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Creating a safer state with electricity and gas

Safety performance report on Victorian electricity networks

November 2021

VICTORIA State Government

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This report has been endorsed by the Victorian Energy Safety Commission.

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Foreword

On 1 January 2021, Energy Safe Victoria became the Victorian Energy Safety Commission (the Commission), although will continue to be known as Energy Safe Victoria (ESV).

The Commission is responsible for providing leadership and strategic guidance and leading ESV's transformation as a safety first, data driven, customer centric regulator, capable of effective, best practice regulation to achieve the highest standard energy safety outcomes for Victorians.

In relation to Victoria's electricity networks, the Commission has statutory responsibilities to achieve the objectives and functions as specified in the *Electricity Safety Act 1998*. These include certain statutory objectives that ESV must fulfil to prevent serious electrical safety incidents.

ESV's core purpose is to prevent harm. New priorities and initiatives are being pursued this year that will increase ESV's transparent and visible use of compliance and enforcement powers. We will also provide compliance guidance for the major electricity companies, councils and other responsible persons with duties associated with electrical network assets.

ESV will strengthen stakeholder and community engagement by ensuring we have constructive relationships with our stakeholders that provide opportunities for greater collaboration and have a clear process in place to manage any stakeholder concerns. This will be supported with advice from statutory committees involving safety and technical regulatory matters, workforce electrical and gas safety, and future energy trends.

ESV will continue to work with government to ensure community safety through ESV's continuing focus on bushfire mitigation through the implementation of rapid earth fault current limiter (REFCL) technology.

Along with REFCLs, ESV will ensure the asset management practices of Victoria's major electricity companies meet community safety expectations, particularly with regard to pole management practices for the distribution networks and vegetation clearance practices around distribution and transmission powerlines.

This year one farmer was killed and another farmer and four non-electrical workers were injured in incidents involving the electricity networks. All instances were associated with farming or construction equipment coming into contact with overhead powerlines. All could have been fatalities. All were preventable. Not one was acceptable.

ESV will continue to attend community farming days and participate in construction industry forums to educate these industries about the dangers of working close to overhead powerlines. We will continue our annual Look Up and Live campaign to ensure the wider community is also aware of this danger, and are working with the distribution networks and WorkSafe Victoria to develop a more coordinated approach and messaging. We will continue to work with industry groups to promote technological solutions such as the installation of proximity sensors on construction and farming equipment to provide audible warnings when in proximity to powerlines.

Marnie Williams

Marnie Williams
Commission Chair
November 2021

Executive Summary

Tragically, we are again reporting fatalities and serious injuries in this report. Every incident was associated with members of the public making inadvertent contact with power lines. We are reporting one fatality and four serious injuries, but little more than chance means we were not reporting five fatalities. It is rare for workers in major electricity companies to be hurt by electricity, predominantly because of the safe systems of work they use and their undoubted awareness of the risks; unfortunately, this is not the case for the public. In response we have materially increased our campaign activity to make farm workers, tip truck drivers and heavy machinery operators aware of the risks associated with operating near overhead powerlines and how to minimise those risks. We have extended the campaign to focus on broader No Go Zone breaches and provided information and education on where to look. We are working to extend the Energy Queensland “Look up and Live” app to provide coverage in Victoria.

This report demonstrates how much of an impact weather has on how the networks perform. It is evident that not only do cooler summers have fewer bushfires generally and fires caused by electrical assets, they also result in fewer asset failures (with or without causing a fire) due to the reduced thermal stress on those assets. However, the number of incidents resulting from contact with electrical assets has not similarly reduced; this is partly due to the wetter cooler conditions causing vegetation to grow more quickly. These relationships are a clear signals that businesses need to be cognisant of the likely impact of climate change on network performance and merits of designing future upgrades to mitigate such impacts.

We have continued our focus on vegetation management, although our ability to inspect has been compromised to some extent by travel restrictions under the COVIDSafe requirements. Nonetheless we still inspected substantially more spans than we were achieving four years ago and the volumes remain sufficient to be representative of each network.

We have continued our focus on noncompliance in areas for which local councils are responsible and continue to help them achieve trajectories towards compliance. In July 2022, we will have the power to issue infringement notices for noncompliant vegetation. This new tool will, we believe, be instrumental in securing substantial improvement in compliance right across the state.

We have continued our work to better understand the causal relationships between weather and climate attributes and bushfire; it is much more sophisticated than a direct relationship with temperature. This analysis is explored on page 15 of this report.

The installation of Rapid Earth Fault Current Limiters (REFCL) has continued apace during the reporting period and remains on track for the completion of the final tranche in May 2023. ESV commissioned and published two independent reviews into the performance and cost/benefit of the REFCL programme. They found that the installed REFCLs are operating as intended, did not recommend a change to the regulations or the timing of the program, and concluded they are a prudent investment in mitigating future catastrophic fire damage caused by powerline failures in extreme conditions. We intend to repeat these investigations next year to further inform the findings as more REFCLs are rolled out.

This report provides both a broad overview of network safety performance across the state as a whole and a deeper dive into the performance of each of the network businesses. I commend it to you and invite any public feedback you may have on its existing content and what might be done to improve it and meet the needs of the community.

Leanne Hughson
Chief Executive Officer
November 2021

Contents

Energy Safe Victoria (ESV) is Victoria's independent safety regulator for electricity, gas and pipelines. Our role is to ensure Victorian gas and electricity industries are safe and meet community expectations. As part of this role, we protect and assist the community by ensuring that Victoria's electricity networks operate safely and to an acceptable standard.

Each year, ESV produces the Safety Performance Report on Victorian Electricity Networks to inform the community, government and industry of how the major electricity companies have performed when delivering their electricity network safety obligations.

This report covers the 2020-2021 financial year.

Copies of previous years' reports can be found at esv.vic.gov.au/about-esv/reports/technical-reports/electrical-safety-performance-reports/

Incidents, investigations and enforcement actions

The safety of the public and energy sector workforce is ESV's highest priority, with the investigation of serious electrical incidents being a key function. 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.

One fatality and five serious injuries occurred during the 2020-2021 period that were associated with Victoria's electricity network assets. ESV investigated all of these events, and further details are provided below.

Incidents, investigations and ESV's ongoing audit and inspection activities may warrant specific enforcement actions to be implemented to modify unsafe behaviours. Enforcement actions undertaken during the year are discussed below.

Fatalities

Farmer fatality due to contact with overhead lines

On 12 November 2020, a farmer was killed in Gerang Gerung in northwest Victoria when contact was made with overhead powerlines.

The incident occurred in a paddock where a 22kV overhead electric line crossed the paddock from a pole in the road reserve to a substation pole located within the farm property. The investigation found that a tractor with an extendable arm had contacted the overhead electric line. The arm was still in contact with the overhead line when the farmer exited the tractor. The farmer then received a fatal shock when he simultaneously made contact with the energised tractor and the ground.

The fatality could have been avoided by the farmer operating in compliance with the No Go Zone guidelines.

Serious injuries

There were four incidents in 2020-2021 involving farming or construction equipment contacting overhead lines. These four incidents resulted in five injuries. All could have easily resulted in a fatality rather than injury. It is for this reason that ESV is undertaking further work across these industries to alert people to the dangers of operating such equipment close to powerlines and to develop technologies that can help avoid future contact events (see page 28).

Crane contact with overhead lines

On 12 April 2021, two people were seriously injured when a crane contacted overhead powerlines in Dromana.

The incident occurred at a building site where three new units were being constructed. A prime mover with a single semi-trailer attached and vehicle-mounted loading crane were found in the vicinity of an overhead three phase 22 kV aerial electric line on the road outside the property.

The crane operator was found lying on the ground at the base of the crane controls and was taken by ambulance to a hospital in Melbourne. A second person, who believed they received a shock when they approached the crane driver, was transported by ambulance to Frankston Hospital.

The investigation found that the crane operator had been standing on the ground using controls located on the driver's side of the crane to unload roof trusses when the crane lifting chain made contact with three phase powerline causing the crane operator to be seriously injured when he received an electric shock. A second person who went to offer assistance to the crane operator received an electric shock but did not require hospitalisation beyond a prudent medical check.

WorkSafe Victoria is the lead investigator on this case. ESV has produced a report on this incident that has been provided to WorkSafe Victoria, and will continue to provide technical expertise as required.

This incident could have resulted in a double fatality. The injury to the driver could have been avoided by the crane being operated in compliance with the No Go Zone guidelines.

With incidents involving powerlines, workers and the general public should be aware of the potential for electrocution and avoid approaching a site if a powerline is down or in contact with equipment.

Farmer injury due to contact with overhead lines

On 27 April 2021, two farm workers were seriously injured on a rural property at Harston in northeast Victoria. The injuries occurred when contact was made with overhead powerlines while using a forklift to transport a grain auger from its storage location to an adjacent location.

The investigation found that one person was driving the forklift and a second person was standing on the tines of the forklift holding onto the auger. The forklift was being driven backwards across a driveway under the HV overhead lines when the auger made contact with the line. The man holding the auger received severe burns consistent with an electrical flash-over event and was treated onsite before being transported to the Alfred Hospital in Melbourne by air ambulance.

WorkSafe Victoria is the lead investigator on this case. ESV has produced a report on this incident that has been provided to WorkSafe Victoria, and will continue to provide technical expertise as required.

Once again, this injury could have been avoided if the two workers had been aware of the dangers posed by overhead powerlines and been in compliance with the No Go Zone guidelines.

Truck contact with overhead lines

On 30 April 2021, a tip truck driver was seriously injured in Narracan in Gippsland when the truck contacted an overhead powerline.

The incident occurred on a potato farm where a 22kV overhead electric line crossed the farm from a pole in the road reserve to an intermediate pole within the farm property. The tip truck contacted the overhead line as the trailer was raised while offloading fertiliser. The driver received an electrical shock as he exited the vehicle and was simultaneously in contact with the truck and the ground. He subsequently attended hospital, but was discharged on the same day.

ESV provided a report on this incident to WorkSafe Victoria, the lead investigator on this case. WorkSafe Victoria has issued an Improvement Notice but is not taking any further enforcement action. ESV is continuing to investigate this incident with the intention of taking enforcement action.

As with the previous incidents this year, this injury could have been avoided if the driver had been in compliance with the No Go Zone guidelines. The installation of proximity sensors on the truck to provide an audible warning when in proximity to powerlines would also help avoid future incidents.

Excavator contact with overhead lines

On 3 May 2021, a tip truck driver was seriously injured in Pakenham when an excavator made contact with a HV overhead line running along the road reserve while being unloaded from the tip truck.

The investigation found that the tip truck, with the excavator on board, had parked directly under the powerline. During the unloading process the arm of the excavator made contact with the overhead line. The truck driver received an electric shock and collapsed when he went to remove metal ramps from the back of the truck while it was still in contact with the overhead powerline. He was given CPR on site to revive him and was then airlifted to hospital.

WorkSafe Victoria is the lead investigator on this case. ESV has produced a report on this incident that has been provided to WorkSafe Victoria, and will continue to provide technical expertise as required.

This incident could easily have resulted in fatality. Any injury could have been avoided if the driver had been aware of the dangers posed by overhead powerlines and been in compliance with the No Go Zone guidelines.

Major investigations

Pole investigation

Following the outcome of a detailed investigation into the cause of the Garvoc fire in south-west Victoria (the 2018 St Patrick's Day fires), ESV completed a comprehensive investigation into the wood pole management systems and practices in place at Powercor. ESV also committed to undertake a review of the wood pole management practices for other Victorian distribution businesses. The investigations are part of ESV's work to ensure that the asset management practices of the distribution businesses will deliver sustainable safety outcomes for the community in the long term.

Drawing from the experience of the Powercor review, an investigation of the wood pole management systems and practices at AusNet Services was undertaken during the 2020-2021 period. A draft public report of the investigation findings was released for consultation on 4 August 2021. ESV's response to submissions and a final report will be followed by a request to AusNet Services to address the recommendations of the report.

Enforcement actions

ESV has enforcement powers that are defined in the *Electricity Safety Act* and subordinate regulations. In exercising these powers, ESV's approach is always to consider and select the most appropriate enforcement tool available to achieve compliance, as articulated in the ESV compliance and enforcement, policy.

The enforcement action selected in each case will follow the principles of being effective, proportionate, targeted, transparent, and consistently applied. It will also consider the actual or potential for harm, the conduct and behaviour of the parties involved, the effectiveness and efficiency of the available tools to achieve compliance, as well as ESV acting in accordance with the law, the Victorian Public Service Code of Conduct and ESV values.

Considering these factors, the selected approach may include:

- providing education and seeking voluntary rectification and future compliance
- directing particular actions to be taken to rectify a safety issue or prevent potential harmful consequences
- issuing infringement notices and imposing penalties or restrictions through legal prosecution in the courts.

2018 St Patricks Day fires

There were several fires in southwest Victoria on the St Patricks Day weekend in 2018. ESV laid six charges under the Electricity Safety Act against Powercor arising out of two of the fires that occurred on 17 March 2018. Three charges were laid under section 98 for failing to meet their general duty at Terang and three charges were laid under section 98 for failing to meet their general duty at Garvoc (The Sisters).

The first mention hearing was held in the Warrnambool Magistrates' Court in January 2020. The contest mention, originally listed for May 2020, was postponed until November 2020. Due to COVIDSafe requirements, the contest mention was subsumed into other procedural hearings in the second half of 2021. The hearing of the charges is scheduled to be held in the Warrnambool Magistrates' Court commencing on 22 November 2021.

Powercor electric line clearance performance

ESV commenced its 2019-2020 HBRA inspection of the Powercor network in the Woodend and Mount Macedon regions. The initial results of the inspections revealed a very high rate of non-compliance; some of the observed non-compliances were particularly unsafe.

As the ESV inspection program continued throughout the fire danger period the observed rates of non-compliance were still unacceptably high; however, the rate flattened out when compared to the rate observed when the inspections commenced.

Powercor took action throughout the remainder of that fire danger period to address its high rates of non-compliance. It also put in place business reforms to replace its vegetation management systems and the management structure of its vegetation management division.

Throughout 2020-21, ESV closely monitored Powercor to confirm the reforms and changes it had implemented led to improved electric line clearance performance. ESV notes that while non-compliance rates for HBRA and LBRA are still too high, Powercor has improved its performance from the previous year and is on a trajectory for improvement that is satisfactory to ESV provided it is sustained.

ESV will continue to closely monitor Powercor's performance throughout 2021-22 to ensure it remains on a path of improvement.

AusNet Services electric line clearance performance

When completing its 2020-21 HBRA and LBRA electric line clearance inspection programs, ESV identified unacceptably high rates of non-compliant vegetation affecting the AusNet Services distribution network.

