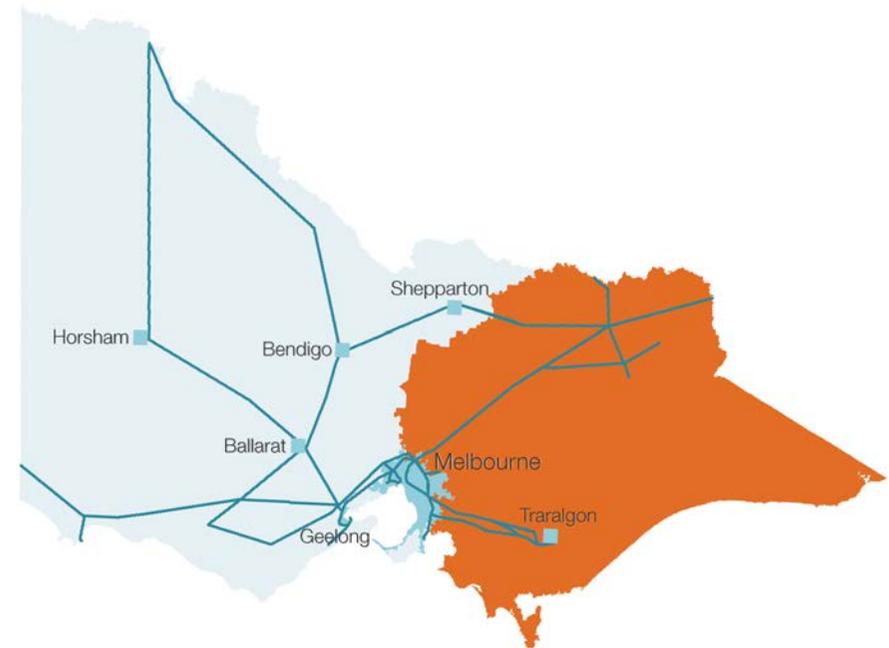


Figure 13 Service area for the AusNet Services distribution network (orange area) and transmission lines ((dark blue)

A1 Plans and processes

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

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

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

A Preliminary Safety Case was first provided by AusNet Services distribution on 31 July 2015. After two iterations a Preliminary Safety Case was accepted by ESV on 10 May 2016, with AusNet Services having now submitted its Final Safety Case for assessment on 13 July 2016. It is expected that, upon assessment of the Final Safety Case, a revised ESMS will be submitted to ESV by 30 November 2016.

The Preliminary Safety Case for the transmission network is expected to be provided by AusNet Services in late 2016.

AusNet Services also submitted its transmission and distribution Electric Line Clearance Management Plan to ESV on 31 March 2016. ESV has assessed the submitted plan and will be consulting with AusNet Services to ensure a compliant and approved plan is in place prior to the fire danger period.

A2 Safety programs

In the 2011-2015 Electricity Distribution Price Review, the Australian Energy Regulator (AER) identified nine safety programs for the AusNet Services distribution network.¹⁴

The targets for two of the safety programs were subsequently revised in 2012 in agreement with ESV.

Performance at the end of the five-year period is detailed in Table 2.

AusNet Services also identified two further safety programs that warranted early replacement of assets that may pose a safety risk. The performance of these two programs is also addressed in Table 2.

All safety programs have been successfully completed. ESV is satisfied with delivery of these safety programs by AusNet Services.

¹⁴ See Table P.44, *Victorian electricity distribution network service providers : Distribution determination 2011–2015*. Final decision - appendices. October 2010.

Table 2 Performance of AusNet Services safety programs

program	target	actual	
AER-designated safety programs			
Crossarm replacement (number replaced)	46,785	49,102	✓
Pre-emptive replacement of steel conductor (km)	1432*	1448	✓
Pre-emptive replacement of copper conductor (km)	284	283.51	✓
Replace HV pin-type insulator sets — pole top fire mitigation (number replaced)	5650	5925	✓
Targeted replacement of EDOs (number replaced)	10,825	20,944	✓
Targeted bird and animal proofing in high bushfire risk areas (number of assets)	6000	12,885	✓
Replace all SWER OCRs (number replaced)	525	524	✓
Replace/upgrade 3-phase ACR controllers (number replaced/upgraded)	234	234	✓
Augment spans — habitat trees (spans)	1620*	1856	✓
Additional AusNet Services safety programs			
Targeted replacement of EDO fuse tubes (number replaced)	7680	11,246	✓
Replacement of HV ABC ¹⁵ in the Dandenongs (km)	61.6	61.6	✓
* Revised targets.			
🕒 Actual is within 10% of target.			

A3 Directions

ESV has issued three directions to AusNet Services to:

- ▶ 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
- ▶ undertake powerline replacement projects specified by the Powerline Bushfire Safety Program under the Powerline Replacement Fund.

The first two directions were due for completion in HBRA by 31 December 2015. AusNet Services completed both on time and, in the case of the rods and dampers direction, undertook more works than required.

AusNet Services was also directed to undertake sixteen projects for the Powerline Replacement Fund by 31 December 2015.

Thirteen projects have been completed, with four delivered on schedule and nine delivered late. All three of the remaining projects are expected to be completed by the end of March 2017.

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

¹⁵ HV ABC = high-voltage aerial bundled cable

A4 Exemptions

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

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

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

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

In 2015 AusNet Services applied for an exemption against the revised 2015 regulations for overhanging vegetation. The exemption sought to reduce the number of spans to be addressed from 2000 to 1620, with the funding to be reallocated to replacement of HV ABC in the Dandenong Ranges to eliminate the overhanging vegetation issue in that area. Given the latter was proposed to address a more-immediate potential bushfire threat, ESV consented to the request for an exemption and the HV ABC replacement program has now been completed.

A5 Audit performance

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

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Extensive systems audits had been conducted on core aspects of the ESMS in previous years, without identifying systemic deficiencies.

A5.2 *Electric line clearance*

Transmission and distribution network desktop audit

An electric line clearance desktop audit of the AusNet Services transmission and distribution networks was conducted between 24 and 25 November 2015. The desktop audit found several minor opportunities for improvement in AusNet Services documentation, although nothing that would directly affect safety outcomes.

The audit found AusNet Services to have comprehensive vegetation management processes and procedures in line with its Electric Line Clearance Management Plan (ELCMP). ESV found that AusNet Services had implemented these processes and procedures appropriately and in compliance with the ELCMP.

ESV recommends that AusNet Services continues to apply its ELCMP to its transmission and distribution assets. It also recommends that ongoing review of the ELCMP occurs to ensure associated processes and procedures remain relevant in achieving the outcome of continued compliance with the regulations.

Distribution network field audit

An electric line clearance audit of the AusNet Services distribution network was conducted between 23 and 27 November 2015. This was undertaken at randomly selected locations throughout the network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected to a lesser extent. A total of 556 electricity spans were inspected during the field component of the audit. Of these spans, 358 were located within HBRA and 198 in LBRA.

The audit found the following:

- ▶ noncompliant spans
 - HBRA 14
 - LBRA 10
- ▶ variance
 - HBRA = 14 out of 358 3.9%
 - LBRA = 10 out of 198 5.0%

Generally the noncompliant spans fell into two groups:

- ▶ Spans for which AusNet Services is responsible = 19

The audit results indicate that, where AusNet Services is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for reasonable compliance standards. This is most important for HBRA. While the results in HBRA are consistent with the 2014 audits, the vegetation noncompliance levels in LBRA (2.5 per cent) are much improved on 2014 results (13.3 per cent). Overall acceptable compliance was achieved.

- ▶ Spans for which AusNet Services is not responsible = 5

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

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

The electric line clearance audit recommended that AusNet Services:

- ▶ considers further assessment of feeders with the highest ratio of noncompliant spans
- ▶ considers reviewing the accuracy of recorded span codes following the next inspection cycles to ensure the accuracy of recorded data
- ▶ considers reviewing the effectiveness of processes in place to ensure all relevant information is effectively captured within the database
- ▶ continues to ensure that processes for assisting and following up Councils regarding vegetation management and compliance activities are rigorous and effective.

A5.3 Bushfire mitigation

Transmission network

ESV conducted a desktop audit on the AusNet Services Bushfire Mitigation Plan and a field audit on the 220kV powerlines running between Mount Beauty and Eildon. A total of 27 transmission towers were inspected.

The field audit made the following observations:

- ▶ some warning and directional signage was not adequately maintained
- ▶ bushfire mitigation activities on the transmission network, as audited, are effective and operating in accordance with the approved bushfire mitigation plan.

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

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. AusNet Services' system of regular patrols of the system would ensure that its knowledge is regularly updated.

Distribution network

The bushfire mitigation audit focused on the general condition of the network to prevent fire starts. ESV visited six distribution feeders from Doreen to Belgrave and viewed 1603 assets in total.

A desktop audit of the technical information provided by AusNet Services was carried out prior to the field audit to ensure that the information ESV had received was appropriate for this audit. The information contained in the documents showed that AusNet Services had in place detailed asset management strategies for different elements of its network. These included risk assessments, maintenance procedures, and analytics as per expected industry standards.

A field audit was then undertaken to assess conditions on the ground. The findings of the field audit were:

- ▶ AusNet Services had reliable knowledge of the status of their distribution system
- ▶ being an early adopter of new inspection technologies (such as cameras and drones for pole-top inspection) has enabled AusNet Services to more accurately assess its pole-top assets.

Of the 29 issues identified, AusNet Services was aware of twelve and unaware of the other seventeen (mainly related to crossarm condition). None of the issues identified was of major safety concern.

The variance was found to be:

- | | |
|---|------|
| ▶ number of assets inspected (detailed review) | 1603 |
| ▶ number of issues identified | 29 |
| ▶ number matching notification by AusNet Services | 12 |
| ▶ variance = $(29-12)/1603$ | 1% |

Therefore, the AusNet Services database accurately represented its assets in the field with an accuracy rate of approximately 99 per cent

A5.4 Work practices

In 2015-2016, ESV undertook six audits of AusNet Services' work practices across six sites. The findings of these audits were as follows:

▶ noncompliances	0
▶ areas requiring attention	1
▶ opportunities for improvement	19

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

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

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

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

A6 Safety incidents

Figure 14 shows the annualised number of all serious electrical incidents reported to ESV by AusNet Services, with the data sorted from most frequent to least frequent. Figure 15 shows the same for those incidents that result in an asset or ground/vegetation fire.