ESV analysis of its inspection data and that of its previous inspection cycles identified a year-on-year systemic decline in the electric line clearance performance for AusNet Services distribution network. This has occurred to the extent where it has fallen from being one of the best performing networks in the 2017-18 period to one of the poorest in 2020-21.

While non-compliant vegetation did not cause a major fire event on the network during the 2020-21 fire danger period, Victorians will be exposed to unacceptable levels of electricity safety risk if this downward trend is not arrested.

ESV has engaged AusNet Services on this matter throughout the year, and AusNet Services has responded in a proactive, transparent manner. It has cited various issues that have affected its performance during the year, including:

- very high vegetation growth rates during the 2020-21 season
- clearing impediments throughout the period due to:
  - wet ground conditions preventing safe access for vegetation clearing crews
  - COVIDSafe requirements delaying access to interstate crews to boost resources
  - program inefficiencies created by the combination of the points above
  - inspection cycles and vegetation classifications that did not account for the points above
- sub-optimal performance of its principle vegetation management contractor
- limited Victorian-based cutting resource and competition for that resource.

During the year AusNet Services committed to ESV to take measures to:

- improve its electric line performance
- reduce its rates of non-compliance
- mitigate the electricity safety risk caused by trees getting too close to electric lines
- ensure sufficient budget is allocated for the above
- update its vegetation management systems if necessary
- keep ESV informed of its progress.

It is noted that AusNet Services has not been the subject of an investigation for systemically failing to meet its electric line clearance responsibilities in the past; however, its rate of declining performance has prompted an ESV investigation into this matter. The investigation is expected to conclude in the first half of the 2021-22 period.

ESV will closely monitor the performance of AusNet Services throughout the year and to gather evidence that may be necessary to assist with future enforcement action.

Powercor REFCL direction

In late 2020, Powercor advised ESV that it had switched part of its Camperdown network to be supplied from the neighbouring Cobden zone substation to facilitate the connection of a wind farm. This resulted in this network section no longer being REFCL-protected.

ESV determined that Powercor's action had increased the bushfire ignition risk of this network section and, on 23 December 2020, directed Powercor to reinstate REFCL protection on total fire ban days throughout the 2020-21 fire season. As a result, the wind farm would not be able to generate on these days.

ESV is considering taking further action ahead of the 2021-22 fire season.

Boroondara Council failure to clear lines

During 2019-020, ESV identified an excessively high rate of non-compliance relating to vegetation where the City of Boroondara is responsible for maintaining clearance around overhead powerlines.

In addressing the broader non-compliance issues, ESV required the City of Boroondara to submit a plan that commits it to actions that will enable it to transition to acceptable standards of compliance. ESV required the City Boroondara to incorporate the transition plan into its electric line clearance management plan, thereby making the plan enforceable.

Throughout 2020-21, ESV has been closely monitoring the progress of the City of Boroondara against the commitments it made to ESV to improve its electric line clearance performance. ESV has noted positive action by the City of Boroondara and a commitment to improving its compliance standards.

ESV reinspection of the City of Boroondara during the year noted a significant improvement in the non-compliance rates across the city; a non-compliance rate of approximately 90 per cent last year has dropped to approximately 50 per cent in 2020-21. This is a positive step; however, further improvement is still necessary.

During the year the City of Boroondara sought to engage with ESV with the proposed development of an application to implement an Alternate Compliance Mechanism under clause 31 of the Code of Practice for Electric Line Clearance.

The basis of the Mechanism would be to manage specified trees inside the required minimum clearance space under enhanced inspection and risk management regimes. The purpose of the Mechanism would be to protect mature trees in the municipality that would otherwise need to be removed or heavily cleared in order to meet the necessary clearing standard in order to comply.

The City of Boroondara submitted the Alternate Compliance Mechanism application to ESV in August 2021. ESV is currently evaluating and considering the merit of the application, and a decision on the acceptability of the application is expected before the end of 2021.

Keeping the public safe

Reducing bushfire risk

Understanding fire trends

There were 1,010 reportable incidents involving the electricity networks this year, of which 54 per cent involved a fire. Where fires occur, 62 per cent do not result in a ground fire. The numbers of incidents resulting in a fire are shown in Figure 1, with their relative contributions to total network fires.

There were 111 fewer fires in 2020-21 than in 2019-20, comprising 88 fewer asset fires and 23 fewer ground fires.

Figure 1 Breakdown of fires by size in 2020-2021[1]

There were no large fires attributable to the electricity networks in 2020-21, which is a positive result.

There was, however, one large fire in Minimay near the South Australian border that started from slashing operations on the farm. This fire caused the collapse of one pole on the Powercor network and significant damage to a second pole. Both poles were replaced after the fire was extinguished.

Of the 17 medium-sized fires, four were on the AusNet Services network, 12 on the Powercor network and one on the United Energy network. Two were due to mobile equipment contacting overhead lines, two were due to birds coming into contact with electrical assets, seven were due to trees and vegetation from outside the clearance space falling or being blown onto overhead powerlines, one was due to a vegetation clearing crew dropping a large branch onto the overhead powerlines and five resulted from asset failures.

There were also four incidents where medium-sized fires, which originated away from network assets, caused damage to poles, overhead powerlines and underground cables. Two were from farming operations, one was due to sparking from a private overhead electric line and one where the cause was not identified.

[1] Localised = less than 10 m^2, small = 10-1,000 m^2, medium = 1,000 m^2 - 10 ha and large = greater than 10 ha

The averages and bounds in Figure 2 show a clear seasonal trend in ground fires due to both asset failures and contact events. Throughout most of the year, there are similar numbers of fires from asset and contact events; however, there is a more pronounced peak in asset-related ground fires in January and February.

The numbers of asset-related ground fires (red bars in Figure 2a) were within one standard deviation of the 2010-2020 average for most of the year. The exceptions were September, March and April, which had fewer fires than expected. The number of fires across bushfire season (November to April) was below the long-term average for each month.

Figure 2b shows that the numbers of contact-related fires were well in excess of the historic numbers in August, November and June. The numbers of fires across most of the bushfire season were in line with historic expectations, with the exception of November.

The outlier in Figure 2b is the peak in June that is well above the normal band of expected fires. Of the 13 contact-related fires in June 2021, tree contact was the cause of five fires on 9 June (all on the United Energy network) and four fires on 10 June (three on the United Energy network and one on the AusNet Services network). These incidents coincided with a major storm event that swept across Victoria, with much of the damage in the Dandenong Ranges and Bass Coast. At its peak, approximately 300,000 customers had lost supply due to wind gusts of 100-140 km per hour, which brought down trees and powerlines.

Major storm events wreaked havoc on the networks on multiple occasions, including in June 2021 (above commentary), in January 2020 when extreme winds caused the collapse of transmission towers near Cressy, and in 2018 when strong winds combined with high temperatures contributed to several fires in southwest Victoria on the St Patrick's Day weekend. It is important that we understand the likely increase in the frequency of such extreme events under climate change so that we can ensure that major electricity companies manage the safety risks to and from Victoria's networks.

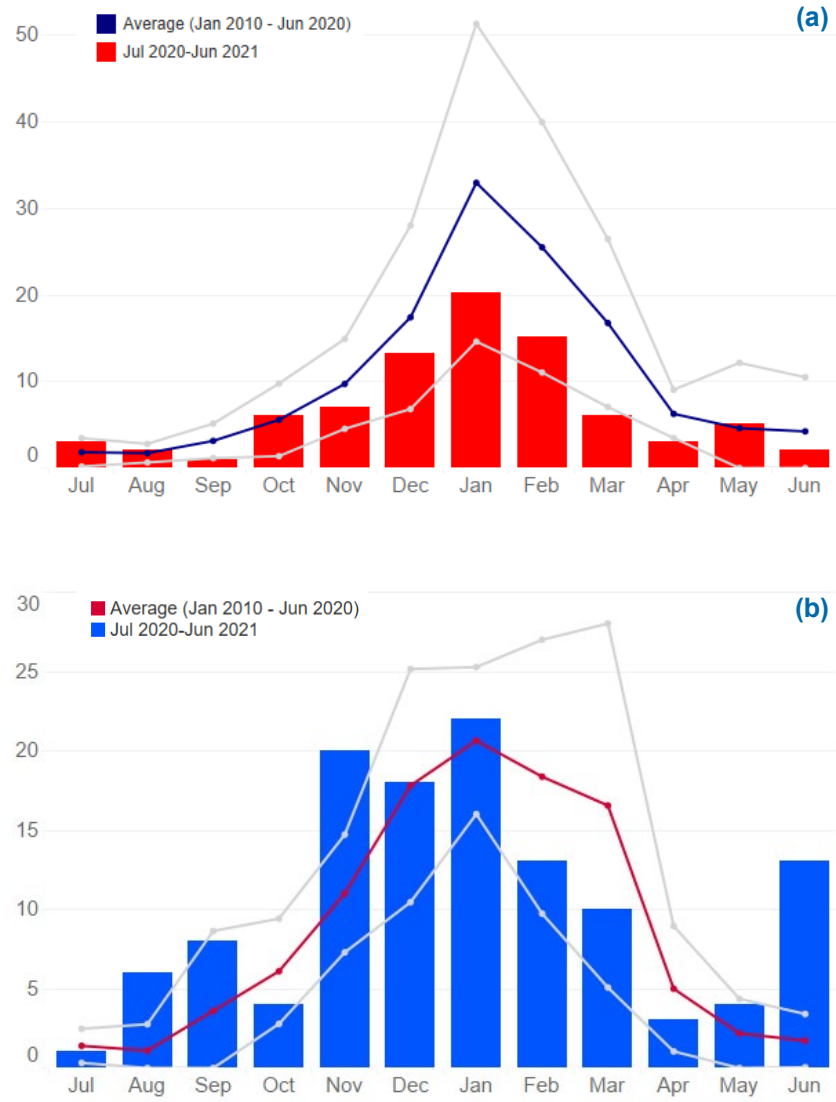

Figure 2 Ground fire incidents due to (a) asset failures and (b) contact events

The grey line is one standard deviation above and below the average

Figure 3 shows the cumulative number of ground fires throughout the fire season (October to April). While the total fires in the first 15 weeks of the fire season were similar to 2019-20, there was no increase in fires in the second half of the season similar to that seen in 2019-20 and other seasons.

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

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

The first declarations for this year's season started later than last year, but still weeks earlier than most previous seasons (Figure 4). Despite these initial declarations, the escalation of declarations was much slower than for the 2008-09 bushfire season (Black Saturday). Full declaration was much later this season and was short-lived, with declarations being removed quickly soon after full declaration. The official fire season finished several weeks earlier than previous years.

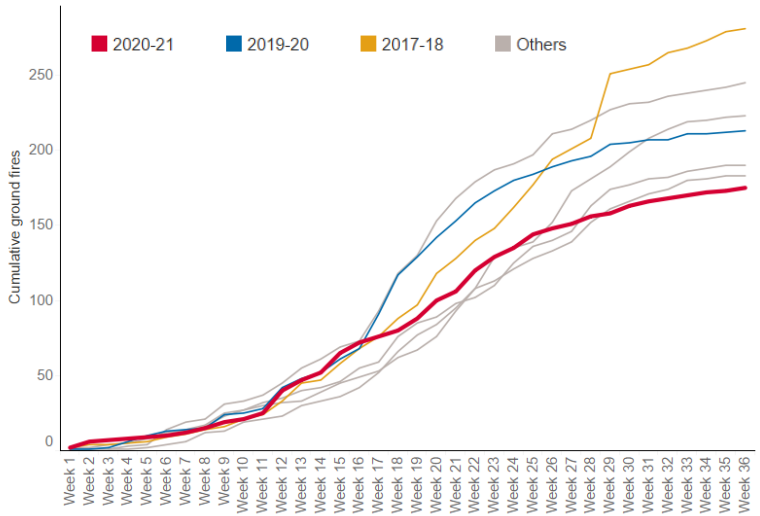

Figure 3 Cumulative fires across the fire season

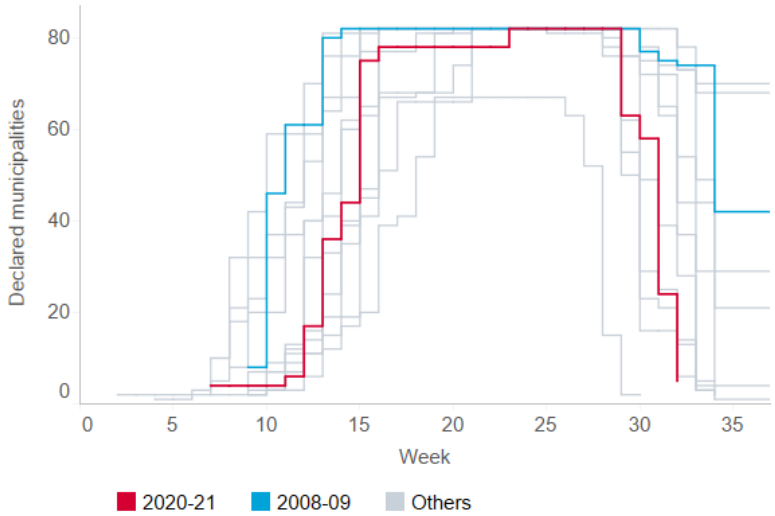

Figure 4 Summary of CFA fire declarations from 2008 to 2021

Figure 5 shows the number of ground fire events on the Victorian networks from most common to least common this year (blue bars) relative to the long-term average for the 2010-2020 period (orange bars).

The four most common causes of fires were tree contact, connection faults,[2] animal contact, and vehicle impacts. The same three events comprised last year's top three causes of fires, with vehicles impacts replacing other asset failures in fourth position.

When compared to the long-term averages across the period from January 2010 to June 2020, fire numbers in 2020-2021 are elevated in five categories, reduced in seven and stable (i.e. within 5 per cent) in one.

After last year's increase, tree contact fires have risen again this year (Figure 6) and continue to be 49-50 per cent above the long-term average for the second year running (Figure 5).

Asset-related ground fires are lower than the long-term average across all categories apart from connection faults and underground cables. The numbers of connections fires dropped this year, but are still 27 per cent above the long-term average.

Figure 6 shows the trend over the last eleven years for the four most common causes of ground fires. This indicates that:

- fires from tree contact have increased again this year and are now 49 per cent above the historic average, mostly due to vegetation blowing and falling onto powerlines from outside the clearance space
- after rising steadily since 2013-14, fires from connection faults have fallen this year but are still 27 per cent above the historic average (last year they are 67 per cent higher)
- animal contact fires increased slightly this year and are now 5 per cent below the historic average (16 per cent below last year)
- fires from vehicle and equipment contacts increased this year and are now 38 per cent above the historic average.

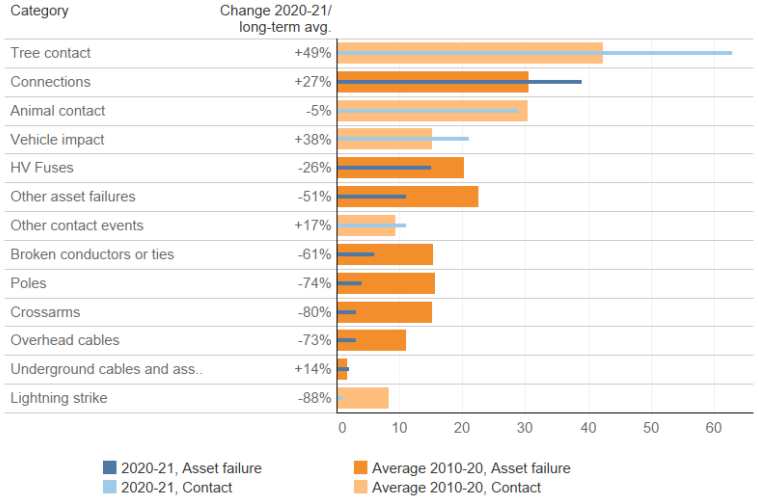

Figure 5 Ground fire-related incidents occurring on Victorian networks

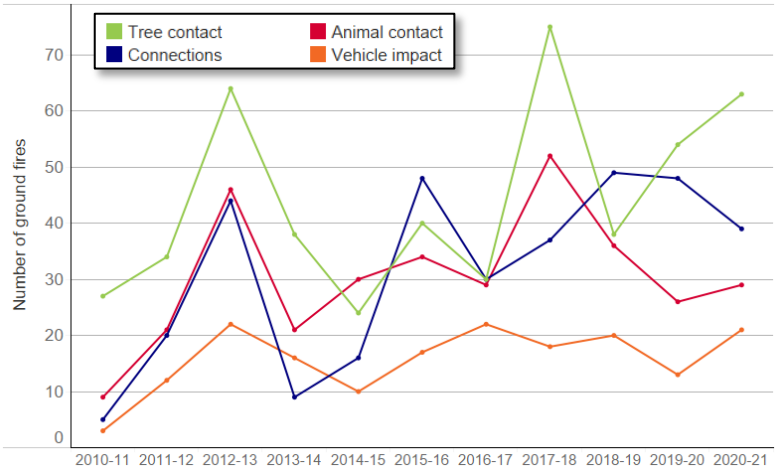

Figure 6 Historic trends for common ground fire events

[2] Connection faults include all faults attributed by the electricity companies to all high and low voltage connections, terminations and joints when they report the incidents to ESV via our OSIRIS portal.

Understanding how weather affects bushfire safety

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

The analysis has considered all fires reported to ESV between 1 January 2010 and 30 June 2020, with the data models being trained on 80 per cent of the data randomly selected between 2012 and 2020. The data from 2010 and 2011 was excluded from the model training due to concerns about the completeness of reporting in the early years of ESV's data collection.

Separate models have been developed for ground fires due to asset failures (Figure 7a), vegetation contact (Figure 7b) and other (non-vegetation) contact events (Figure 7c). The models predict the number of each type of incident based on daily weather observations from the nearest of 37 Bureau of Meteorology stations. The actual numbers of ground fires are then aggregated by month and shown as coloured bars in each of the figures; the prediction is shown as a blue line. The blue line also differs between the three figures due to variations in the mix of weather factors driving each model's prediction.

In order of impact, the main factors affecting each type of event are:

- asset failure fires — maximum daily temperature, temperature differential between days and three-day lag temperature differential
- tree contact fires — maximum wind gust speed and maximum daily temperature
- other contact fires — maximum daily temperature.

These findings can help us understand the physics underpinning such events. For example, the major contribution of wind gust to tree contact fires could indicate that such fires are driven more by blown branches and fallen trees than by direct contact. Further analysis of existing data is needed to confirm or refute the hypothesis. This will be supplemented with data from ESV's new inspection program targeting vegetation outside of the clearance space.

The models, and hence the predictions of fires, have changed from last year's report due to:

- further improvements to weather station mapping to increase the number of stations being used from 20 stations to 37 stations
- a larger dataset for training of the models.

All three event types naturally follow a seasonal trend with peaks in summer and troughs in winter. The seasonality is most pronounced in the asset failure fires and least pronounced with the vegetation fires. The latter is possibly due to clearance programs reducing the impact of vegetation growing into the powerlines, which leaves the residual impact primarily from blown branches and fallen trees associated with storm fronts.

The major exceedances in the summer of 2012-13 (see Figure 7a) were due to an extremely hot summer across the southern half of Australia, with a new national average maximum being set on 7 January 2013 and six of the 20 hottest days in Australian records occurring in January 2013. This not only raised the potential for bushfires, but also put greater stress on network assets that may have contributed to their failure, particularly when combined with higher electrical demand (from air-conditioning, for instance).

Similarly, Figure 7b shows peaks in February and March 2018. These may be due to:

- extreme storm fronts that resulted in dry branches blowing and trees falling onto overhead powerlines when they are susceptible to ignition
- the practices of the distribution businesses
- causes other than direct weather influences.

In general, the predictions reflect the shape and structure of the peaks in the incident data, and are close matches with the actual number of fires.

Our focus moving forward with this modelling is to limit further updates of the models and to observe how they correlate with future events. If we continue to see strong correlations between the models and observations, we may explore using deviations from the predictions as an indicator of aberrant and positive network behaviours. These models can also help ESV explore the implications of future climate change on network safety.

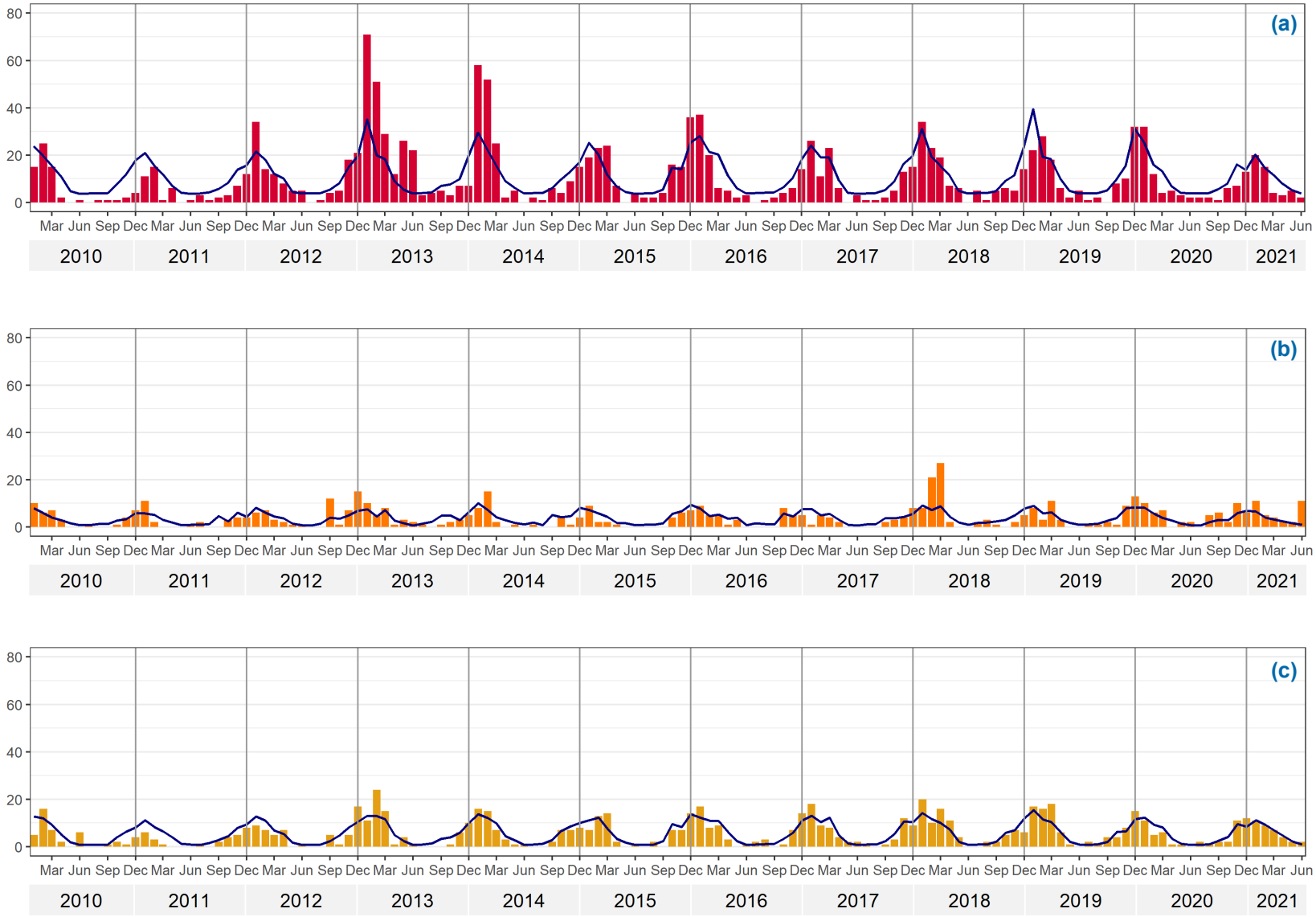

Figure 7 Influence of weather on ground fires due to (a) asset failures, (b) vegetation contact and (c) other contact events

We have also explored occurrences of fires on at-risk days (that is, those days when the networks are most susceptible to fire ignitions due to weather).

At-risk days are separately defined for asset failure fires, vegetation contact fires and other contact fires. We considered the conditions specific to each event type and identified those parameters that most contributed to a fire occurrence. An at-risk day was determined to have occurred when those conditions were met or exceeded in the meteorological records. Further details on the weather modelling and the definitions of at-risk days for each fire type can be found in Appendix K.

Figure 8 shows the numbers of at-risk days for ground fires against the number of fires per at-risk day in HBRA for the three event types. This shows that:

- the numbers of at-risk days has decreased since 2017-18 for asset failures and other contact events, while the at-risk days for vegetation contact fires has been relatively stable
- the rate at which ground fires occur on at-risk days has been stable for asset failures and other contact events, and decreasing for vegetation fires
- the number of at-risk days each year for other contact fires is about 1.5 times larger than for vegetation contact fires, and more than twice as many days than for asset failure fires.

While the asset failures are under control of the major electricity companies, the tree contacts comprise vegetation growing into the lines (under control) and trees and branches falling or blown onto overhead lines (outside control). The other contact fires are generally outside the control of the major electricity companies. Further analysis and data collection will help us to quantify the respective contributions from vegetation within and outside the clearance space.

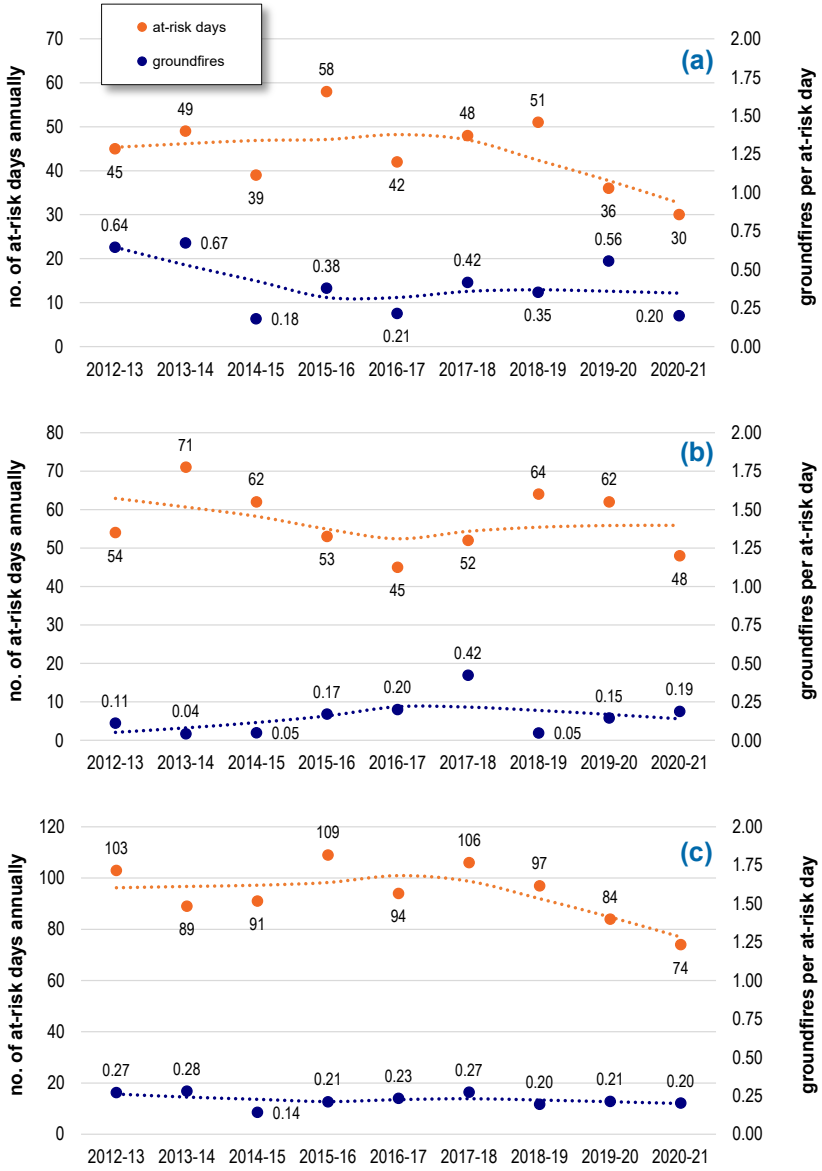

Figure 8 Numbers of 'at risk' days each year and the associated rate of incidents in HBRA on those days for (a) asset failures (b) vegetation contacts and (c) other contacts

Non-compliant vegetation poses a safety risk

Vegetation contact with powerlines can cause electrocution, fires and bushfires, and impact the reliability of electricity supply. These risks must be managed by major electricity companies, municipal councils and other responsible persons.

Vegetation clearance is the primary method for managing these risks, with minimum clearing requirements prescribed by the Code of Practice for Electric Line Clearance (the code). The code is a schedule to the Electricity Safety (Electric Line Clearance) Regulations.