Of the five most common incidents, only vehicle impact is not within the direct control of AusNet Services to manage. All of the five most common fire-related incidents are manageable by AusNet Services.

While fuse failures are the most common incident on the AusNet Services network, only 13 per cent result in fires and, for many of these, the fire will be contained to the fuse itself. The number of fuse failures has remained relatively static since 2012, possibly as a result of there being significant numbers of fuses in the network (where replacement can be slow) and high vegetation densities locally (putting pressure on fuses as a first line of defence against tree contact events).¹⁶

It is not surprising that AusNet Services had more of these incidents than other distribution businesses given that it has a larger service area and more assets than all the other companies (with the exception of Powercor). Even so, Powercor only experienced 73 per cent of the fuse failures that AusNet Services did despite its larger asset base. This may possibly be due to the impact of vegetation on its fuse fleet. ESV will discuss this with AusNet Services to better understand the reasons for its higher fuse failure rate.

More concerning than fuse failures is the high number of tree contact events, of which 55 per cent result in a fire. During the 2015-2016 period AusNet Services experienced more than twice the number of fires from tree contact than Powercor, the next highest reporter. This is not unexpected given the more mountainous terrain and higher tree densities across the AusNet Services network area.

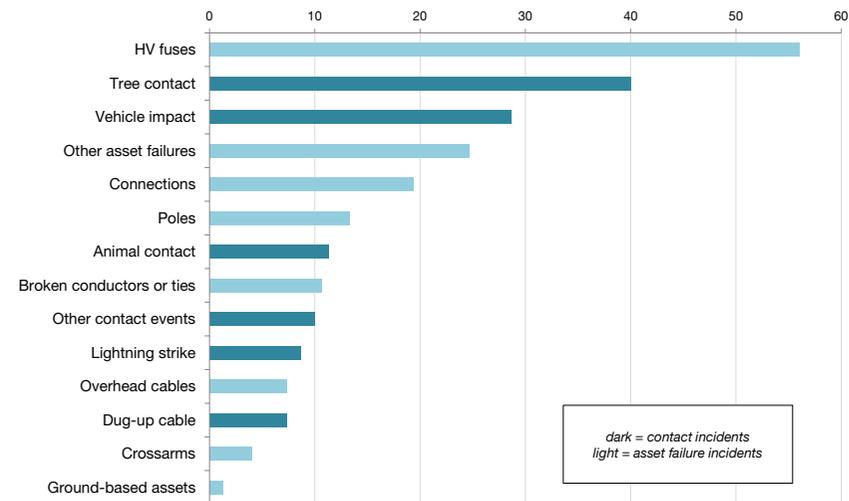


Figure 14 Incidents on the AusNet Services network (per year)

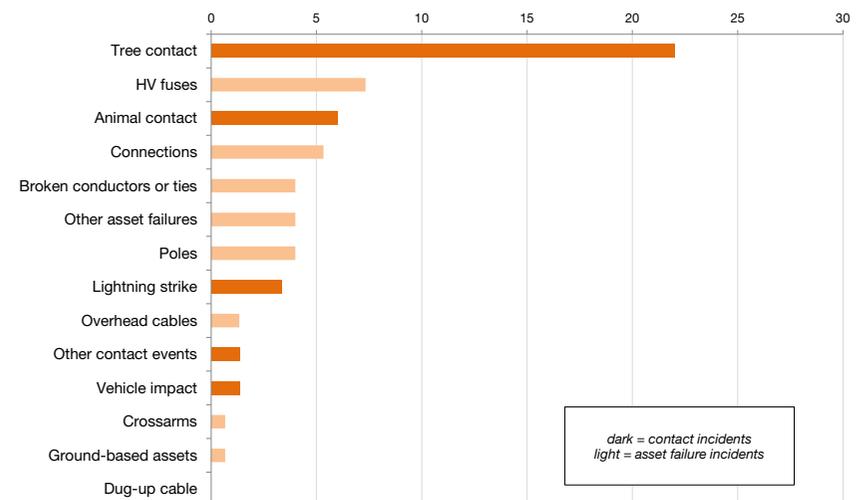


Figure 15 Incidents on the AusNet Services network resulting in fires (per year)

¹⁶ Tree density across Victoria is shown in Appendix H.

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

The high tree density and geography of its service area continues to place AusNet Services at a high risk of fire start, and for that fire start to escalate to a bushfire event. This risk should be reduced by the introduction of REFCLs and the continuation of existing efforts by AusNet Services to install covered conductor on its overhead lines in line with recent amendments to the bushfire mitigation regulations.

That said, AusNet Services needs to maintain vigilance concerning tree contact fires. It needs to continue its focus on tree clearance around its assets and, as it is already doing, in upgrading its assets to minimise opportunities for contact events to result in fires.

Other related incidents (such as animal contact, particularly from possums) also need continued attention to prevent these incidents from also resulting in fires.

A7 Implementation of 2014 recommendations

AusNet Services confirmed in November 2015 that it accepted the recommendations of ESV. AusNet Services also described how it had implemented the recommendations.

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APPENDIX B : BASSLINK

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

Basslink owns and operates the Basslink HVDC interconnector between Victoria and Tasmania. In Victoria its assets comprise the Loy Yang converter station connected to the 500kV transmission system via 3.2km of AC overhead line. From the converter station, 57km of DC overhead line and 6.4km of underground cable connect to the submarine cables that cross Bass Strait to Tasmania (Figure 16). 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 early 2006.



Figure 16 Location of Basslink transmission assets (dark blue line)

B1 Plans and processes

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

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

With the new requirement to submit a Safety Case for approval prior to review of its ESMS, the timetable for submission of the ESMS was amended to require a Preliminary Safety Case to be submitted before 30 September 2016 and this will be seen by ESV as triggering the ESMS process.

Basslink also submitted its Electric Line Clearance Management Plan to ESV on 19 April 2016. ESV has assessed the submitted plan and will be consulting with Basslink to ensure a compliant and approved plan is in place prior to the fire danger period.

B2 Safety programs

Basslink is not regulated by the AER and, as such, AER-approved safety programs do not apply.

Basslink has no identified safety issues that warrant monitoring by ESV.

B3 Directions

ESV has not had cause to issue directions to Basslink.

B4 Exemptions

Basslink has sought no exemptions from regulations.

B5 Audit performance

B5.1 Electrical Safety Management Scheme

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Extensive systems audits had been conducted on core aspects of the ESMS in previous years, without identifying systemic deficiencies.

B5.2 Electric line clearance

An electric line clearance audit of the Basslink transmission assets was conducted in 2013. ESV audited the 57km 400kV DC powerline running between the Loy Yang convertor station and the coastal connector station. This was undertaken at randomly selected locations along these powerlines. The electrical assets owned and operated by Basslink were considered to be recent installations. Audit records from 2013 found them to be in good condition. Vegetation clearance standards observed at this time, and during an informal visit in late 2015, did not indicate concern with compliance to the regulations.

For these reasons a formal electric line clearance audit was not conducted in 2015.

ESV recommends that Basslink continues to apply its ELCMP to its transmission assets. It also recommends that ongoing review of the ELCMP occurs to ensure associated processes and procedures remain relevant in achieving the outcome of continued compliance with the regulations.

B5.3 Bushfire mitigation

ESV audited the 400kV DC powerlines running between the Loy Yang convertor station and the coastal connector station in 2013. Transmission towers along the entire route were randomly inspected. This audit was conducted in parallel with the electric line clearance audit (see Section B5.2).

The field audit made the following observations:

- ▶ the transmission line is relatively new in terms of its life cycle
- ▶ the transmission line easement is well managed and clear of vegetation or hazard tree risks.

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

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.

B5.4 Work practices

ESV is yet to undertake a work practice audit of Basslink as the transmission line is expected to be operational almost all the time, and is a relatively new asset requiring very little maintenance at this stage of its life cycle.

Planned works involving an outage is scheduled for January 2017. ESV intends to conduct a work practice audit at this time.

B6 Safety incidents

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

Compared to the AusNet Services transmission network, Basslink has the further advantage of having a relative 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 2015-2016 period.¹⁷

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

B7 Implementation of 2014 recommendations

ESV made no recommendations specific to Basslink.

¹⁷ The likelihood of an incident was further reduced by Basslink being out of service from 20 December 2015 to 13 June 2016 due to a fault on the marine section of the interconnector running across Bass Strait. This fault was outside of ESV's jurisdiction.

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APPENDIX C : CITIPOWER

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

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 C5.1) and the work practices observations audits (Section C5.4) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the CitiPower network and have therefore been assessed independently of the Powercor assets.

The AC distribution network covers an area of approximately 157km², and includes Melbourne's central business district and inner suburbs (Figure 17). It comprises approximately 1850km of overhead line, 1340km of underground cable and 58,240 poles. Most of this network (75 per cent) is in the central business district.



Figure 17 Service area for the CitiPower distribution network (orange area)

Jemena and United Energy service boundaries are shown in orange

C1 Plans and processes

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

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

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

A Preliminary Safety Case was first provided by CitiPower on 27 July 2015. After three iterations a Preliminary Safety Case was accepted by ESV on 1 September 2016. CitiPower is proceeding with developing its Full Safety Case incorporating feedback from the Preliminary Safety Case assessment for submission to ESV by 11 November 2016.

CitiPower also submitted its Electric Line Clearance Management Plan to ESV on 31 March 2016. ESV has assessed the submitted plan and will be consulting with CitiPower to ensure a compliant and approved plan is in place prior to the fire danger period.

C2 Safety programs

In the 2011-2015 Electricity Distribution Price Review, the Australian Energy Regulator (AER) identified eight safety programs for the CitiPower distribution network.¹⁸

Since CitiPower did not treat these programs as safety programs but rather regular maintenance, it did not set annual forecasts for the AER-accepted programs. CitiPower was not funded to undertake accelerated replacement safety programs, but was funded to deliver maintenance programs over the price review period to forecast volumes provided by CitiPower based on expected asset replacement rates over the five years.

ESV then linearly apportioned the forecast volumes to create annual estimates to monitor against for progress.

While such works may be scheduled as part of routine maintenance, the AER bundled funding under the safety program umbrella where these works would deliver a benefit to electrical safety. ESV has monitored performance against the volume assumptions implicit in the AER's expenditure allowances.

Performance at the end of the five-year period is detailed in Table 3.

Only two of the eight safety-related programs have been completed. The remaining six safety-related programs did not reach the estimated targets.

The replacement program for staked poles was completed and significantly exceeded the original target (by 52 per cent). While the other four pole replacement programs were not completed, the total number of poles actually replaced exceeded the target. This is an acceptable outcome.

¹⁸ See Table P.37, *Victorian electricity distribution network service providers : Distribution determination 2011–2015*. Final decision - appendices. October 2010.

The crossarm replacement program also exceeded its target by 21 per cent. This too is a good outcome.

Little work was undertaken on the designated conductor replacement programs between 2011 and 2015. CitiPower noted that this was because its condition monitoring did not determine any conductors as requiring replacement. This was despite forecasting 15km of conductors as requiring replacement as part of its submission to the AER at the outset of the period. Either CitiPower over-estimated the future replacement works during the AER economic review or there is an issue with the ability of CitiPower to forecast its future asset replacement workload. ESV will follow this up with CitiPower.

Table 3 Performance of CitiPower safety programs

program	target	actual	
Pole replacements (FC148) – sub-transmission (poles)	56	29	✘
Pole replacements (FC148) – HV (poles)	231	149	✘
Pole replacements (FC148) – LV (poles)	574	335	✘
Pole replacements (FC148) – pole and stay (poles)	65	2	✘
Pole replacements (FC148) – staked (poles)	1325	2023	✔
Crossarm replacements (FC155) (crossarms)	3700	4462	✔
HV overhead conductor replacements (km)	12.5	0	✘
LV overhead conductor replacements (km)	2.5	0.3	✘

C3 Directions

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

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

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

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

C4 Exemptions

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

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

- ▶ cyclic clearing – ABC or insulated cable in all areas
- ▶ cyclic clearing – powerlines other than ABC or insulated cable in hazardous bushfire risk areas (HBRA)
- ▶ cyclic clearing – powerlines other than ABC or insulated cable in low bushfire risk areas (LBRA).

Compliance was to be achieved by 31 December 2013. In 2013 CitiPower requested an extension of one year to achieve compliance. This extension was granted and all three programs were completed to ESV's satisfaction in 2014.

C5 Audit performance

C5.1 Electrical Safety Management Scheme

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Extensive systems audits had been conducted on core aspects of the ESMS in previous years, without identifying systemic deficiencies.

C5.2 Electric line clearance

An electric line clearance audit of the CitiPower distribution network was conducted between 6 and 8 January 2016. This was undertaken at randomly selected locations throughout the network. All CitiPower assets fall within LBRA. A total of 609 electricity spans were inspected during the field component of the audit.

The audit found the following:

- | | |
|------------------------------|-------|
| ▶ noncompliant spans in LBRA | 63 |
| ▶ variance = 63 out of 609 | 10.4% |

Generally the noncompliant spans fell into two groups:

- ▶ Spans for which CitiPower is responsible = 43

The audit results indicate that, where CitiPower is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for reasonable compliance standards.

The field audit assessed 566 spans as being compliant for vegetation clearance from a CitiPower perspective, which represented 92.9 per cent of the audit sample.

- ▶ Spans for which CitiPower is not responsible = 20

Where noncompliant vegetation was not the management responsibility of CitiPower, it was the responsibility of municipal councils or private property owners and occupiers. Noncompliant vegetation was significantly more evident around low voltage assets where council-managed vegetation was close to or contacting overhead electrical cables or conductors. Of the 20 findings, the results shows 19 were “hard-contact” instances to low voltage conductors.

The high number of “hard-contact” noncompliant spans in areas managed by other responsible persons may adversely affect electrical safety, the reliability of supply and increase the potential for fire starts.

CitiPower has systems in place to notify such responsible persons of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:

- track or provide for follow up consultation on responsible person inaction
- accommodate an effective escalation process when a responsible person has failed to act.

The field audit assessed 421 spans (69.1 per cent) as having field observations different from the data recorded in the CitiPower system. This was indicative of possible issues with the quality and accuracy of elements of vegetation management data held by CitiPower.

The electric line clearance audit recommended that CitiPower:

- ▶ utilises the opportunity of transitioning to a new vegetation management database to establish clear protocols for data capture and database management

- ▶ reviews the process for assessing, capturing and recording span code data as the field audit results indicate inconsistencies between recorded codes and observations recorded by the Field Auditor
- ▶ reviews the accuracy of recorded inspection span codes following the next inspection cycles as the field audit results indicate inconsistencies between recorded and actual data.

C5.3 Bushfire mitigation

The bushfire mitigation desktop audit assessed compliance with legislation and internal business process, with a focus on asset inspection.

The audit findings showed that CitiPower generally had sound processes and procedures in place to adequately manage and check on the quality of the asset inspection work. These included clear role responsibilities, training requirements, and audit procedures.

Some opportunities for improvement were identified during the audit, namely to:

- ▶ ensure the latest accepted bushfire mitigation plan is published on its website
- ▶ develop a detailed procedure that defines responsibilities for the updating of bushfire mitigation plan and ensures its currency
- ▶ closely monitor the audit program to ensure it complies with the requirements stated in relevant auditing standards and in the CitiPower policies and procedures

None of the issues identified was of major concern.

C5.4 Work practices

In 2015-2016, ESV undertook two audits of CitiPower work practices across four sites. The findings of these audits were as follows:

▶ noncompliances	0
▶ areas requiring attention	4
▶ opportunities for improvement	3

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

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

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

- ▶ have a detailed understanding of the JSA process and know the contents of relevant Safe Work Method Statements
- ▶ check the condition of equipment prior to use, and use appropriate PPE, particularly LV and HV insulating gloves and fall prevention equipment
- ▶ 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.

C6 Safety indicators

Figure 18 shows the annualised number of all serious electrical incidents reported to ESV by CitiPower, with the data sorted from most frequent to least frequent. Figure 19 shows the same for those incidents that result in an asset or ground/vegetation fire.

Of the five most common incidents, the top three events are largely outside of the direct control of CitiPower. Only incidents due to connections and overhead cables failures (as opposed to broken conductors) are within the direct control of CitiPower.

While it has a smaller service area and asset base than the other distribution businesses, CitiPower has experienced more vehicle impacts and dug-up cables than three of the four other businesses. The only business with more of these types of events was Powercor, with the largest service area. The high levels of vehicle impacts and dug-up cables are not surprising given:

- ▶ the extremely high levels of traffic within, into and transiting through the Melbourne CBD and inner suburbs contribute to higher levels of vehicle impacts
- ▶ the high levels of brownfield development in the Melbourne CBD and inner suburbs where excavation and trenching can potentially impact underground assets.

All of the five most common fire-related incidents are manageable by CitiPower. These were the only incident types for which CitiPower experienced fires, and the number of fires annually from these sources is low at less than two fires per year from each source.

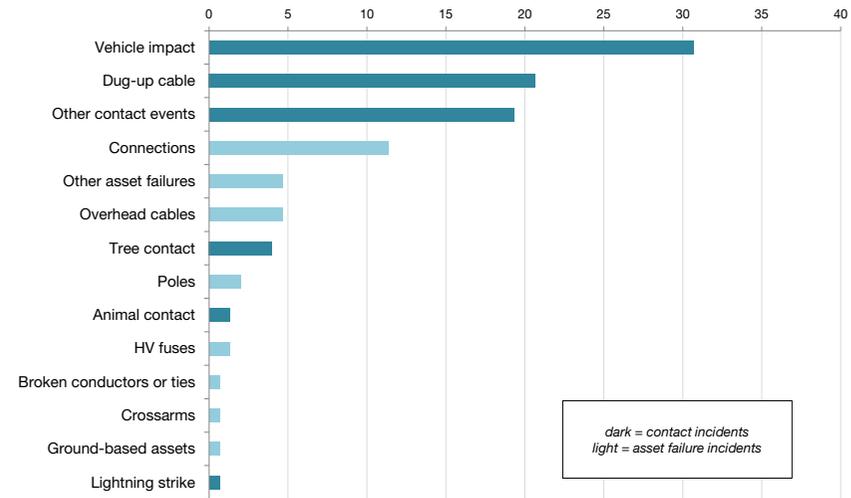


Figure 18 Incidents on the CitiPower network (per year)

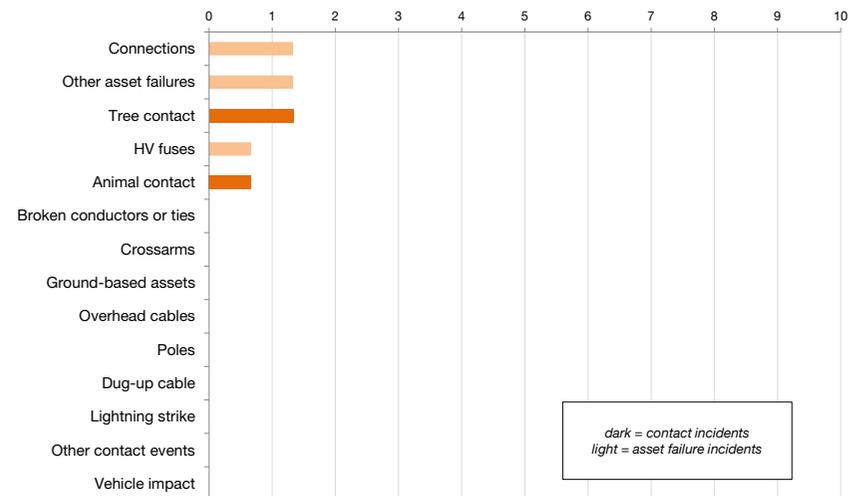


Figure 19 Incidents on the CitiPower network resulting in fires (per year)

CitiPower has noted that condition monitoring from 2011 to 2015 identified fewer assets that required replacement than had been estimated in the CitiPower submission to the AER at the outset of the period. Therefore, CitiPower did not complete several of its AER-approved safety-related programs to the forecast volumes. This suggests there may be an issue with the ability of CitiPower to accurately estimate its asset replacement requirements, which may cast doubt on forecasts of asset replacement requirements in other areas.

CitiPower has the smallest service area of all the businesses yet the highest customer density. As such, the CitiPower network faces some unique challenges due to urban density, increasing development and high traffic levels. While these drivers are not necessarily within the direct control of CitiPower, the business does need to consider setting strategies in place to better manage these risks. Such measures could include:

- ▶ identification of black-spot areas and development of engineering solutions to relocate or protect assets at risk
- ▶ identification and follow-up education of offenders for dug-up cables and No Go Zone infringements to avoid recurrence
- ▶ targeted awareness campaigns on trenching procedures, including Dial Before You Dig procedures, information on the types of protective covers, identification of power cables, and how to read and interpret engineering drawings.