In 2020-2021 ESV undertook a range of activities to ensure responsible persons adequately manage vegetation for which they are responsible. These responsible persons included the 10 major electricity companies (five distribution businesses and five transmission businesses), 67 municipal councils and a variety of other owner-operators of electric lines. The activities included:

- evaluation and approval of 27 electric line clearance management plans
- 14 vegetation management systems audits
- inspection of vegetation for 12,846 electricity spans.

These activities are designed to ensure that those responsible have suitable plans and systems in place to keep vegetation clear of powerlines, and thereby protect against the threat of bushfires, outages and other contact incidents.

Major electricity companies

ESV has seen an increase in the rates of non-compliant vegetation across the networks in HBRA for a third consecutive year (Figure 9a), with this year's increase due to the poor performance of AusNet Services and United Energy. Both Jemena and Powercor improved when compared to last year.

The rate of major non-compliances affecting the networks (that is, instances where vegetation was at imminent risk of contact with powerlines) also increased in HBRA when compared to last year (Figure 9b).

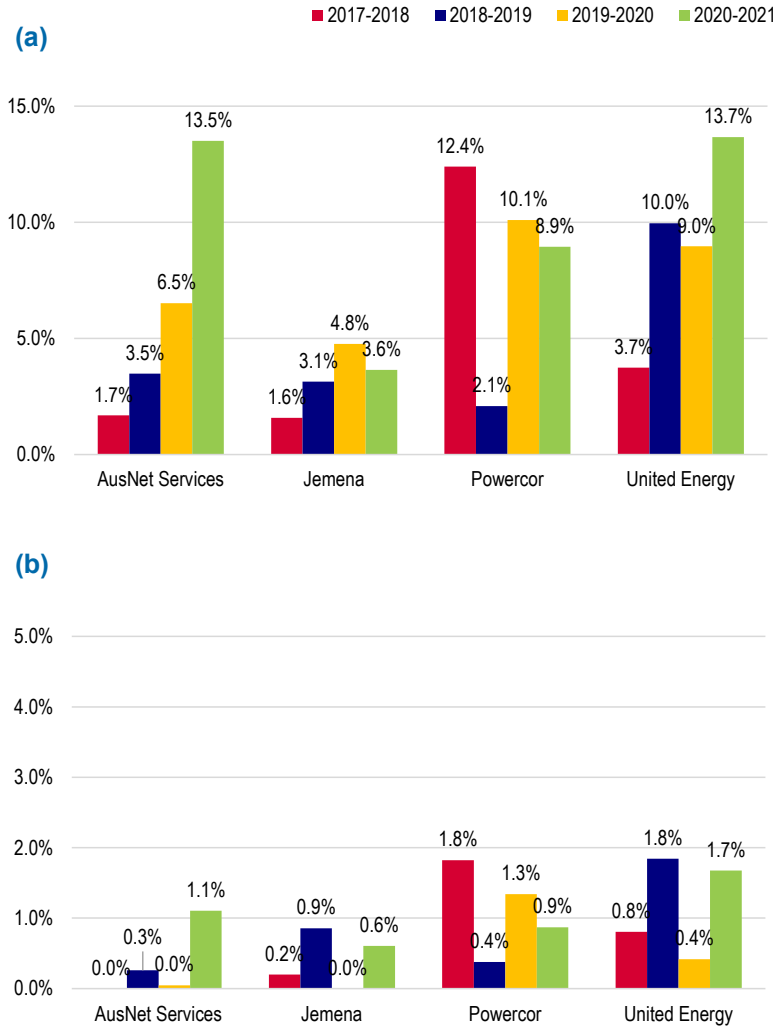

Figure 9 Non-compliance rates in HBRA (a) all non-compliances and (b) major non-compliances

The rate of non-compliant vegetation affecting the distribution networks in LBRA was marginally worse than the previous year. The increase in non-compliance was directly due to the declining performance of AusNet Services and the smaller CitiPower; compliance standards in LBRA improved for each of the other distribution businesses (Figure 10a).

Like HBRA, the rate of major non-compliances affecting the distribution networks also increased in LBRA over the last twelve months (Figure 10b).

All the non-compliant spans identified by ESV are issued to the responsible distribution businesses by notice made under section 86(1) of the *Act*, which requires clearing of vegetation in timeframes specified by ESV. These were promptly cleared by the relevant network owners, resulting in the elimination of these potentially hazardous situations.

The individual performance of each major electricity company is detailed in the appendices to this report.

Factors affecting electric line clearance programs

During the year each of the major electricity companies reported observing very high vegetation growth rates due to favourable growing conditions. This was among several other reasons some of the businesses cited as impacting their ability to meet their electric line clearance obligations.

The reasons cited as a cohort, or individually, included:

- inspection cycles and vegetation classifications not adequately accounting for the growth rates experienced
- wet ground conditions preventing safe access for work crews
- COVIDSafe requirements delaying access to interstate crews normally used to boost local resources
- limited numbers of Victorian-based cutting crews and competition for that resource
- program inefficiencies created by the combination of the points above.

Note: All of the above reasons should not be attributed to all networks.

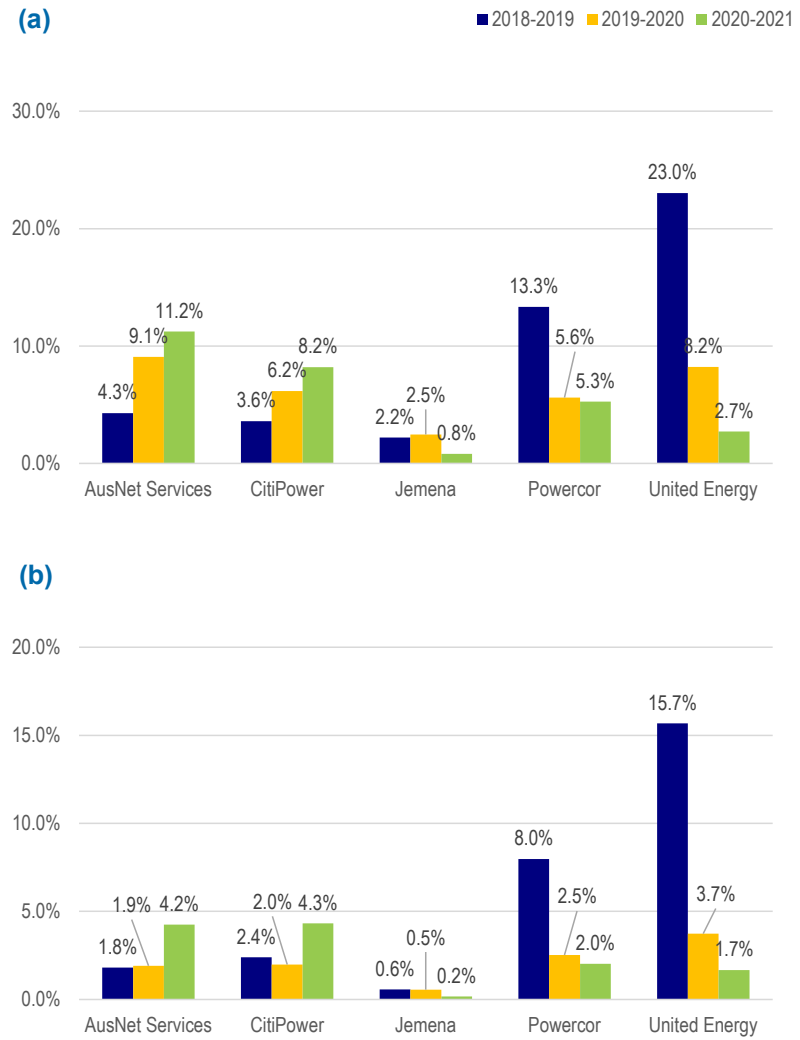

Figure 10 Non-compliance rates in LBRA
(a) all non-compliances and (b) major non-compliances

ESV recognises that environmental conditions and COVIDSafe requirements during 2020-21 adversely affected delivery of vegetation management programs. However, obstacles such as these do not absolve a major electricity company from meeting its electric line clearance responsibilities. Rather, the company must develop innovative strategies to make sure their vegetation management programs are adaptable and resilient to the ongoing effects of climate change and the pandemic.

ESV has seen early evidence of some major electricity companies taking action to reform historical vegetation management processes and practices to mitigate these risks.

The availability of Victorian-based cutting resource is a matter that has been raised by both the major electricity companies and municipal councils as a major concern for them during the year; although resource shortages are not new to the industry. As this is a commercial, industry market matter where ESV has limited scope to influence change. We have, however, recommended the relevant training necessary to become a vegetation management worker is considered for funding under Government incentive schemes. It has also engaged with the Department of Environment, Land, Water and Planning (DELWP) to see what other assistance may be made available to address this matter.

Municipal councils

In March 2019 ESV initiated a program for comprehensive inspection of municipal councils that have electric line clearance responsibilities. Prior to this, ESV had focused primarily on the major electricity companies.

Councils are only responsible for keeping trees clear of electric lines where those trees are located on public land managed by the councils.

ESV's inspections in LBRA have identified the rate of non-compliance in 2020-2021 is much higher for councils (25.6 per cent on average) than for the distribution businesses (7.3 per cent on average).

During the 2020-21 period, ESV identified 923 non-compliant spans across the 10 councils it inspected in that period (Figure 11). All the non-compliant spans identified by ESV are issued to the responsible council by notice made under section 86(1) of the Act, which requires clearing of vegetation in timeframes specified by ESV.

ESV worked with each council throughout the year to ensure they appropriately managed these risks and cleared the identified non-compliant vegetation.

As councils predominantly only have electric line clearance responsibilities in LBRA, the extent of council non-compliance does not create a significant bushfire risk for Victoria. It can, however, impact on the reliability of electricity supply for metropolitan Melbourne, regional cities and townships and pose other safety risks to the community.

When a council creates unacceptable electricity safety risks by systemically failing to comply, ESV requires the council to reform its vegetation management systems and functions. The reforms must allow the council to work toward achieving acceptable standards of compliance.

ESV monitors implementation of the reforms until it is satisfied the council is appropriately managing its electricity safety risks.

Where compliance cannot be achieved by a council within an acceptable timeframe, ESV has the power to direct the relevant distribution business to undertake any necessary clearance works.

In 2020-21, ESV revisited the three poorest-performing councils from the 2019-2020 period — the City of Boroondara, the City of Maribyrnong and the Shire of Whittlesea. This was done to ensure they had improved their electric line clearance performance and reduced the electricity safety risks in these municipalities. Failing to demonstrate improved performance would have resulted in strict enforcement action.

It was pleasing to note that each of these councils had responded by showing vastly improved compliance standards; greatly improving electricity safety in these municipalities (Figure 12).

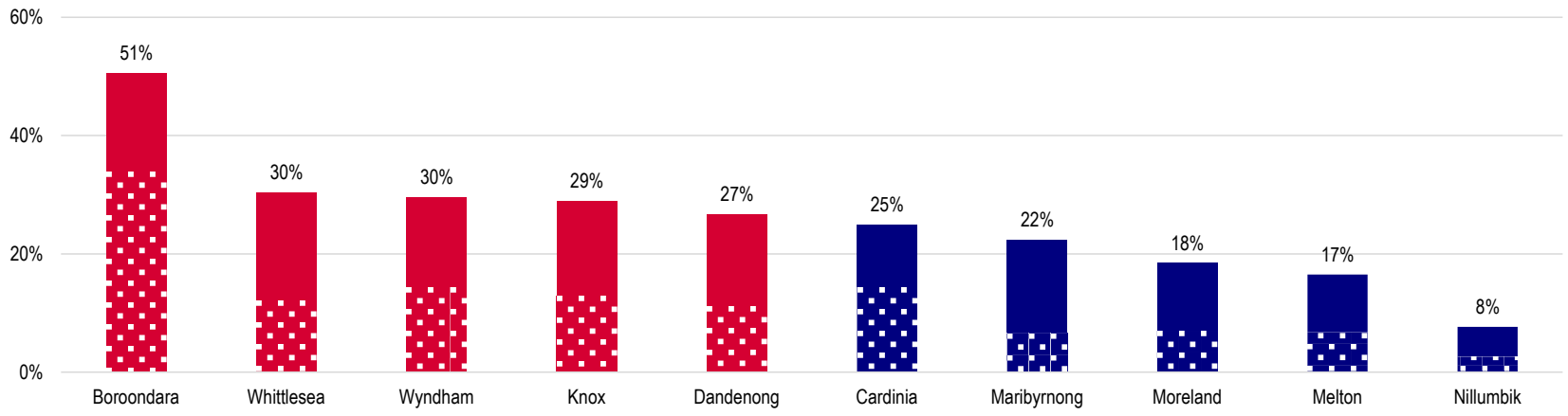

Figure 11 Non-compliance rates for councils inspected in 2020-2021

The councils shown in red had non-compliance rates in excess of the council average.
The dotted area shows the levels of high risk non-compliance within the overall non-compliance rate.

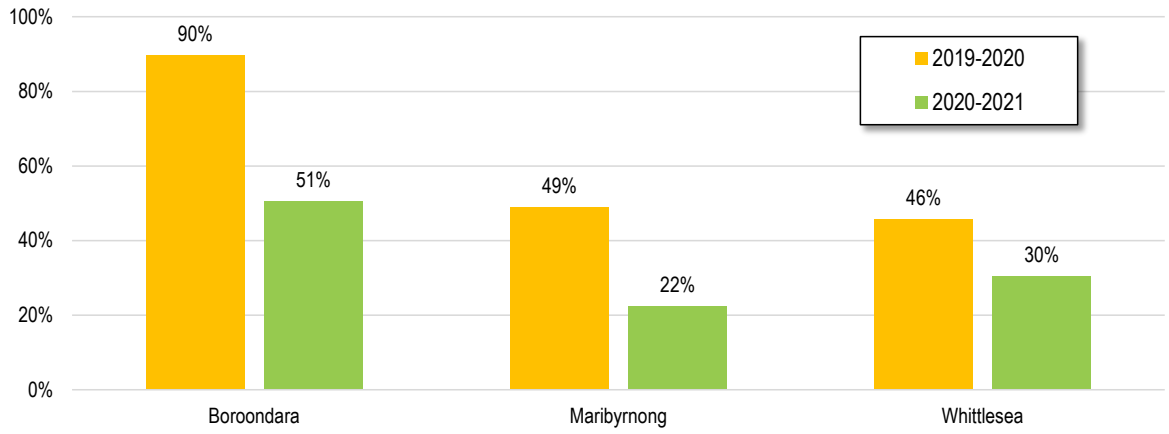

Figure 12 Performance improvement of three worst-performing councils from 2019-2020

Adapting to changes in the environment

The code specifies minimum clearance distances to be maintained between vegetation and electric lines in order to mitigate risks from vegetation contact. The clearances distances required in HBRA are greater than those required in LBRA due to the greater safety risks in the former, particularly the risk of bushfire.