ESV recognises the efforts that CitiPower currently makes in relation to these last two measures and its ongoing collaboration with ESV to improve outcomes in these areas.

C7 Implementation of 2014 recommendations

In November 2015, when responding to the recommendations of ESV, CitiPower made specific reference to the deployment of a new IT platform and integrated works management system that would address many of the issues raised by ESV in the 2014 report. This has recently been deployed; testing and refinement is currently in progress.

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APPENDIX D : JEMENA

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

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

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

The Jemena AC distribution network covers any area of approximately 950km², across Melbourne's northern and western suburbs, including Melbourne International Airport (Figure 20). It comprises approximately 4450km of overhead line, 1800km of underground cable and 104,700 poles. Most of this network (86 per cent) is in urban areas.



Figure 20 Service area for the Jemena distribution network (orange area)

CitiPower and United Energy service boundaries are shown in orange

D1 Plans and processes

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

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

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

A Preliminary Safety Case was first provided by Jemena on 5 October 2015. After three iterations, a Preliminary Safety Case was accepted by ESV on 20 September 2016. Jemena is proceeding with developing its Full Safety Case incorporating feedback from the Preliminary Safety Case assessment for submission to ESV by 2 December 2016.

Jemena also submitted its Electric Line Clearance Management Plan to ESV on 31 March 2016. ESV has assessed the submitted plan and will be consulting with Jemena to ensure a compliant and approved plan is in place prior to the fire danger period.

D2 Safety programs

In the 2011-2015 Electricity Distribution Price Review, the Australian Energy Regulator (AER) identified fourteen safety programs for the Jemena distribution network.¹⁹

Jemena sought to revise the targets for eight of the programs in 2012. This saw the two service replacement programs merged into a single program and the target for one service line clearance program revised down and one clearance program removed. Notwithstanding this, ESV continues to report against the original AER targets.

Performance at the end of the five-year period is detailed in Table 4.

Of the thirteen safety programs being reported against, seven have been successfully completed.

Jemena has provided the following comments on the remaining six safety programs that did not achieve their original target:

- ▶ Non-preferred service replacement

The target comprised proactive replacement works independent of other programs and replacement works to be undertaken in conjunction with other programs.

Jemena has completed the proactive replacement works; however, there were fewer opportunities to replace services as part of other planned programs.

The planned replacement of non-preferred services will continue throughout 2016 as an ongoing safety initiative. That said, ESV notes that there is no definitive program of works (including completion date) that has been communicated to ESV.

¹⁹ See Table P.41, *Victorian electricity distribution network service providers : Distribution determination 2011–2015*. Final decision - appendices. October 2010.

Table 4 Performance of Jemena safety programs

program	target	actual	
Planned non-preferred service replacement (services)*	33,987*	30,972	🕒
Height replacement – non-preferred service replacement (services)*			
Identification and removal of public lighting switch wire (spans)	5100	5746	✓
Replace existing SWER lines with 22 kV overhead bare conductor (km)	13	14	✓
Install GFN and associated equipment at zone substations (zone substations)	3	0	✗
Replace crossarms/insulator sets – pole top fire mitigation (number replaced)	2835	2834	✓
Replace crossarms – based on age and condition (number replaced)	14,117	12,684	✗
Replace poles – based on age and condition (number replaced)	1294	1879	✓
Stake poles – based on age and condition (number replaced)	1114	3650	✓
Replace undersized poles (number replaced)	1385	551	✗
Stake undersized poles (number replaced)	1100	2070	✓
Replace overhead conductor – mainly steel (km)	112	163.31	✓
Service line clearance – overhead services requiring relocation (services)	2691	132	✗
Service line clearance – overhead services requiring undergrounding (services)	672	0	✗

* The two targets of 30,000 and 3987 respectively have been added together as Jemena only reports on these two programs on combined basis.

🕒 Actual is within 10% of target.

- ▶ Install GFN and associated equipment at zone substations

Ground fault neutralizers (GFN), generically known as rapid earth fault current limiters (REFCL), are a new technology and have posed challenges to implement.

While all front-end engineering work was completed in 2011, Jemena was awaiting the results of the Victorian industry GFN trials to inform its decision on the technology before commencing installation works.

ESV notes that work on installation of an arc suppression coil device at Sydenham Zone Substation was to commence in early 2016; however, this had not started as of 30 June and is likely to be deferred until 2017. With the new bushfire regulations, operational delivery of full GFN/REFCL program is to be completed in stages statewide by 2023 (see Section 3.6.3). As part of this program, the works at Sydenham Zone Substation are not due to be completed until 1 May 2023 and, therefore, failure to deliver this safety program is not regarded as material at this stage.

- ▶ Replace crossarms - based on age and condition

All Jemena crossarms have been inspected and those identified as requiring replacement have been replaced.²⁰

Jemena continues to inspect assets, identify and prioritise those requiring replacement, with the focus for the 2016 program being replacement of crossarms with high and medium priority ratings. Jemena no longer uses asset age alone as a determinant for replacement.

- ▶ Replace undersized poles

A greater number of poles were suitable for staking. The combined total of undersized poles actually staked and replaced exceeds the combined target.

²⁰ For any age group, there can be a high degree of variability due to differences in crossarm material type (including different types and sources of wood), environmental conditions and exposure to pests and rot. Replacement based on age only may see assets replaced when condition assessment would recommend they stay in service. Premature replacement of serviceable assets can impact financially on the distribution business and its customers.

- ▶ Service line clearance – overhead services requiring relocation or undergrounding

Jemena has inspected all overhead services and determined that the AER targets overestimated the volume of service lines requiring relocation to achieve compliance.

Jemena holds that reductions in works on this category have been offset by increases in other programs where compliance was better achieved through other measures.

Line replacement works will continue throughout 2016 as part of maintenance rather than as a safety improvement initiative.

While ESV notes the explanations for most underperforming programs, ESV is concerned by the significant under-delivery of the program to relocate or underground overhead services — delivering only 132 services against a combined target of 3363 (just 4 per cent). Jemena has identified the issue to be the overestimation of volumes of work it provided to the AER at the outset of the Price Review period. This calls into question the ability of Jemena to accurately forecast its future asset replacement needs. ESV will hold further discussions regarding this specific program and will seek further advice from Jemena on its condition monitoring processes.

D3 Directions

ESV has issued two directions to Jemena:

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

By 31 December 2015 Jemena had only installed 1701 armour rods against a target of 5100. Jemena has explained that it had over-estimated the number of armour rods that required installation when the AER determination was developed. Jemena asserts the all spans have been inspected and those needing armour rods have had them installed.

ESV has concerns that either Jemena is not delivering against this direction or faces difficulties in estimating the condition (and hence safe operations) of its network. This will be an area of focus for ESV's ongoing oversight of Jemena.

Jemena has also installed 5234 vibration dampers against a target of 5100.

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

D4 Exemptions

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

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

- ▶ cyclic clearing – ABC or insulated cable in all areas
- ▶ cyclic clearing – powerlines other than ABC or insulated cable in hazardous bushfire risk areas (HBRA)
- ▶ cyclic clearing – powerlines other than ABC or insulated cable in low bushfire risk areas (LBRA).

Compliance was to be achieved by 31 December 2013. All three exemptions were completed to ESV's satisfaction in 2013.

D5 Audit performance

D5.1 Electrical Safety Management Scheme

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Additionally, extensive systems audits had been conducted on core aspects of the ESMS in previous years, without identifying systemic deficiencies.

D5.2 Electric line clearance

An electric line clearance audit of the Jemena distribution network was conducted between 9 and 11 December 2015. This was undertaken at randomly selected locations throughout the network. The audit inspected assets in HBRA and LBRA, although emphasis was placed on assets in HBRA due to the increased fire threat associated with HBRA. This was despite HBRA in the Jemena service area being relatively small at approximately 4000 spans. A total of 470 electricity spans were inspected during the field component of the audit. Of these spans, 258 were located within HBRA and 212 in LBRA.

The audit found the following:

- ▶ noncompliant spans
 - HBRA 0
 - LBRA 9
- ▶ Variance
 - HBRA = 0 of 258 0%
 - LBRA = 9 of 212 4.2%

Jemena has improved its vegetation management in HBRA relative to previous years.

Generally the noncompliant spans in LBRA fell into two groups:

- ▶ Spans for which Jemena is responsible = 8

The audit results indicate that, where Jemena is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for reasonable compliance standards (as indicated by its exemplary performance in HBRA covered by the audit). Vegetation within LBRA is maintained well, albeit to a lesser extent in lower risk areas. Overall acceptable compliance was achieved.

- ▶ Spans for which Jemena is not responsible = 1

Where noncompliant vegetation identified was not the management responsibility of Jemena, it was the responsibility of municipal councils or private property owners and occupiers. The high level of compliance in this area reflects the proactive approach by Jemena in recent years to follow up notification and consultation with other responsible parties regarding noncompliant vegetation.

There was a high level of validation between database information and field audits with 93.2 per cent (438 spans) of span information being assessed as accurate indicating sound practices in database, assessment and information management.

Conversations with a small sample of land owner / occupiers indicated they were satisfied with the notification and consultation processes adopted by Jemena for vegetation management activities affecting their property.

The electric line clearance audit recommended that Jemena:

- continues to utilise and develop procedures to ensure annual inspection programs are completed efficiently and vegetation database management is maintained at its current high level of currency and accuracy
- considers implementing a management plan to address the non-conforming spans identified.

D5.3 Bushfire mitigation

The bushfire mitigation desktop audit assessed compliance with legislation and internal business process with a focus on asset inspection.

The audit findings showed that Jemena generally had sound processes and procedures in place to adequately manage and check on the quality of the asset inspection work. These included clear role responsibilities, training requirements and audit procedures.

Some opportunities for improvement were identified during the audit which included:

- ▶ implementing an approved procedure for the checking of asset defect photographs
- ▶ developing a detailed procedure that defines responsibilities for the updating of bushfire mitigation plan, and ensures its currency
- ▶ updating the asset inspection manual which is out of date and contains information that does not meet the asset inspection timeframe requirements of the bushfire mitigation regulations [r.7(1)(i)(i)]
- ▶ ensuring a sound understanding of the regulatory requirement to submit a revised bushfire mitigation plan, and adequately capturing the changes made to the plan in the revision log.

None of the issues identified was of major concern.

D5.4 Work practices

In 2015-2016, ESV undertook two audits of Jemena work practices across four sites. The findings of these audits were as follows:

- | | |
|---------------------------------|---|
| ▶ noncompliances | 2 |
| ▶ areas requiring attention | 4 |
| ▶ opportunities for improvement | 7 |

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

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

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

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

D6 Safety indicators

Figure 21 shows the annualised number of all serious electrical incidents reported to ESV by Jemena, with the data sorted from most frequent to least frequent. Figure 22 shows the same for those incidents that result in an asset or ground/vegetation fire.

Of the six most common incidents, the top two events are largely outside of the direct control of Jemena to manage. Crossarm, broken conductor/tie and connection failures are within the direct control of Jemena, as is tree contact.

The same applies to fire-related events where fires from other contact events and vehicle impact are outside the direct control of Jemena.

Jemena has substantially failed to deliver the estimated targets for the relocation and undergrounding of overhead services components of its safety program. The gaps are of such a size that it can only call into question the processes around asset inspection and forecasting of future replacement for this class of assets.

That said, Jemena has been active in allocating resources to manage its risks in HBRA and is the only business that has replaced all wooden crossarms in HBRA with steel crossarms to prevent crossarm fires. This is a positive outcome that has been reflected in Jemena having no crossarm fires (see Figure 22).

While only mandated to install one REFCL under the amended bushfire mitigation regulations, Jemena has committed to install three additional arc suppression coils to proactively reduce risk of ignition on its network.

5.6 Implementation of 2014 recommendations

Jemena provided a comprehensive response to the recommendations of ESV, including detail of what it had done to ensure they were implemented.

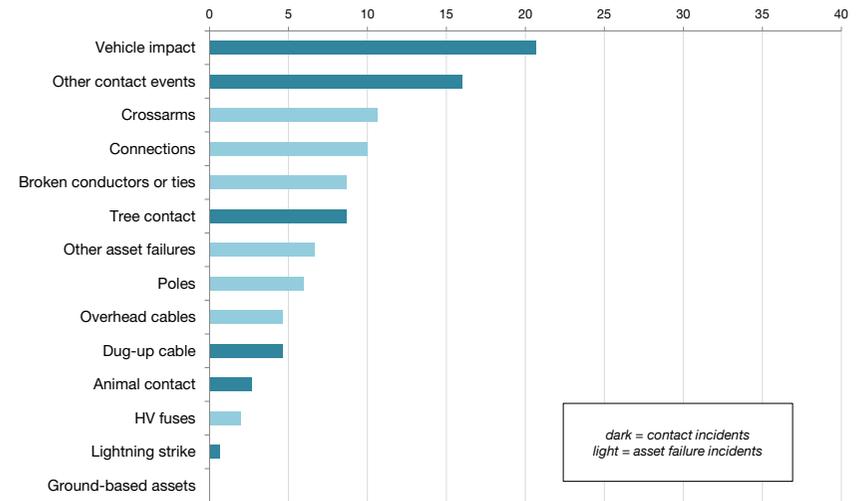


Figure 21 Incidents on the Jemena network (per year)

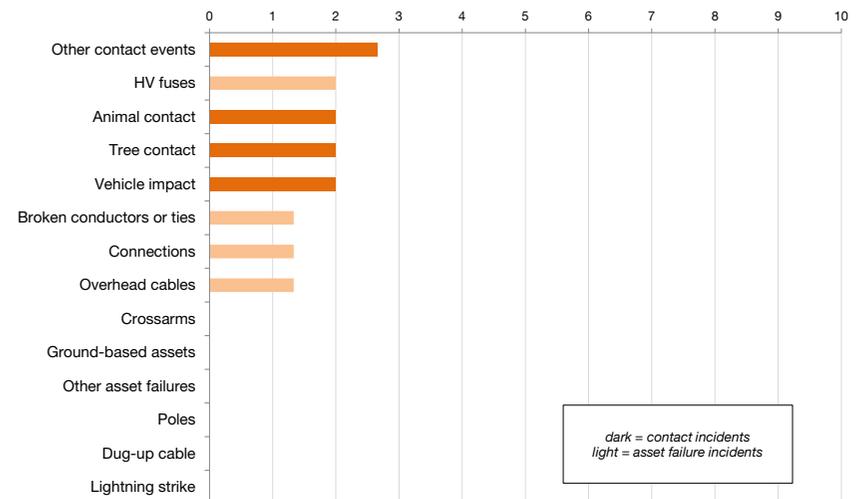


Figure 22 Incidents on the Jemena network resulting in fires (per year)

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APPENDIX E : POWERCOR

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

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 C5.1) and the work practices observations audits (Section C5.4) 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 AC distribution network covers any area of approximately 145,700km², and includes Melbourne's Docklands Precinct, west from Williamstown to the South Australian border, north to the Murray and south to the coast (Figure 23). It comprises approximately 58,960km of overhead line, 8040km of underground cable and 562,000 poles. Most of this network (92 per cent) is in rural areas.



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

E1 Plans and processes

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

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

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

A Preliminary Safety Case was first provided by Powercor on 27 July 2015. After three iterations a Preliminary Safety Case was accepted by ESV on 1 September 2016. Powercor is proceeding with developing its Full Safety Case incorporating feedback from the Preliminary Safety Case assessment for submission to ESV by 11 November 2016.

Powercor also submitted its Electric Line Clearance Management Plan to ESV on 31 March 2016. ESV has assessed the submitted plan and will be consulting with Powercor to ensure a compliant and approved plan is in place prior to the fire danger period.

E2 Safety programs

In the 2011-2015 Electricity Distribution Price Review, the Australian Energy Regulator (AER) identified nine safety programs for the Powercor distribution network.²¹

Since Powercor did not treat these programs as safety programs but rather regular maintenance, it did not set annual forecasts for the AER-accepted programs. Powercor was not funded to undertake accelerated replacement safety programs, but was funded to deliver maintenance programs over the price review period to forecast volumes provided by Powercor based on expected asset replacement rates over the five years.

ESV then linearly apportioned the forecast volumes to create annual estimates to monitor against for progress.

While such works may be scheduled as part of routine maintenance, the AER bundled funding under the safety program umbrella where these works would deliver a benefit to electrical safety. ESV has monitored performance against the volume assumptions implicit in the AER's expenditure allowances.

Performance at the end of the five-year period is detailed in Table 5.

Only five of the eight safety-related programs have achieved the forecast volumes initially provided by Powercor. The remaining three safety-related programs have not achieved their initial forecasts, with two close to completion and one that is well below the anticipated volume of work. While some targets have been exceeded by more than 100 per cent, the shortfall on the HV conductor replacement program calls into question the ability of Powercor to forecast volumes associated with some asset classes. ESV will follow this up with Powercor.

²¹ See Table P.39, *Victorian electricity distribution network service providers : Distribution determination 2011–2015*. Final decision - appendices. October 2010.

Table 5 Performance of Powercor safety programs

program	target	actual	
AER-identified safety programs			
Pole replacements (FC148) – sub-transmission (poles)	336	272	✘
Pole replacements (FC148) – HV (poles)	3312	5014	✔
Pole replacements (FC148) – LV (poles)	1056	1300	✔
Pole replacements (FC148) – pole and stay (poles)	96	194	✔
Pole replacements (FC149) – staked (poles)	4760	5239	✔
Crossarm replacements (FC155) (crossarms)	16,000	33,322	✔
HV overhead conductor replacements (km)	2380	366	✘
LV overhead conductor replacements (km)	20	18	🕒
🕒 Actual is within 10% of target.			

E3 Directions

ESV has issued three directions to Powercor:

- ▶ 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 LBRA by the end of 2020
- ▶ undertake powerline replacement projects specified by the Powerline Bushfire Safety Program under the Powerline Replacement Fund.

The first two directions were due for completion in HBRA by 31 December 2015. Powercor was directed to undertake nineteen projects for the Powerline Replacement Fund (PRF) with separate completion dates for each project.

The spacers and spreaders direction and the nineteen PRF projects were completed on time.²² The armour rods and vibration dampers direction still needs to be completed.

In setting up the armour rod and vibration damper direction, Powercor estimated 20,300 armour rods and 195,700 vibration dampers would be needed.²³ Despite having separate targets for each component, the method used by Powercor for recording progress against this program did not differentiate between the two components. Effectively Powercor only reported to ESV the number of sites where one or more components were installed (in line with the other distribution businesses).

²² Powercor was recently recognised by the Australian Institute of Project Management for the successful delivery of these projects.

²³ This differed from the other distribution businesses, where the target referred to a number of sites where rods and/or dampers would be required. Given some locations may require installation of both components, the two targets cannot be simply added together into a combined target.

By 31 December 2015 Powercor had installed armour rods and/or vibration dampers at 177,558 sites. This is a shortfall against the vibration damper target.

Powercor estimates that approximately 9 per cent of its asset locations in HBRA still need to have armour rods and vibration dampers installed, and that the remaining spans will be completed by the end of 2016.²⁴

Powercor has demonstrated to ESV that the outstanding nine per cent to be completed in HBRA is of lower risk due to the higher standard of 66kV assets where armour rods and vibration dampers have yet to be deployed. Nonetheless these areas are still exposed to a higher (albeit small) bushfire risk than would have been the case if the direction had been completed on time.

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

ESV will monitor Powercor's implementation of the recommendations and completion of the works in HBRA to ensure the situation is rectified as soon as possible.

E4 Exemptions

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

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

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

Compliance was to be achieved by 31 December 2014. The works on powerlines other than ABC or insulated cable in HBRA were completed in 2013. The other two exemptions were both 99.8% complete by 31 December 2014, and were finished to ESV's satisfaction in 2015.

²⁴ In 2014, Powercor and AusNet Services wrote to ESV seeking a reduction in this program on the basis that not all overhead lines identified would be subject to wind-induced vibration. ESV requested that an engineering assessment be provided justifying the claim. No further evidence was supplied.

While AusNet Services moved forward and completed its directions program, Powercor sought to defer 16,700 spans until after 1 November 2015 and, without receiving an exemption from ESV, failed to complete its directions program.

E5 Audit performance

E5.1 Electrical Safety Management Scheme

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Additionally, extensive systems audits had been conducted on core aspects of the ESMS in previous years, without identifying systemic deficiencies.