Electrical asset inspection and maintenance cycles are also dependant on whether the asset is located in an HBRA or LBRA – to ensure those cycles are proportionate to the prevailing risks.

The Country Fire Authority (CFA) is responsible for assigning HBRA and LBRA boundaries across most of Victoria. The cyclical reviews undertaken historically lapsed in 2013, and the boundaries had not been reviewed since.

In 2018, given changing risk profiles due to revegetation of some areas, changing environmental conditions and urban development in others, ESV initiated a process for the reinstatement of cyclical reviews of the boundaries by the CFA.

The review program began in August 2019 with the Powercor network, which was completed before the end of 2020. Review of the Jemena and United Energy networks followed with these reviews being completed by mid-2021. The AusNet Services network will be reviewed in 2021-22.

As the changes in the Jemena network only involved HBRA transitioning to LBRA, Jemena did not have to plan for increased maintenance requirements.

By contrast Powercor and United Energy saw parts of their networks transition from LBRA to HBRA and, as a result, they have developed plans to upgrade some assets, schedule more frequent maintenance and inspections, and greater vegetation clearance distances.

The roll-out of the boundary changes will be staggered throughout 2021-22 to allow the businesses to prepare their networks to be compliant.

Managing hazards outside the clearance space

Most network incidents involving vegetation are due to trees, or parts of trees, falling onto electric lines from outside the minimum clearance space required by the code. Such trees are often referred to as hazard trees.

The major electricity companies have methods, described in their electric line clearance management plans, for managing hazard trees.

In 2019-20 ESV initiated a project to examine if hazard trees are being managed according to the methods described in each business' plan. The project also sought to test if the methods being used provide an appropriate framework to manage the electricity safety risks caused by hazard trees.

The project commenced in February 2020 with the inspection of 121 spans that United Energy had identified as being affected by hazard trees. In March 2020, the project then inspected 362 spans that AusNet Services had identified were similarly affected in its network.

While the inspections found that United Energy and AusNet Services were generally managing hazard trees according to the methods described in their plans, ESV inspections identified three hazard trees on the United Energy network and 49 on the AusNet Services network that had not been identified. ESV has since required that these trees be managed so that the risks posed are addressed.

United Energy and AusNet Services committed to the ongoing review and amendment of the hazard tree management programs, considerate of the improvement opportunities identified by ESV during its inspections.

ESV hazard tree inspections were to be conducted on the Powercor, Jemena and CitiPower networks throughout 2020-2021; however, progress of this work was impacted by work restrictions imposed by COVIDSafe requirements. This work was deprioritised to allow ESV to focus on the HBRA and LBRA inspection programs and ensure appropriate oversight of the higher risk being managed by electric line clearance programs.

ESV will reinitiate hazard tree inspection of Powercor, Jemena and CitiPower in 2021-22 and as an ongoing annual electricity safety program to continue to track the performance of each business in future years.

Reducing the fire risk from the networks

The *Electricity Safety Act 1998* and the Electricity Safety (Bushfire Mitigation) Regulations 2013 require major electricity companies to ensure that:

- all polyphase electric lines originating from prescribed zone substations can reduce the energy delivered into phase-to-earth faults to a specified level within defined timeframes to reduce the risk of fire ignition
- each electric line within an Electric Line Construction Area with a nominal voltage of between 1 kV and 22 kV that is constructed, or wholly or substantially replaced, after 1 May 2016 will be a covered or underground electric line
- an Automatic Circuit Recloser is installed on each Single Wire Earth Return line in its supply network by 1 January 2021.

Installing Rapid Earth Fault Current Limiters

The affected distribution businesses are deploying Rapid Earth Fault Current Limiters (REFCLs) to achieve the required capacity. These are being rolled out in three tranches in accordance with the regulations, with the REFCL tranches operational by 1 May 2019, 1 May 2021 and 1 May 2023.

The regulations require REFCLs to be installed at 45 zone substations, with 22 in the AusNet Services network, 22 in the Powercor network and one in the Jemena network.

Over the 2020-21 reporting period ESV granted a general exemption regarding underground cable, an exemption regarding parts of Jemena's Coolaroo network and a time extension for some of AusNet Services' zone substations. Details are provided in sections A2.3, B4 and E4.

By 30 June 2020, ESV had accepted 13 AusNet Services zone substations and 16 Powercor zone substations as compliant. Figure 13 shows the cumulative number of compliant REFCLs installed by each major electricity company and the anticipated progress to achieving full compliance at all mandated substations. Figure 14 shows the coverage of the substations with REFCLs mandated by the regulations.

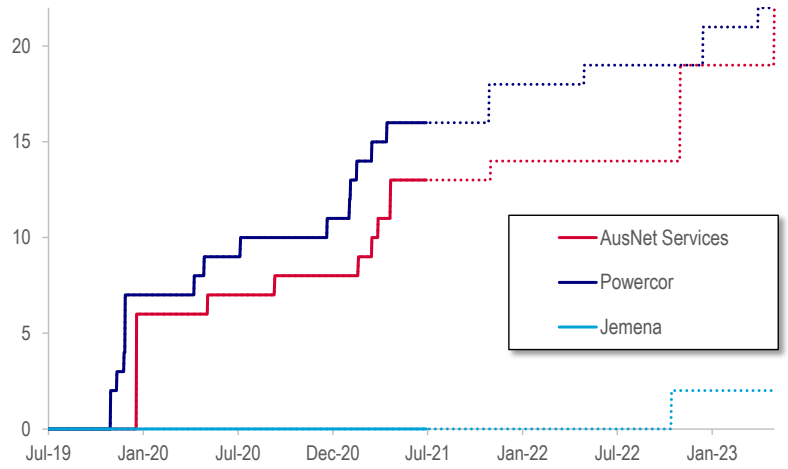

Figure 13 Compliant REFCLs installed to 30 June 2021

Dotted lines are projected delivery times

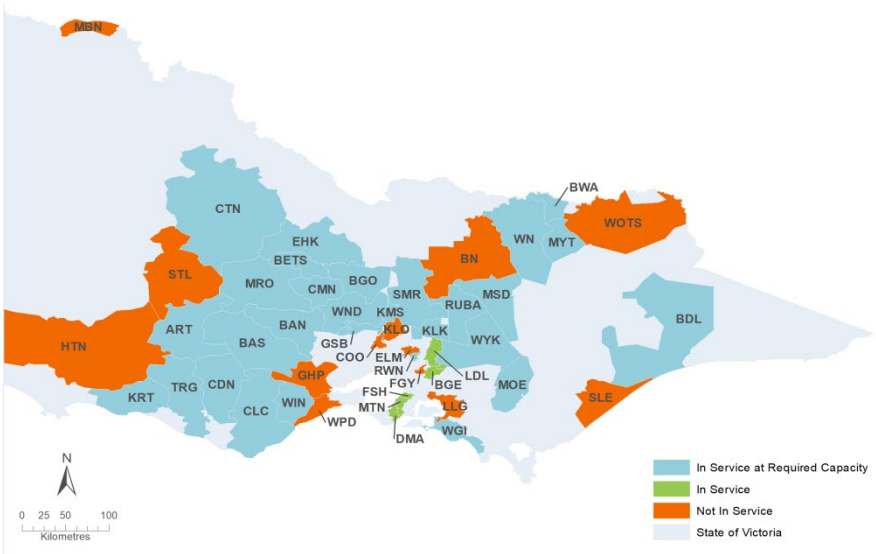

Figure 14 Mandated REFCLs and their status at 30 June 2021

In addition to the mandated REFCLs, United Energy has voluntarily installed REFCLs at Frankston South, Mornington and Dromana zone substations, and Jemena has voluntarily installed a base-level[3] REFCL system at the Sydenham zone substation.

In 2020, ESV engaged consultants to undertake a cost benefit analysis and functional (engineering) performance review of the REFCL program. They found that the installed REFCLs are operating as intended, did not recommend a change to the regulations or the timing of the program and are a prudent investment in mitigating future catastrophic fire damage caused by powerline failures in extreme conditions. ESV is currently working with major electricity companies to implement the functional performance review recommendations.[4]

Replacing bare overhead powerlines in Electric Line Construction Areas

AusNet Services and Powercor each have approximately 1,600 km of overhead conductor within the highest-risk Electric Line Construction Areas. These bare overhead powerlines are to be progressively replaced with insulated or underground solutions.

As of 30 April 2021, AusNet Services reports that 81 per cent of polyphase electric lines in Electric Line Construction Areas within its supply network consisted of bare overhead wire. Powercor reports 72 per cent bare overhead wire remaining.

AusNet Services, Powercor, United Energy and Jemena are also trialling new covered-conductor technologies to achieve a high-risk reduction at significantly lower cost than underground.

Installing Automatic Circuit Reclosers

Automatic Circuit Reclosers (ACRs) on single wire earth return (SWER) lines can be set remotely so that they turn off those powerlines quickly when faults occur and, thereby, reduce the risk of these lines starting fires.

The *Electricity Safety Act 1998* requires the distribution businesses to install a new-generation ACR on each SWER line within their distribution network by 1 January 2021. All distribution businesses have complied with this requirement and the program has now ended.

[3] A base-level REFCL consists of an arc suppression coil only and cannot achieve the same performance as a mandated REFCL.

[4] The reports are accessible at https://esv.vic.gov.au/about-esv/reports/technical-reports/rapid-earth-fault-current-limiter-reports/.

Making network infrastructure safer

Understanding asset failure trends

Figure 15 shows the number of network safety incidents on the Victorian networks. The numbers of asset failure incidents and contact events are reported separately.

The historical average for the period January 2010 to June 2020 shows a seasonal trend with increased asset failures over the summer period (Figure 15a). The numbers of asset failure incidents in the last year were well below the 2010-2020 average, with eight of the 12 months being more than one standard deviation below the average. The annual peak that normally occurs in January and February did not occur in 2020-2021.

The numbers of contact events show less seasonality and a less pronounced peak occurring in March (Figure 15b). Such events are largely outside the direct control of the networks to manage.

Contact events this year also showed a high degree of variability. Two months were more than one standard deviation below the long-term average, and one month was higher than one standard deviation above the average.

The peak in June 2021 was primarily a spate of tree contact incidents associated with a major storm front that crossed Victoria on the 9-10 June (see page 12).

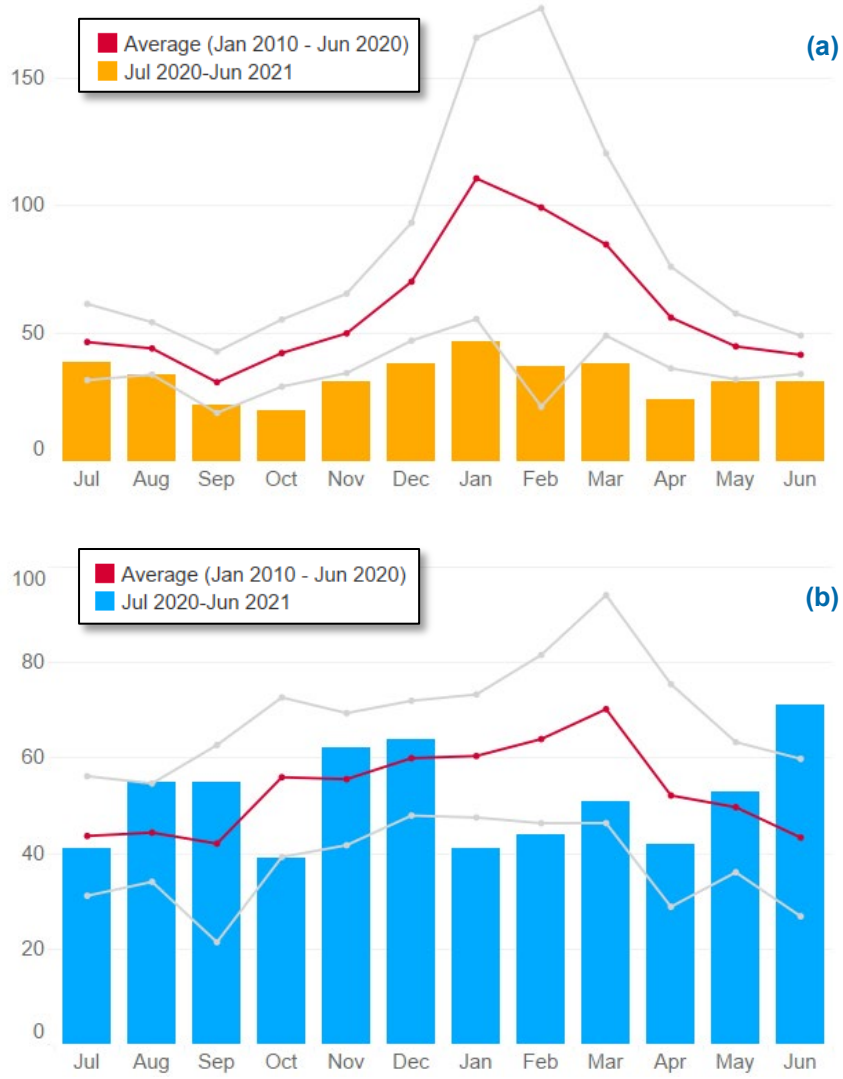

Figure 15 All incidents in the period due to (a) asset failures and (b) contact events

The grey line is one standard deviation above and below the average

Figure 16 shows the number of incidents on the Victorian networks from most common to least common this year (blue bars) relative to the long-term average for the 2010-2020 period (orange bars).

The four most common incidents were vehicle impacts[5], tree contact, other contact events and HV fuse faults. Two of these events are outside the direct control of the networks to manage (vehicle impacts and other contact events), one is partly in control of the networks (tree contact) and one is within their control (HV fuse faults).

When compared to the long-term averages across the period from January 2010 to June 2020, the incidents in 2020-21 are elevated in four categories, stable in one category and lower in nine categories.

Of particular note is that, apart for HV fuse faults, which are stable, all the incidents involving asset failures are much lower than the long-term average. The areas where incidents are exceeding the long-term average are primarily those events involving third parties – vehicle impacts (including contacts from construction and farming equipment) and dug up cables (mainly excavators and boring equipment). The other area of increase is tree contact and, while these are partly managed by the networks where vegetation grows into the clearance space, there is also a significant contribution from trees and branches blowing in or falling into the clearance space, which is outside the direct control of the networks.