E5.2 Electric line clearance

An electric line clearance audit of the Powercor distribution network was conducted between 9 and 13 November 2015. This was undertaken at randomly selected locations throughout the network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting electricity spans located in HBRA. Spans in LBRA were inspected to a lesser extent. A total of 598 electricity spans were inspected during the field component of the audit. Of these spans, 406 were located within HBRA and 192 in LBRA.

The audit found the following:

- ▶ noncompliant spans
 - HBRA 3
 - LBRA 19
- ▶ variance
 - HBRA = 3 of 406 0.7%
 - LBRA = 19 of 192 9.9%

Generally the noncompliant spans fell into two groups:

- ▶ Spans for which Powercor is responsible = 13

The audit results indicate that, where Powercor is responsible for vegetation management, its processes and clearing activities are implemented effectively and provide for reasonable compliance standards. This is particularly the case for the HBRA covered by the audit. Vegetation within LBRA is maintained to a lesser extent. Overall acceptable compliance was achieved.

The field audit assessed 585 spans as being compliant for vegetation clearance from a Powercor perspective which represented 97.8 per cent of the audit sample.

- ▶ Spans for which Powercor is not responsible = 9

Where noncompliant vegetation identified was not the management responsibility of Powercor, it was the responsibility of municipal councils or private property owners and occupiers. For spans managed by other responsible parties, the audit results indicate that 9 out of 112 spans were noncompliant, equating to 8.0 per cent of the audit sample.

While the potential for bushfire starts in LBRA is lower than HBRA, the higher frequency of noncompliant spans in LBRA may adversely affect electrical safety and the reliability of supply.

Powercor has systems in place to notify such responsible persons of the requirement to maintain a clearance space. The audit indicates that there is room for further improvement in this area.

Based on the evidence collected for the specific audit sample the systems and processes utilised by Powercor to manage electric line clearance appeared to be, in general, effective and provided a sound basis for ensuring compliance to the relevant regulations, code of practice and their submitted electric line clearance management plan.

The electric line clearance audit recommended that Powercor:

- ▶ utilises the opportunity of transitioning to a new vegetation management database to establish clear protocols for data capture and database management
- ▶ reviews the process for assessing, capturing and recording span code data as the field audit results indicate inconsistencies between recorded codes and observations recorded by the ESV auditor
- ▶ reviews the accuracy of recorded inspection span codes following the next inspection cycle as the field audit results indicate inconsistencies between recorded and actual data.

E5.3 Bushfire mitigation

The bushfire mitigation desktop audit assessed compliance with legislation and internal business process with a focus on asset inspection.

The audit findings showed that Powercor generally had sound processes and procedures in place to adequately manage and check on the quality of the asset inspection work. These included clear responsibilities for each role, training requirements, and audit procedures.

Some opportunities for improvement were identified during the audit, which included:

- ▶ ensuring the latest accepted bushfire mitigation plan is published on its website
- ▶ developing a detailed procedure that defines responsibilities for the updating of bushfire mitigation plan, and ensures its currency
- ▶ closely monitoring the audit program to ensure it complies with the requirements stated in relevant auditing standards and Powercor policies and procedures.

None of the issues identified was of major concern.

E5.4 Work practices

In 2015-2016, ESV undertook three audits of Powercor work practices across five sites. The findings of these audits were as follows:

- | | |
|---------------------------------|---|
| ▶ noncompliances | 1 |
| ▶ areas requiring attention | 1 |
| ▶ opportunities for improvement | 5 |

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

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

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

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

E6 Safety indicators

Figure 24 shows the annualised number of all serious electrical incidents reported to ESV by Powercor, with the data sorted from most frequent to least frequent. Figure 25 shows the same for those incidents that result in an asset or ground/vegetation fire.

Of the five most common incidents, two of the events are outside of the direct control of Powercor to manage. Only crossarms, connections and pole failures are within the direct control of Powercor.

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

Powercor operates the largest network in Victoria: the area it services is 82 per cent larger than AusNet Services and it owns 68 per cent more overhead lines than AusNet Services. It is therefore not surprising that Powercor recorded the highest number of electrical safety incidents in the 2015-2016 period. Even so, Powercor experienced four times as many pole failures and twenty times more crossarm failures than AusNet Services despite only having 72% more wooden poles.

In contrast, Powercor experienced fewer tree contact events and HV fuse failures than AusNet Services (see Section A6). Fewer tree contacts are to be expected given the lower vegetation density across the Powercor network (see Appendix H). Conversely, Powercor has a larger network with more fuses and, therefore, more HV fuse failures would be expected on its network. This is a positive result for which Powercor should be commended.

Powercor also experienced more fire events than the other businesses across all categories except two. AusNet Services had the largest number of fires from tree contact.

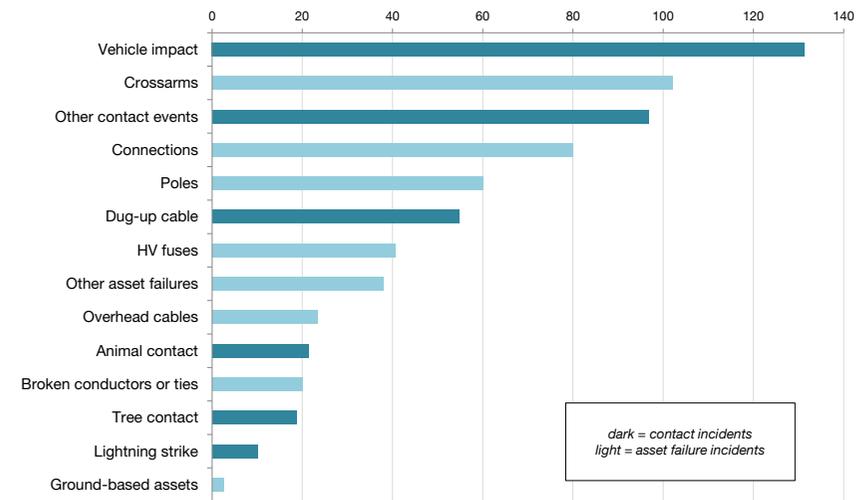


Figure 24 Incidents on the Powercor network (per year)

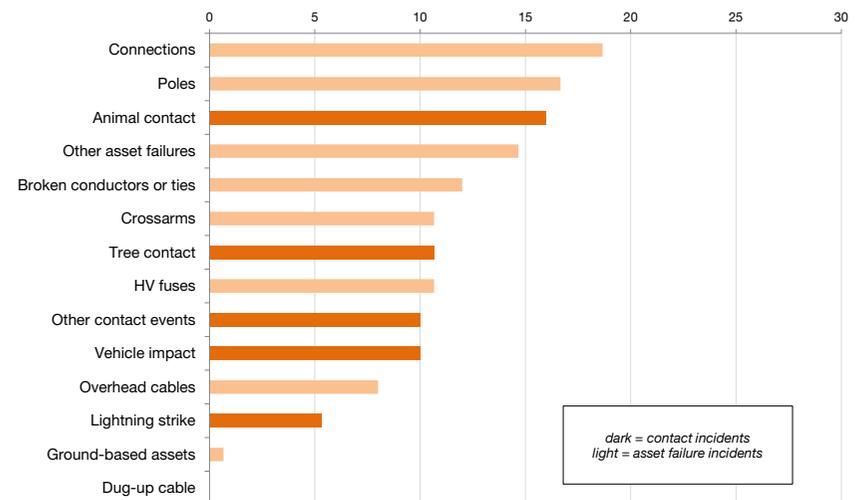


Figure 25 Incidents on the Powercor network resulting in fires (per year)

It should be noted that, with the deployment of the new OSIRIS incident reporting system, Powercor has been exemplary in providing genuinely constructive feedback to improve the reporting system. ESV will be undertaking further data analysis and discussions with Powercor to ascertain the true cause of the disproportional number of fire events on the Powercor network.

That said, ESV remains concerned with high incident rates on the Powercor network, the forecasting of its AER-funded safety programs and the delivery of its directions.

Powercor did not deliver the volumes initially forecast for HV overhead conductor replacement. Regardless of whether this is treated as a safety program or as business-as-usual maintenance as Powercor contends, Powercor did not complete the works it initially estimated would be required. This is possibly because of poor forecasting of the volume of work that should be identified from future asset inspection. This indicates that Powercor may need to improve the forecasting processes used to inform asset replacement decision-making.

ESV will therefore be increasing its oversight of the Powercor asset management strategy, the forecasting techniques used and the decision-making processes around asset replacement.

E7 Implementation of 2014 recommendations

In November 2015 Powercor wrote to ESV in response to its recommendations. ESV recommended that Powercor reconsiders its management process to ensure the directions and exemptions programmes are adequately completed and recorded. Powercor asserted that the programmes were on track. ESV could only assume a linear rate of progress against which track the performance of Powercor because Powercor failed to provide a plan against which to track progress. This may explain the difference, but does not alter that fact that the Powercor vibration damper and armour rod program was not completed on time.

APPENDIX F : TRANSMISSION OPERATIONS AUSTRALIA

Transmission Operations Australia (TOA) is jointly owned by Cheung Kong Infrastructure Holdings Ltd (50 per cent) and Power Assets Holdings Ltd (50 per cent). Both are part of the Cheung Kong Group of companies. Together they also 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.

TOA owns and operates the connection from the Mt Mercer Wind Farm to the electrical transmission network (Figure 26). 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 owns and maintains. Its assets are also newer having only been commissioned in November 2013.



Figure 26 Location of TOA transmission assets (orange square)

F1 Plans and processes

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

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

TOA submitted its Electric Line Clearance Management Plan to ESV on 31 March 2016. ESV has assessed the submitted plan and will be consulting with TOA to ensure a compliant and approved plan is in place prior to the fire danger period.

F2 Safety programs

TOA is not regulated by the AER and, as such, AER-approved safety programs do not apply.

TOA has no identified safety issues that warrant monitoring by ESV.

F3 Directions

ESV has not had cause to issue directions to TOA.

F4 Exemptions

TOA has sought no exemptions from regulations.

F5 Audit performance

F5.1 Electrical Safety Management Scheme

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Additionally, 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. Given this and that fact that it had been subject to a major audit prior to commissioning in November 2013, ESV determined that there was greater merit focussing on embedding the new safety case regime and its structured approach to risk management within TOA.

F5.2 Electric line clearance

The electric line clearance of the TOA transmission assets were inspected as part of the validation audit of the TOA ESMS in October 2013. Additionally electric line clearance processes were audited as part of the Powercor audit between 9 and 13 November 2015. This was undertaken at randomly selected locations along the length of the 22km 132kV powerline, which is all in HBRA.