Figure 17 shows the trend over the last ten years for the top four events above. This indicates that:

- vehicle impacts on overhead lines and poles have increased
- tree contacts have also increased this year
- other contact events have decreased markedly this year
- HV fuse faults have been stable.

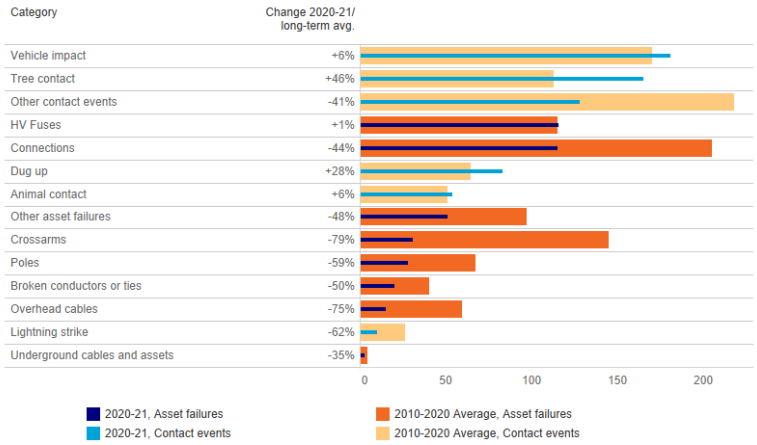

Figure 16 Incidents occurring on Victorian networks

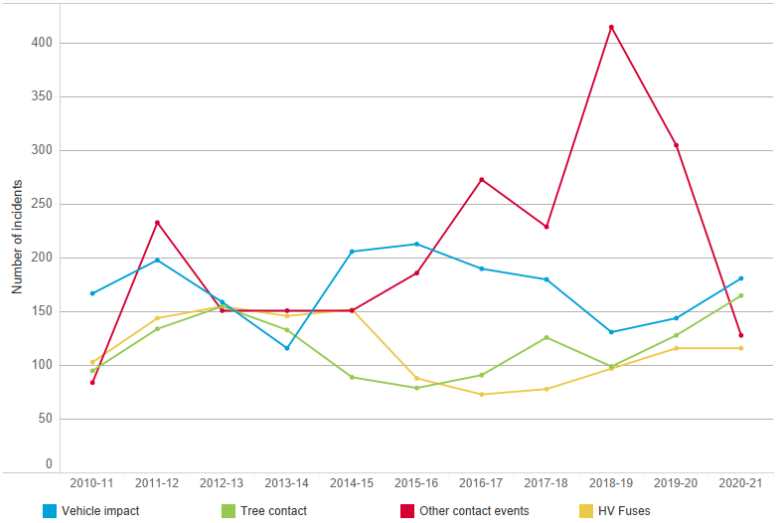

Figure 17 Historic trends for common incident events

[5] Vehicle impacts include collisions with poles and damage to overhead powerlines from road transport and farming and construction equipment.

Reviewing the performance of wood poles

ESV undertook an assessment of Powercor's asset management practices relating to wood pole management, and its capacity to deliver sustainable safety outcomes for the community. A draft technical report was published in December 2019 for public consultation.

The final technical report was published in March 2020. It made thirteen recommendations to improve Powercor's wood pole management.

Recommendation 1 was for Powercor to develop a Wood Pole Management Improvement Plan addressing the report recommendations. Once the plan has been reviewed and approved by ESV, it will be incorporated into Powercor's publicly-available Bushfire Mitigation Plan (Recommendation 2). Powercor will then update is wood pole management documentation to incorporate the revised objectives, strategies, performance measures, forecasts, plans and improvement initiatives (Recommendation 3).

The remaining recommendations related directly to Powercor's inspection method and practices. Powercor has submitted responses detailing how it plans to implement these ten recommendations. ESV has reviewed and accepted the submissions made by Powercor. These will now be incorporated into Powercor's Bushfire Management Plan.

ESV will continue to assess and monitor delivery of the Powercor pole intervention program over the 2021-2026 period, and Powercor pole management practices via its ongoing safety regulation audit program to ensure they continue to address the deficiencies identified in the public technical report.

ESV will continue to progress its recommendations, and has established lead and lag indicators and provided clarity on the definition of unassisted failures. Wood pole performance reporting is being continuously improved as the series of pole investigations progress across Victorian major electricity companies.

While the review was initially undertaken on the Powercor network, ESV has committed to reviewing the sustainability of pole management practices in the other Victorian distribution businesses. In 2020-21, ESV undertook an investigation of the AusNet Services program. A draft public report was released for consultation on 4 August 2021. A final report will be published addressing the submissions on the draft report. ESV will then request AusNet Services to address the recommendations of the report.

ESV has also committed to a review of the United Energy and Jemena asset management practices relating to wood pole management in the 2021-2022 period. The findings of these investigations will be published on the ESV website in due course.

ESV is also observing and assisting with a Victorian Electricity Supply Industry committee investigating non-destructive testing technologies for assessment of poles. The committee is undertaking a trial of wood pole testing devices that will deliver an expansion in the size, scope and investment by member businesses across Victoria.

Improving worker safety in the No Go Zone

In the past year the joint industry and ESV working group has continued to develop solutions to reduce the rate of occurrence of No Go Zone (NGZ) breaches and contact incidents.

The NGZ Working Group continued its risk-based approach focusing on the key industries of farming and construction where incidents primarily occur, and the causal factors in these industries such as people holding hand-held items and operating mobile plant, in particular backhoes, excavators, tripper trucks and farm equipment.

The NGZ Working Group has implemented actions to improve NGZ safety outcomes, including:

- Initiated work to revamp of the NGZ safety information and awareness campaign in collaboration with industry and WorkSafe media and corporate affairs experts to ensure consistent messaging.
- Developing more specific public educational and guidance material for tipper trucks and the farming sector.
- Developed a paper on available technology options for installation of non-contact voltage detecting equipment for installation on tip trucks, backhoes, excavator booms and mobile plant. This paper will now be used to influence the uptake of such technological controls.

ESV has gathered and analysed further specific NGZ data from the industry to share with Government to assess the value of further proactive controls. One example is the amendment of the planning and permit requirements for new buildings to ensure all new building applications demonstrate compliance to the *Electricity Safety Act* and relevant Regulations in maintaining suitable offsets from overhead powerlines.

Further information on working around powerlines can be found at https://esv.vic.gov.au/technical-information/electrical-installations-and-infrastructure/no-go-zones/.

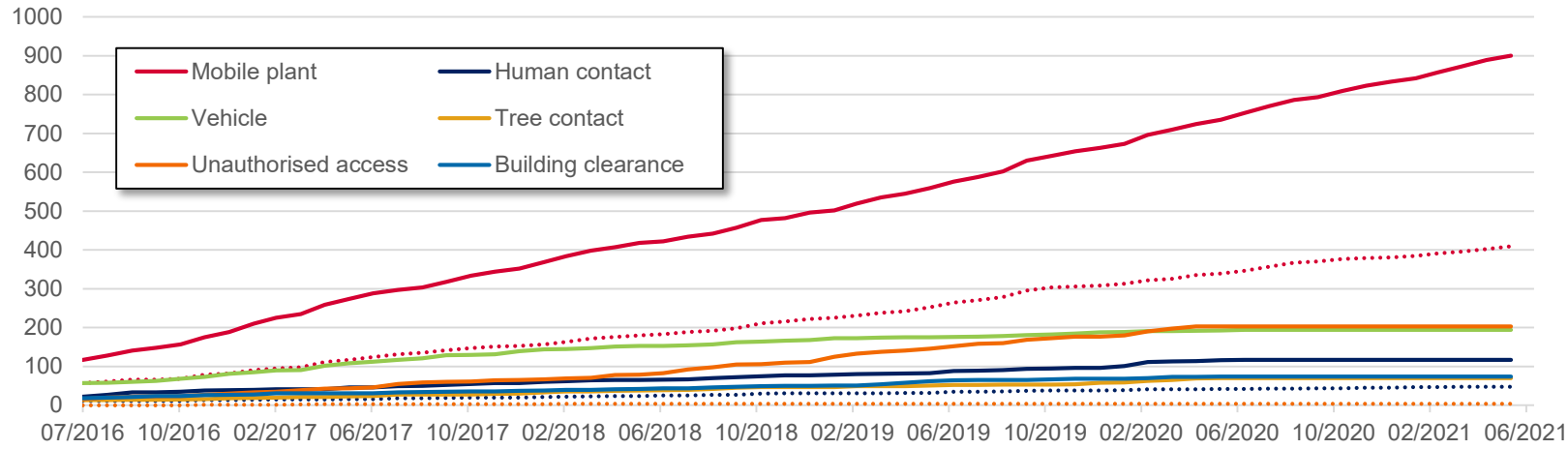

Figure 18 Cumulative trends involving NGZ incidents since 1 October 2015

solid lines = overhead assets, dotted lines = underground assets

Appendix A : Energy Safe Victoria

A1 Managing network safety under COVIDSafe requirements

ESV quickly responded to Victorian Government public health restrictions in early 2021 assessing operations to determine how to best perform our regulatory functions in the new environment. This resulted in working from home arrangements for all staff. This continued throughout 2021-22 apart from a few months where restrictions eased and a limited return to office occurred.

Recognising that ESV still needs to ensure the safety of Victoria's electricity networks, we have further developed policies and procedures to protect our staff and the community while we are working in the field. These include:

- providing personal protective equipment (face masks, gloves, sanitiser)
- providing training to staff on the correct use and disposal of face masks and PPE, and on correct hand hygiene practices
- developing protocols on managing the exchange of cars between ESV staff, and regular cleaning of pool cars between use
- establishing protocols to assist with contact tracing for field-based activities
- managing staff movements to minimise exposure and eliminate large gatherings, including; not attending company depots, staying outside of work zones, and using mobile phones to communicate with company staff while on site (to maintain social distancing during inspections)
- targeting and limiting field works to the most critical audits and inspections.

While operating with public health restrictions, the bushfire hazard mapping review for HBRA and LBRA (per section 80 of the *Act*) has continued and is on track to the original program timeframe. The review has been completed in Powercor, United Energy and Jemena, and is on track to be completed in AusNet Services by the end of June 2022. United Energy and Jemena transitioned to the updated risk layers on 1 August 2021, and Powercor is on track to transition to the updated risk layers on 1 November 2021 as per the ESV accepted transition plan.

COVIDSafe requirements have impacted the delivery of the REFCL program, as distribution businesses have experienced delays in the importation of essential equipment from Asian and European manufacturers and with construction sector shutdowns. Due to national and international travel restrictions, their engineers have also been unable to witness factory acceptance testing of REFCL units and other major plant items prior to shipping. Where possible, this is now being done via teleconference.

High-voltage customers needing to interface with REFCL networks have also seen on-premises works delayed due to restrictions and financial hardship.

ESV has been able to continue its observation of the REFCL program compliance testing in a modified format. More broadly, ESV has been able to successfully modify its audit, inspection and observation practices to continue oversight with the appropriate diligence and rigor to achieve planned business outputs.

A2 Operational performance

A2.1 The risk management hierarchy

ESV undertakes a wide range of functions to ensure safety risks are being appropriately managed by the Victorian transmission and distribution networks. Figure 19 shows an idealised hierarchy of controls, illustrating how the *Electricity Safety Act* and associated regulations flow down through the various plans into processes, and are finally deployed as practices on the ground. The blue boxes designate the levels within the hierarchy and examples of elements at each level.

As regulator, ESV attempts to gain insight into the various levels of the hierarchy to ensure that failures at the top levels don't manifest at systemic issues at the lower levels. Examples of the tools we use to gain insight are shown as the red boxes in Figure 19.

Section A2 provides an overview of ESV's activity this year in gaining such insights, and Appendices B to J provide specific findings on each of the major electricity companies.

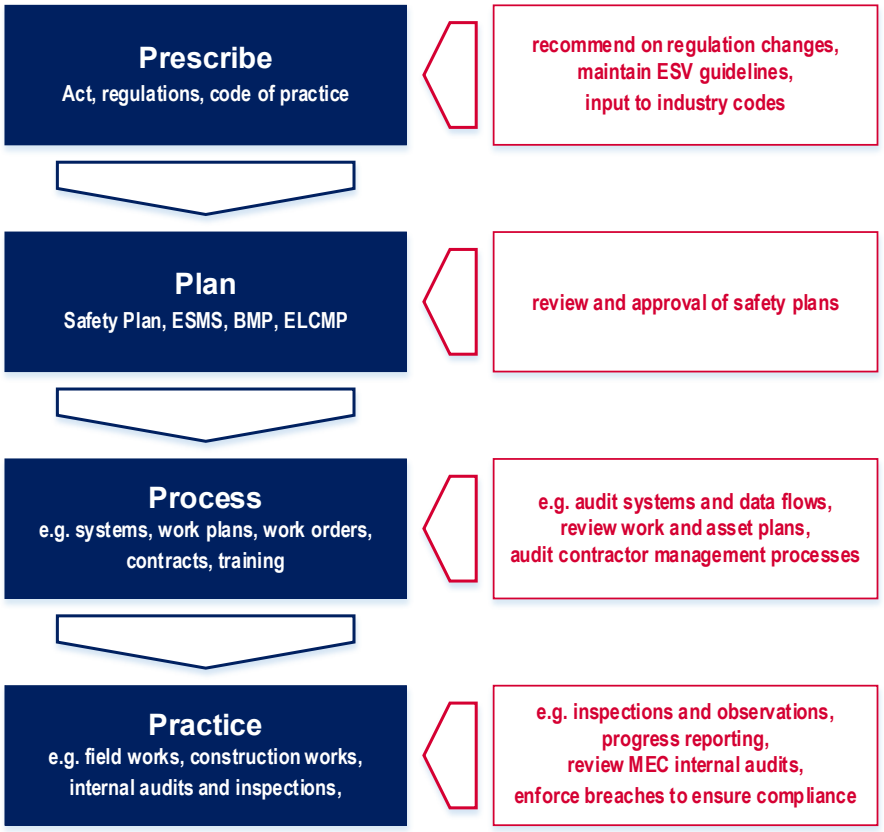

Figure 19 The regulatory hierarchy of controls

A2.2 Statutory plans

Electricity Safety Management Schemes

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

The numbers of ESMSs processed each year are shown in Figure 20.

Having accepted ESMSs for all major electricity companies during 2018-20, ESV focused on auditing the implementation of the ESMSs in the 2020-21 period.