Consistent with being a new asset (commissioned in November 2013), the audit indicated that TOA requires very little maintenance at this stage of its life cycle with adequate clearance maintained.

The audit results also indicate that TOA is responsible for all vegetation management; its processes and clearing activities are implemented effectively and provide for reasonable compliance standards. Overall acceptable compliance was achieved.

Based on the evidence collected for the specific audit sample the systems and processes utilised by TOA to manage electric line clearance appeared to be, in general, effective and provided a sound basis for ensuring compliance to the relevant regulations, code of practice and their submitted electric line clearance management plan

F5.3 Bushfire mitigation

The bushfire mitigation desktop audit was coupled with the Powercor audit (as it is effectively the same system). The audit assessed compliance with legislation and internal business process with a focus on asset inspection.

The audit 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 asset inspection work. These included clear role responsibilities, training requirements, and audit procedures.

Some opportunities for improvement were identified during the audit which included:

- ▶ ensuring the latest accepted bushfire mitigation plan is published on its website
- ▶ develop a detailed procedure that defines responsibilities for the updating of bushfire mitigation plan, and ensures its currency
- ▶ closely monitor the audit program to ensure it complies with the requirements stated in relevant auditing standards, and Powercor policies and procedures

F5.4 Work practices

ESV is yet to undertake a work practice audit 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.

F6 Safety incidents

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

Compared to the AusNet Services transmission network, TOA has the further advantage of having a very short transmission line. Also being a relatively new asset, TOA 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 their transmission network during the 2015-2016 period.

F7 Implementation of 2014 recommendations

ESV made no recommendations specific to TOA.

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APPENDIX G : UNITED ENERGY

United Energy is jointly owned by DUET Group (66 per cent) and SGSP (Australia) Assets Pty Ltd (34 per cent). SGSP (Australia) Assets also owns 100 per cent of Jemena and the two companies forming SGSP (Australia) Assets Pty Ltd also own the controlling interest in AusNet Services.

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

The distribution network covers an area of approximately 1470km² across Melbourne's eastern and south-eastern suburbs and the Mornington Peninsula (Figure 27). It comprises approximately 10,300km of overhead line, 2600km of underground cable and 204,000 poles. Most of this network (75 per cent) is in rural areas.



Figure 27 Service area for the United Energy distribution network (orange area)

Jemena and CitiPower service boundaries are shown in orange

G1 Plans and processes

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

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

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

A Preliminary Safety Case was first provided by United Energy on 30 September 2015. The Preliminary Safety Case was accepted by ESV on 11 March 2016, with United Energy having now submitted its Final Safety Case for assessment on 1 July 2016. It is expected that upon assessment of the Final Safety Case, a revised ESMS will be submitted to ESV by 30 November 2016.

United Energy also submitted its Electric Line Clearance Management Plan to ESV on 31 March 2016. ESV has assessed the submitted plan and will be consulting with United Energy to ensure a compliant and approved plan is in place prior to the fire danger period.

G2 Safety programs

In the 2011-2015 Electricity Distribution Price Review, the Australian Energy Regulator (AER) identified 22 safety programs for the United Energy distribution network.²⁵

United Energy sought to revise the targets for eight of the programs in 2012. These changes were noted by ESV, but ESV continues to report against the original AER targets.

Performance at the end of the five-year period is detailed in Table 6.

In 2012 United Energy identified eleven further safety programs that warranted early replacement of assets that may pose a safety risk. The performance of these programs is also addressed in Table 6.

At the end of the five-year period, only five of the 22 AER-designated safety programs and six of the eleven United Energy safety programs were completed.

United Energy has provided a summary report to ESV that offers an unsatisfactory explanation for the lack of progress on its numerous safety programs. United Energy asserts that all assets have been inspected and any safety issues rectified, and the lack of progress is largely due to not finding as many opportunities for replacements or repair as had been expected when United Energy set the original targets.

Given United Energy failed to deliver against 22 of the 33 safety programs, comments on individual programs will not be provided herein. Either United Energy over-estimated its replacement works during the AER economic review, or did not effectively manage its safety programs, or faces significant difficulties in forecasting volumes for future workloads.

²⁵ See Table P.46, *Victorian electricity distribution network service providers : Distribution determination 2011–2015*. Final decision - appendices. October 2010.

Table 6 Performance of United Energy safety programs

program	target	actual	
AER-identified safety programs			
Planned non-preferred service replacement (services)	144,000	102,305	✘
Height replacement – non-preferred service replacement (services)	12,618	10,380	🌀
Identification and removal of public lighting switch wire (spans)	7236	38,779	✔
Replace existing SWER lines with 22 kV overhead bare conductor (km)	44	4.5	✘
Install GFN and associated equipment at zone substations (zone substations)	7	0	✘
Replace crossarms – pole top fire mitigation (number replaced)	3000	486	✘
Replace sets of insulators – pole top fire mitigation (number replaced)	3400	1287	✘
Inspections, cleaning, tightening, life extension – pole top fire mitigation (number)	3300	3038	🌀
Replace crossarms – based on age and condition (number replaced)	50,088	36,565	✘
Pole top structure - HV fuse replacement	808	1466	✔
Pole top structure - surge diverter replacement	1054	1682	✔
Install HV ABC in high bushfire risk areas (metres)	24,000	1600	✘
Install LV ABC in high bushfire risk areas (metres)	14,750	1300	✘
Replace poles – based on age and condition (number replaced)	2805	3551	✔
Stake poles – based on age and condition (number replaced)	2098	3855	✔
Replace overhead steel conductors in high bushfire risk areas (km)	80	29.65	✘

program	target	actual	
Replace other conductors in high bushfire risk areas (km)	126	5.13	✘
Install backup protection schemes (zone substations)	15	14	🌀
Service line clearance – overhead services requiring relocation (services)	7083	1047	✘
Service line clearance – overhead services requiring undergrounding (services)	1771	1	✘
Overhanging trees capex (underground, line relocation, ABC etc) – High bushfire risk area (spans)	700	0	✘
Overhanging trees capex (underground, line relocation, ABC etc) – Low bushfire risk area (spans)	28	0	✘
Additional United Energy safety programs			
Doncaster pillars	790	739	🌀
Air break switch replacement with gas switches	915	370	✘
P brackets with pole caps replacement	1200	7021	✔
Kaon fuse replacement	50	1	✘
LiDAR	1	0	✘
Low transformer mounting height	17	175	✔
Low tramways projects	4	4	✔
Zone substation security	6	10	✔
Earthing	153	3	✘
DC systems management	43	44	✔
Bird and animal proofing	793	1628	✔
🌀 Actual is within 10% of target.			

If ESV had accepted the revised targets proposed by United Energy in 2012, this would only have resulted in successful completion of a further three AER-designated programs. ESV would still have the same concerns about the efficiency of safety program management or condition forecasting by United Energy. This will be an area of focus for ESV's ongoing oversight of United Energy.

The 2010-2015 regulatory period was completed without United Energy achieving the volumes associated with its safety program targets. Many of these issues still remain in its network (for instance, only a third of asbestos pillars in Doncaster have been replaced). ESV is concerned that United Energy believes that these can now be managed by general condition monitoring and asset inspection without proactively removing these known risks from its network. ESV will be seeking further consultation with United Energy about its ongoing commitment to addressing the safety concerns remaining in its network.

G3 Directions

ESV has issued two directions to United Energy:

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

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

G4 Exemptions

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

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

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

Compliance was to be achieved by 31 December 2013. All three exemptions were completed to ESV's satisfaction in 2013.

G5 Audit performance

G5.1 Electrical Safety Management Scheme

In 2015 ESV focused its attentions on electric line clearance and bushfire mitigation audits as subsets of the ESMS and key elements of bushfire prevention. Additionally, extensive systems audits had been conducted on core aspects of the ESMS in previous years, without identifying systemic deficiencies.

G5.2 Electric line clearance

An electric line clearance audit of the United Energy distribution network was conducted between 14 and 16 December 2015. This was undertaken at randomly selected locations throughout the network. Due to increased fire threats associated with the network, particular emphasis was placed on inspecting 1 electricity spans located in HBRA. Spans in LBRA were inspected to a lesser extent. A total of 437 electricity spans were inspected during the field component of the audit. Of these spans, 325 were located within HBRA and 112 in LBRA.

The audit found the following:

- ▶ noncompliant spans
 - HBRA 33
 - LBRA 37
- ▶ Variance
 - HBRA = 33 of 325 10.2%
 - LBRA = 37 of 112 33.0%

Generally the noncompliant spans fell into two groups:

- ▶ Spans for which United Energy is responsible = 25 (in HBRA), 28 (in LBRA)

The audit results where United Energy is responsible for vegetation management included 51 of the non-compliant spans related to vegetation growth inside the minimum clearance space, and two spans where vegetation was in contact with low voltage assets. The audit results indicate that vegetation management by United Energy focuses more on HBRA, whereas LBRA is maintained to a lesser extent.

- ▶ Spans for which United Energy is not responsible = 8 (in HBRA), 9 (in LBRA)

Where noncompliant vegetation identified was not the management responsibility of United Energy, it was the responsibility of municipal councils or private property owners and occupiers, accounting for seventeen noncompliant spans. Local councils were assessed as being responsible for eight noncompliant spans from a total of 103 spans audited (in HBRA and LBRA) or 7.8 per cent of the relevant audit sample. Property owner / occupiers were assessed as being responsible for nine noncompliant spans from the audit sample.

Span noncompliance rates for both HBRA and LBRA (7.7 and 25.0 per cent respectively) indicated a decline in performance compared to 2014 data, which recorded noncompliance rates of 4.6 and 15.3 per cent in HBRA and LBRA respectively across a sample of 891 spans.

The audit found evidence of noncompliant spans within HBRA indicating a possible delay in the completion of pre-summer preparedness activities.

United Energy has systems in place to notify responsible persons of the requirement to maintain a clearance space. There is, however, evidence that these systems may fail to:

- effectively notify the relevant persons of their responsibility
- track or provide for follow up consultation on responsible person inaction
- accommodate an effective escalation process when a responsible person has failed to act.

The electric line clearance audit recommended that United Energy:

- ▶ review the current Vegetation Management Database management procedures with its service providers to ensure they are effective in maintaining the accuracy and quality of database information across both HBRA and LBRA
- ▶ review the current processes and practices associated with confirming the accuracy of field assessment information to ensure its vegetation management data is captured and maintained with a high level of accuracy and quality
- ▶ implement a management plan to address the nonconforming spans identified.

Subsequently United Energy has implemented these recommendations to improve its vegetation management practices.

G5.3 Bushfire mitigation

The bushfire mitigation desktop audit assessed compliance with legislation and internal business process with a focus on asset inspection.

The audit findings showed that United Energy generally had sound processes and procedures in place to adequately manage and check on the quality of the asset inspection work. These included clear role responsibilities, training requirements, and audit procedures.

Some opportunities for improvement were identified during the audit which included:

- ▶ remove the disconnection of information flow between United Energy and its service providers²⁶
- ▶ ensure all asset inspection procedures and procedures for asset inspection are appropriately documented

- ▶ ensure the latest approved versions of all asset inspection policies and procedures are placed on the intranet to ensure they are easily locatable for relevant personnel.

ESV noted that United Energy is in the process of bringing management of its asset inspection program in-house; this had previously been contracted out to third-party suppliers. United Energy will contract directly with third parties to provide the asset inspection fieldwork services.

G5.4 Work practices

In 2015-2016, ESV undertook two audits of United Energy work practices across four sites. The findings of these audits were as follows:

- | | |
|---------------------------------|---|
| ▶ noncompliances | 0 |
| ▶ areas requiring attention | 2 |
| ▶ opportunities for improvement | 5 |

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

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

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

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

²⁶ As an example, asset inspectors have to use 'established channels' between the service provider and United Energy to communicate issues found in the field instead of providing this information directly to United Energy in an appropriate and timely manner.

G6 Safety indicators

Figure 28 shows the annualised number of all serious electrical incidents reported to ESV by United Energy, with the data sorted from most frequent to least frequent. Figure 29 shows the same for those incidents that result in an asset or ground/vegetation fire.

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

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

Across the fourteen types of contact and asset failure events, United Energy experienced the highest number of ground-based asset failures and the second-highest number of failures in six other categories. The categories in which United Energy experienced elevated incident levels were tree contact, other contact events and connection, crossarm, overhead cable and other asset failures.

The high levels of other contact events (including No Go Zone infringements and copper theft) may be explained by United Energy having large areas of peri-urban development in its service area. However, rating highly in half of the categories is unusual given United Energy has a significantly smaller asset base than Powercor and AusNet Services.

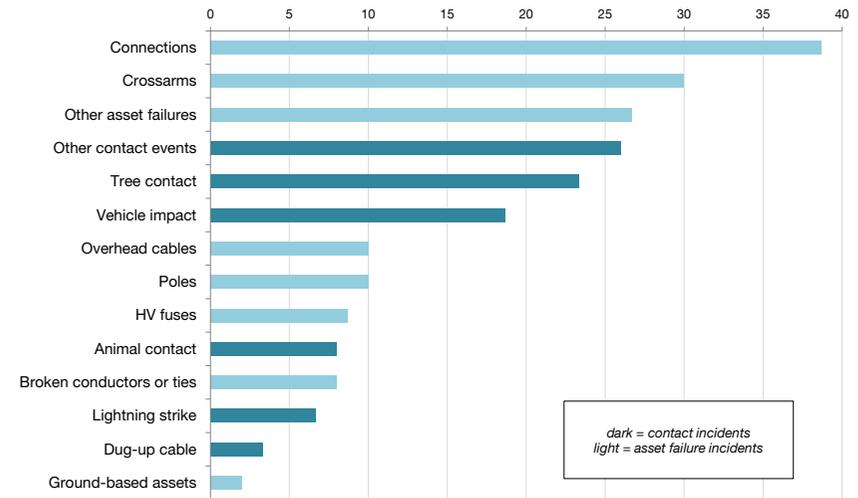


Figure 28 Incidents on the United Energy network (per year)

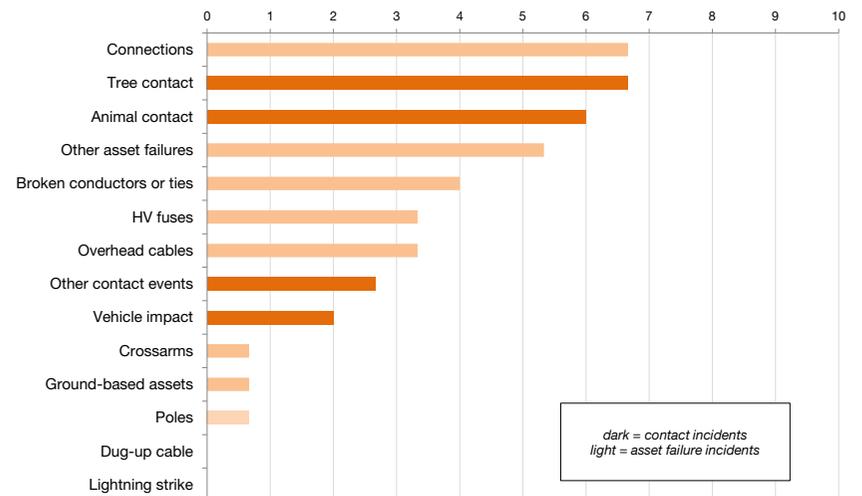


Figure 29 Incidents on the United Energy network resulting in fires (per year)

As noted in Section G2, United Energy failed to deliver most of its safety programs to the volumes originally estimated, both those initially agreed with the AER and those it introduced itself. Delivery of less than a quarter of the AER-designated safety programs and only half of the additional United Energy programs raises a number of issues that may have safety implications.

United Energy was unable to adequately forecast the volumes of work required for its safety programs. This indicates that United Energy may need to improve the forecasting processes used to inform asset replacement decision-making. ESV will therefore be increasing its oversight of the United Energy asset management strategy, the forecasting techniques used and the decision-making processes around asset replacement.

ESV recognises that, in 2014, United Energy reviewed and amended its pole-top inspection practices to align with well-established industry best practice. This has allowed United Energy to better assess the condition of its crossarms, and hence the need to replace them. This has led to a step-change increase in crossarm replacement rates late in the regulatory period.

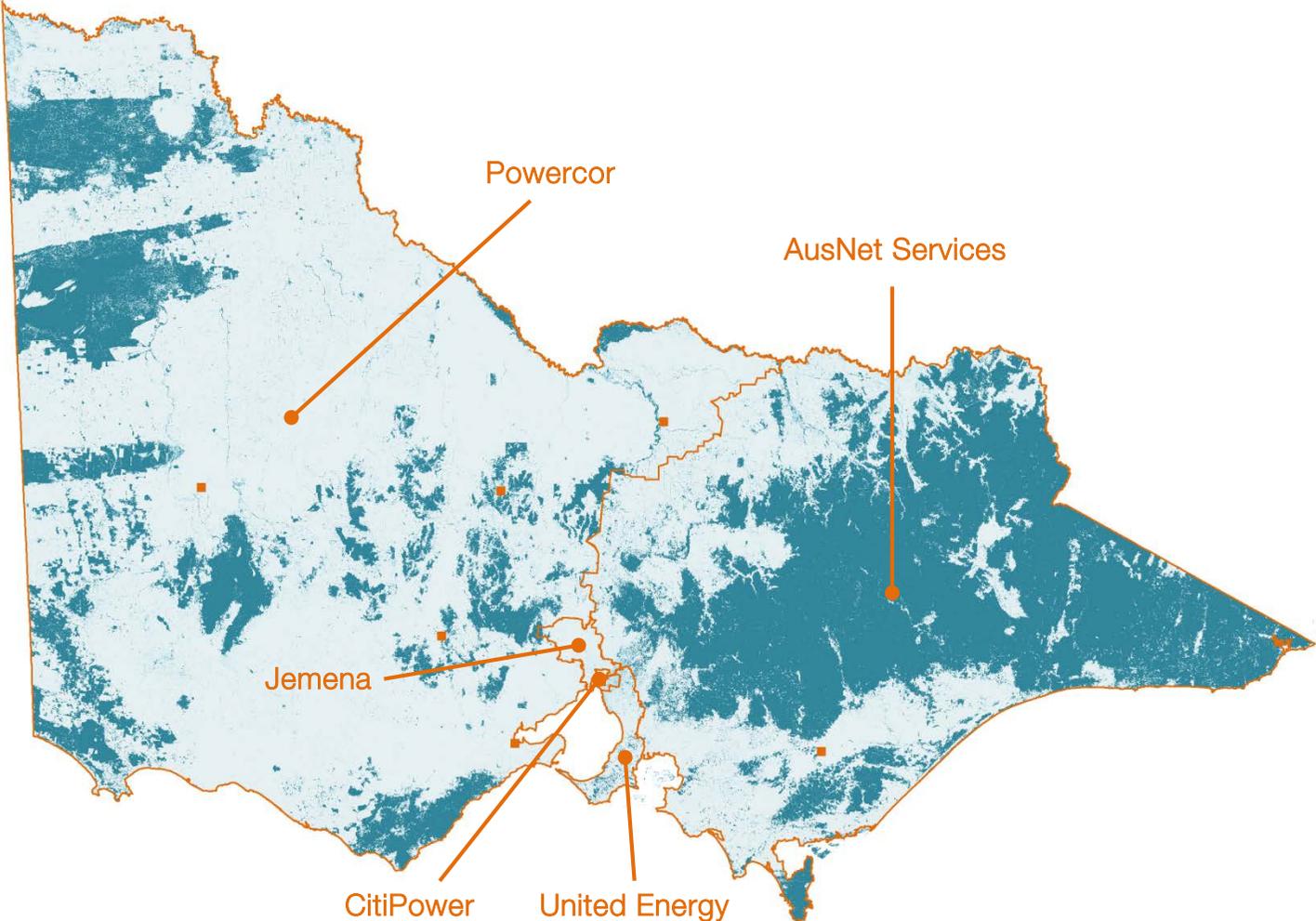
Given the poor estimation and changes to its safety programs, the late adoption of best practice pole-top inspection techniques and United Energy's poorer comparative performance in its incident and fire incident rates, ESV is concerned that United Energy has much work to do in developing an effective long-term strategy for managing safety improvement initiatives.

G7 Implementation of 2014 recommendations

In November 2015, United Energy wrote to ESV and described how it had complied with the recommendations of ESV. The United Energy response included the findings of ESV audits to validate its acceptance of a number of the recommendations.

APPENDIX H : 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.



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