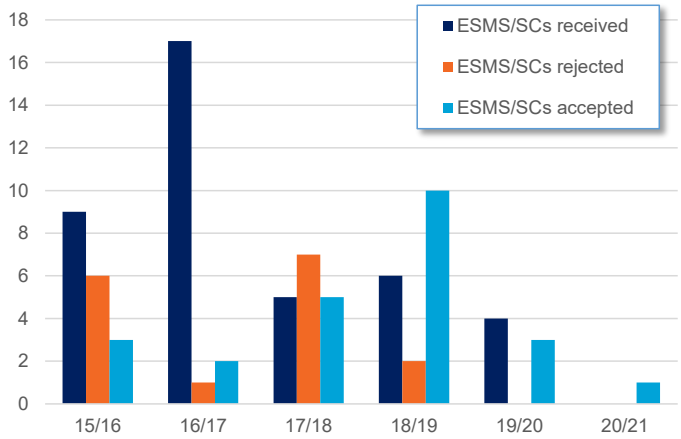

Figure 20 ESMSs and safety cases received and accepted

Bushfire Mitigation Plans

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

All specified operators who own or operate a high voltage overhead line in HBRA are also required to submit a BMP to ESV for acceptance every year, or after any similar changes.

The numbers of BMPs received and approved by ESV each year are shown in Figure 21.

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

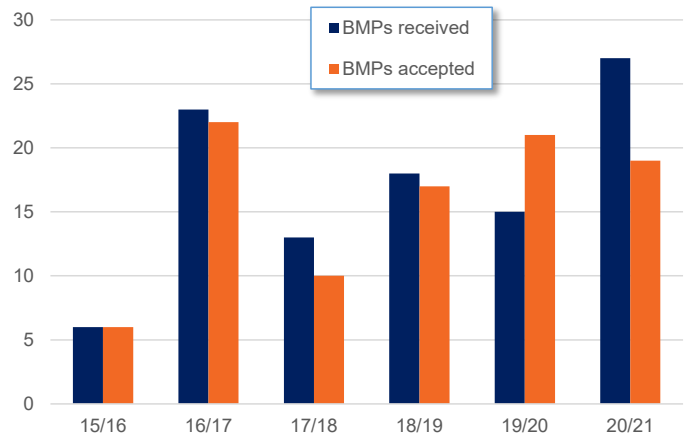

Figure 21 Bushfire Mitigation Plans received and accepted

Electric Line Clearance Management Plans

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

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

As the major electricity companies pose the greatest risk with regard to electric line clearance, ESV prioritises evaluation and approval of their plans. During the 2020-21 period, plans from all of the major electricity companies were evaluated and approved.

Municipal councils and other responsible persons carry different electric line clearance risk profiles when compared to the major electricity companies. Their risk profiles are less focused on bushfires and more concerned with minimising harm and maintaining reliable electricity supply.

Council and other responsible persons have less knowledge of these risks and, as a result, their plans are less mature than those of the major electricity companies. Typically, they are poor at identifying their electric line clearance risks and articulating how they intend to manage those risks.

As such, additional effort is required by ESV to educate this cohort of regulated entities on what comprises a quality plan, their line clearance responsibilities and the levels of compliance expected by ESV and the community.

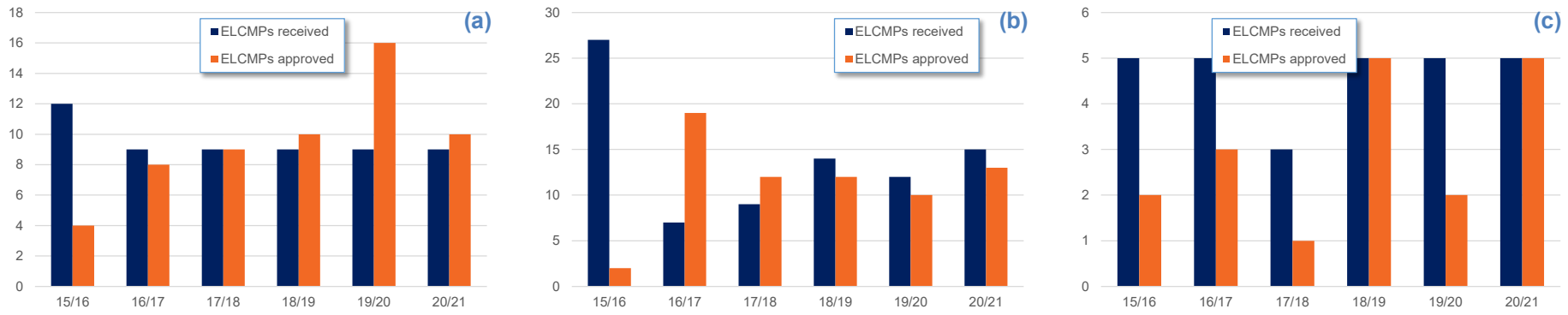

Figure 22 ELCMPs received and approved for (a) major electricity companies, (b) councils and (c) other responsible persons

A2.3 Exemptions

The process for exemptions related to the Powerline Bushfire Safety Program is that the Governor in Council, on recommendation from the Minister, has the power to grant an exemption under section 120W of the Act. ESV then has the power to grant matching exemptions to the relevant parts of the bushfire mitigation regulations under regulation 13. In practice, both exemptions are informed by ESV's evaluation and analysis in consultation with DELWP.

On 12 October 2020, ESV granted a general exemption to AusNet Services, Jemena and Powercor removing the requirement to achieve the required capacity (REFCL-protection) on underground cables for which REFCL protection will not provide tangible bushfire mitigation benefit.

Over the reporting period ESV also granted:

- a time extension and corresponding exemption to AusNet Services
- an exemption regarding Jemena's delivery of Coolaroo zone substation.

Details of the requests can be found in Sections B4 and E4.

Further information on the REFCL program, including details on all exemptions and time extensions granted can be found on ESV's website at https://esv.vic.gov.au/about-esv/reports/technical-reports/victorian-refcl-program-status/.

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

The number of such applications has fallen dramatically from its peak in 2016-17 (Figure 24). The bulk of applications received in recent years related to the installation of the National Broadband Network (NBN). Those applications have tapered off significantly now that most of the network backbone has been deployed.

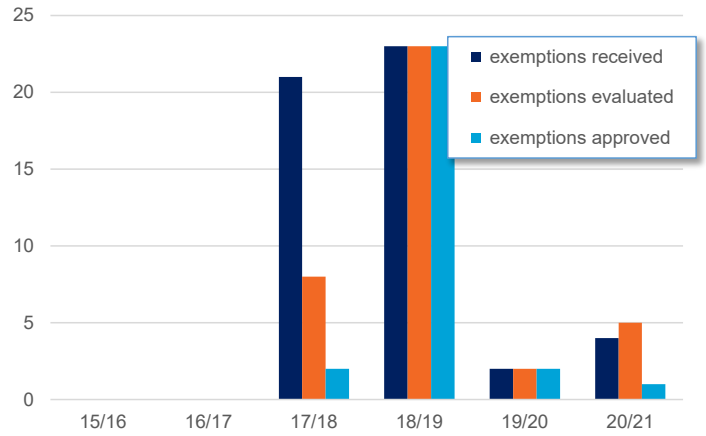

Figure 23 Bushfire Mitigation Plan exemptions

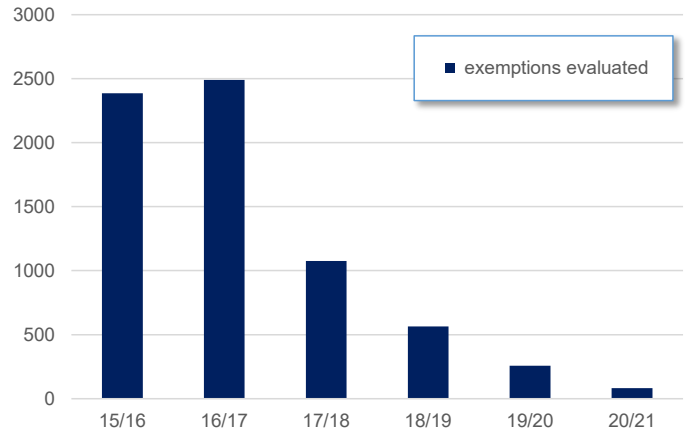

Figure 24 Electric lines on public lands exemptions

A2.4 Audits, inspections and observations

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

Electricity Safety Management Scheme audits

The nine major electricity companies are individually required to have an accepted Electricity Safety Management Scheme (ESMS) in place. ESV regularly audits for compliance with the accepted scheme.

Figure 25 shows the numbers of ESMS audits undertaken each year.

During 2020-2021, ESV carried out ESMS system audits that reviewed the process and procedures of sub-contractor management.

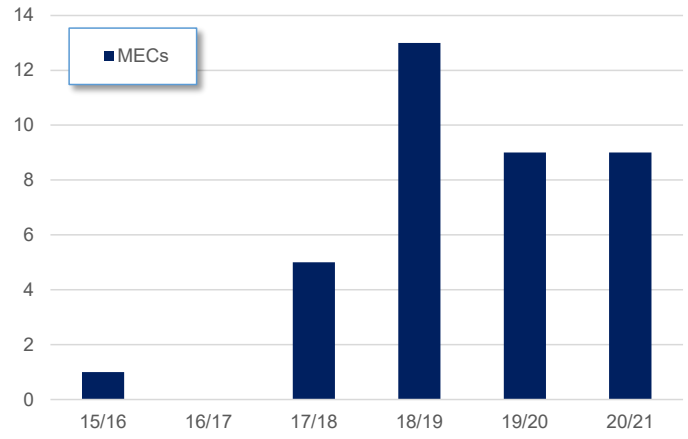

Figure 25 Numbers of ESMS audits

Bushfire mitigation audits and inspections

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

Figure 26 shows the numbers of bushfire mitigation audits undertaken each year. Each of the nine major electricity companies is audited at least once each year. The peak in 2017-18 resulted from secondary pole audits of four of the distribution businesses due to stakeholder concerns.

ESV aims to undertake a bushfire mitigation audit of at least one specified operator each year. These businesses represent a low risk of fire ignition compared to the major electricity companies due to the small length of lines they operate. In 2021, ESV performed an audit on Pacific Hydro.

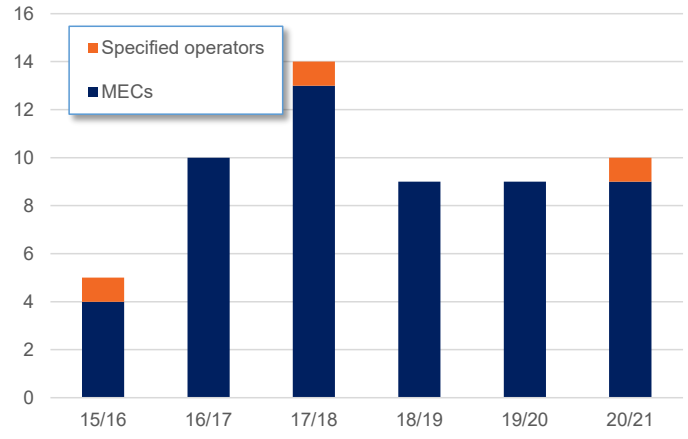

Figure 26 Numbers of bushfire mitigation audits

Electric line clearance audits and inspections

Figure 27(a) shows that the numbers of pre-summer audits have remained relatively stable over the last six years. Figure 27(b) shows these audits have been complemented by the comprehensive inspection programs introduced in 2017-18.

The volume of spans inspected by ESV has increased from 2,000-3,000 spans in 2015-2016 and 2016-2017 to over 16,000 in 2018-2019.

The number of spans inspected has decreased in HBRA in the last two years. This is, at least in a large part, due to COVIDSafe requirements on travel. Even so, the additional resource we recruited in 2017-18 have allowed ESV to conduct inspection sampling that generally provides 95 per cent assurance that our inspection results are representative of the broader compliance standards for the networks. This, in turn, provides us with more information to hold responsible persons accountable for their maintenance of vegetation around the state's powerlines, and thereby ensure that bushfire risk is being properly managed.

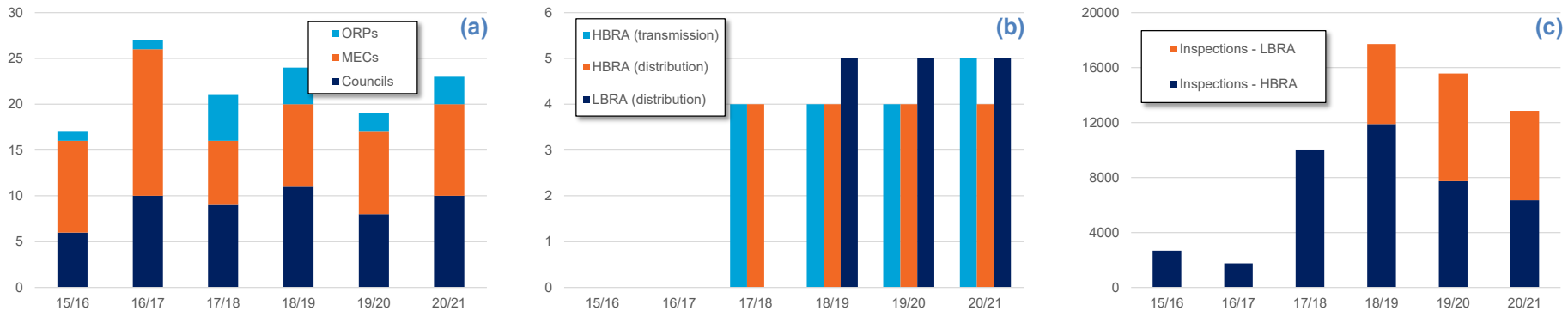

Figure 27 Electric line clearance audits and inspections showing (a) the number of pre-summer outcomes audits, (b) the number of inspection programs of major electricity networks and (c) the volume of spans inspected during these audits and inspections

Note: The number of inspections reported last year was for the distribution businesses rather than for all major electricity companies.

Works practice observations

Works practice observations provide key insights into the ability of the major electricity companies to plan and deliver safety outcomes. Any breakdowns in the process become evident when works in the field are monitored.

ESV conducts two types of works practice observations:

- planned observations are organised with the distribution businesses, and ESV's work practices advisers often attend the pre-work meetings before observing the work being undertaken
- opportunistic observations involve ESV's works practices advisers identifying work locations from the distribution businesses' websites and arriving unannounced to observe the work being undertaken.

Figure 28 shows the number of works practice observations undertaken each year. ESV's three works practice advisors conducted a total of 26 field-based observations this year. This work was interspersed with their education and consultation duties working with industry committees, urban and rural businesses, and other relevant organisations across the state.

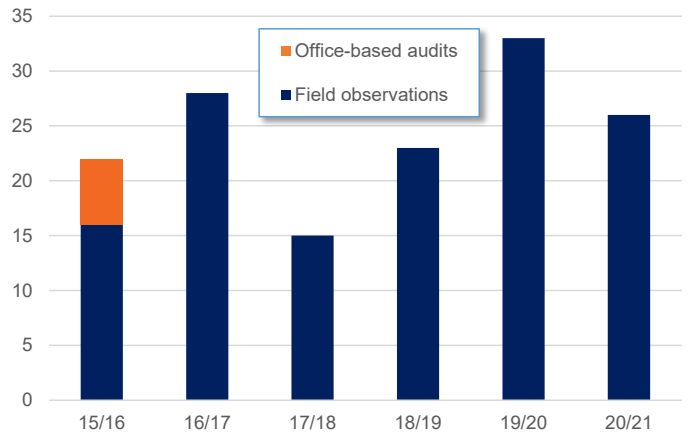

Figure 28 Numbers of works practice observations

A2.5 Investigations

ESV undertakes assessment of all complaints or incidents raised with ESV. Comprehensive investigations are then undertaken if this assessment identifies that there is a serious breach of legislative requirements, or where multiple recurrences indicate systemic problems with how businesses and individuals are managing a safety risk they are responsible for. These detailed investigations determine whether enforcement action is warranted and, if so, support a successful outcome.

Figure 29 shows the numbers of new investigations opened each year and the number that have been completed. Given the level of detail required to support an enforcement action, many of these investigations may extend into future years.

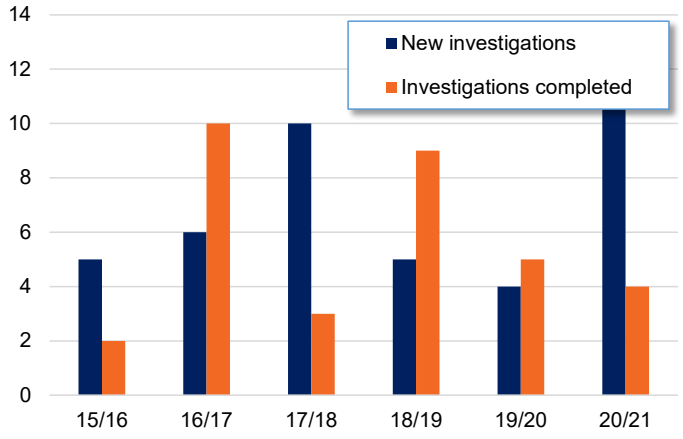

Figure 29 Numbers of new and completed investigations

Appendix B : AusNet Services

AusNet Services[6] has two shareholders with a significant investment and board representation, being Singapore Power (32.3 per cent) and State Grid of China (19.9 per cent). The remaining 48 per cent is publicly owned. The two major shareholders of AusNet Services also own 100 per cent of Jemena and 34 per cent of United Energy.

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

AusNet Services is the only major electricity company in Victoria operating both transmission and distribution networks.[7]

The transmission network services all of Victoria (500kV and 220kV) and also includes interconnections with New South Wales and South Australia (330kV and 275kV respectively). It comprises approximately 6,560 km of transmission lines and 13,200 towers.

The distribution network covers an area of approximately 80,000 km^2, and includes Melbourne's outer-eastern suburbs and runs north to the New South Wales border and south and east to the coast (Figure 30). It comprises approximately 38,200 km of overhead line, 7,600 km of underground cable, 333,200 power poles and 97,400 public lighting poles. Most of this network (93 per cent) is in rural areas.

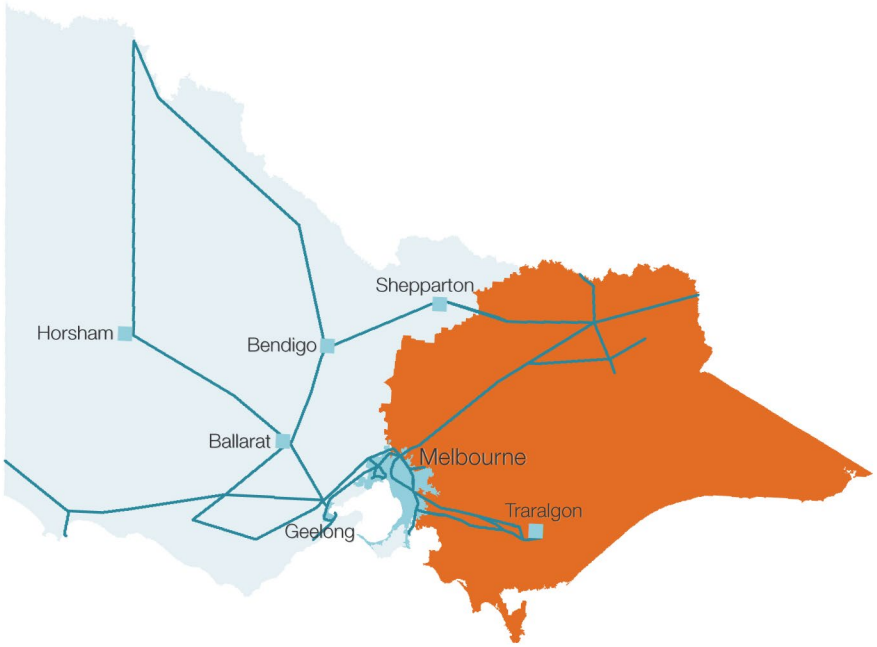

Figure 30 Service area for the AusNet Services distribution network (orange area) and transmission lines (dark blue)

[6] AusNet Transmission Group Pty Ltd and AusNet Electricity Services Pty Ltd are the listed holders of the electricity transmission and distribution licences respectively.

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

B1 Plans and processes

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

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

On 22 February 2021, AusNet Services provided an updated distribution bushfire mitigation plan for ESV review. The plan was updated to include details relating to the REFCL program mandated by regulation, the protection sequence for ACRs and feeder circuit breakers, and to reflect an alternative REFCL provider. ESV reviewed the plan and provided comments regarding changes required before ESV would accept the plan. Final acceptance is awaiting ESV management review and is yet to be granted.

AusNet Services submitted its 2021-2022 transmission and distribution electric line clearance management plans to ESV in March 2021, and both were approved in advance of the upcoming fire danger period.

B2 Directions

Two directions to AusNet Services were due to be completed by 1 November 2020. These are to:

- install armour rods and vibration dampers in low risk areas within hazardous bushfire risk areas (HBRA) and in low bushfire risk areas (LBRA)
- install spacers on high voltage (HV) lines and spreaders on low voltage (LV) lines in LBRA.[8]

In April 2017, AusNet Services approached ESV to amend its armour rods and vibration dampers plan for HBRA and LBRA. The proposal was based on Australian Standard AS/NZS 7000 *Overhead line design*, which allows for an engineering assessment to determine if vibration dampers are effective in a given location. ESV previously reviewed the methodology behind the proposal and the amended installation plan and accepted both. The AusNet Services program for the installation of armour rods and vibration dampers was completed by 1 November 2020.

The direction to install spacers and spreaders in LBRA was completed ahead of time.

[8] The installation of armour rods and vibration dampers in high risk areas within HBRA and spacers and spreaders in HBRA was completed by 1 November 2015.

B3 Powerline bushfire safety programs

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

Figure 31 shows the progress of the AusNet Services REFCL installation program as of 1 May 2019, 2020 and 2021, and its anticipated progress in the next twelve months.

By 30 June 2021, ESV had accepted 13 AusNet Services zone substations as compliant, and granted time extensions in relation to four zone substations.

AusNet Services has experienced technical challenges in achieving the required capacity on some feeders with a high proportion of single-phase spurs, feeders that are excessively long and/or feeders that experience mutual coupling effects due to proximity to transmission or sub-transmission lines. AusNet Services is undertaking modelling and has engaged global experts in this field to address the issue.

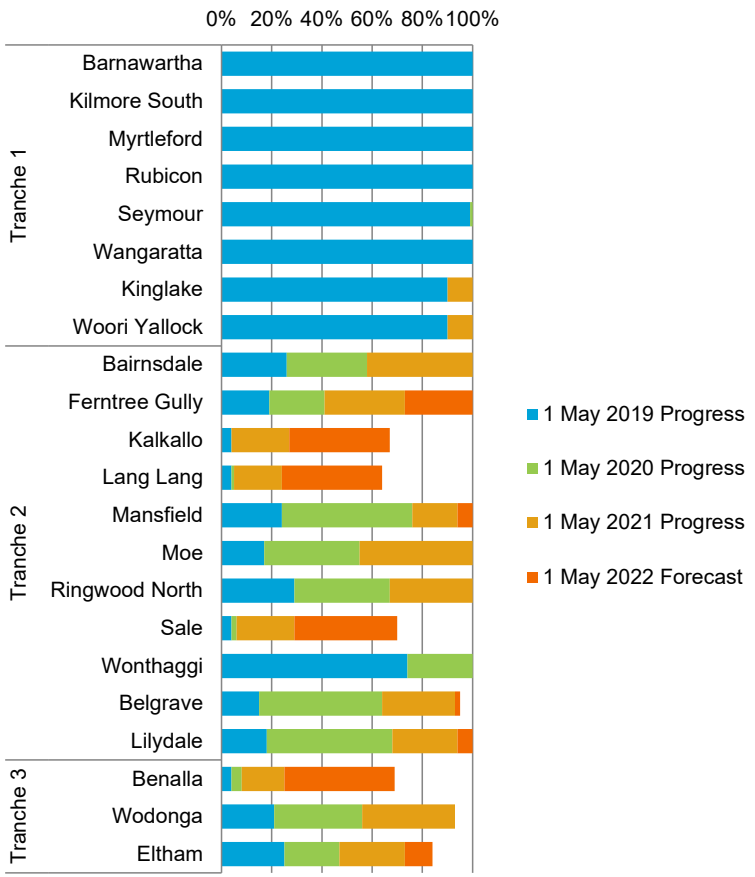

Figure 31 Status of the AusNet Services REFCL program

B4 Exemptions

On 27 April 2021, ESV granted a time extension and corresponding exemption for the AusNet Services REFCL program due to third-party delays beyond its reasonable control and unanticipated technical issues. This effectively changed AusNet Services' regulatory deadlines to:

- 13 substations by 1 May 2021
- 14 substations by 1 November 2021
- 19 substations by 1 November 2022
- 22 substations by 1 May 2023

Where possible, AusNet Services is implementing interim solutions to deliver the risk reduction associated with REFCL protection to the affected communities ahead of formal acceptance by ESV.

ESV also expects to receive exemption applications from AusNet Services in relation to the Ferntree Gully and Kalkallo zone substations. The exemptions relate to replacing bare powerlines with underground or covered conductor instead of REFCL-protecting to overcome technical challenges. In each case, it is expected that the alternative solution will deliver an equivalent or better safety outcome.

B5 Audit performance

B5.1 Electricity Safety Management Scheme (ESMS)

During October 2020, ESV audited the AusNet Services contractor and sub-contractor process and procedures for both transmission and distribution. This focused on the process and procedures used by AusNet Services to manage contractors. The ESMS was found to adequately describe the contractor processes and procedures and be compliant in this area. ESV provided one suggested improvement relating to on-site access to the latest AusNet Services standards via electronic means.

AusNet Services provided a plan to address the ESV audit findings and implement changes in 2021.

B5.2 Electric line clearance

Distribution network pre fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted on the AusNet Services distribution network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found two major non-compliances and two opportunities for improvement. The non-compliances related to technical procedural deficiencies for vegetation clearing rectification timeframes and vegetation coding.

Through the audit and inspection process, ESV concluded that AusNet Services was not strictly managing its line clearance responsibilities on its distribution network as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. While a fire did not occur on the AusNet Services network in 2020-2021 due to vegetation growing into electric lines, the ESV field inspection component of the audit found there was an increasing risk of vegetation contacting the network.

AusNet Services has committed to addressing the procedural deficiencies identified by ESV through revised procedures in its electric line clearance management plan. In addition, it is to procure additional resource to better enable it to manage its electric line clearance responsibilities.

ESV will review the application of these mitigation strategies as part of the 2021-22 auditing and inspection programs. It is closely monitoring this situation to identify what intervention maybe necessary to ensure AusNet Services addresses this increasing risk and delivers a trajectory of improved performance.

Distribution network inspection

During the 2020-21 period, ESV inspected 4857 spans on the AusNet Services distribution network, with 2170 being in HBRA and 2687 in LBRA.

ESV identified 595 non-compliant spans across the network — 293 in HBRA and 302 in LBRA. ESV issued all non-compliant spans it identified to AusNet Services under section 86(1) notices and all were cleared by AusNet Services as a matter of priority, resulting in the elimination of these potentially hazardous situations.

In 2020-21, ESV observed a significant rise in the rate of major non-compliances affecting the AusNet Services distribution network (Figure 32). A major non-compliance is regarded as high risk where vegetation is touching, or could soon touch, uninsulated conductors.

A progressive decline in the performance of AusNet Services has been observed since 2017-18 (see Figure 9 and Figure 10); with a significant further deterioration observed this year.

The rates of non-compliance and major non-compliance have increased significantly this year in both HBRA (Figure 9) and LBRA (Figure 10).

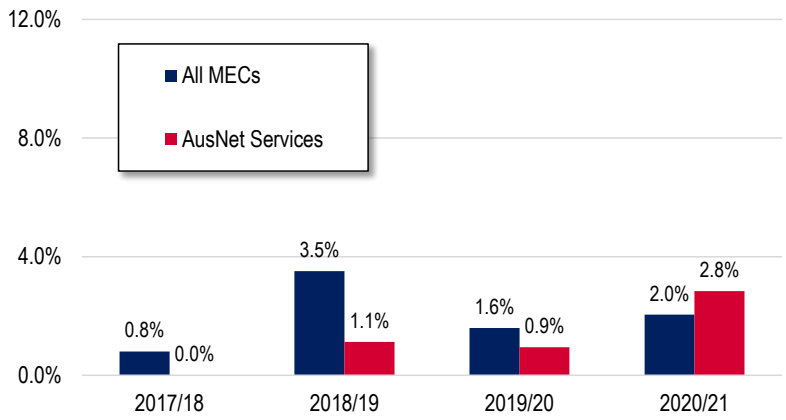

Figure 32 Rate of major non-compliances (HBRA and LBRA)

This is of particular concern as the network has a large footprint covering most of eastern Victoria. ESV has required AusNet Services to explain how it plans arrest this trend. It has responded by informing ESV it is completing an end-to-end review of its vegetation management systems, and will implement reforms designed to address the increasing non-compliance rates.

Transmission network pre fire danger period audit

ESV also completed an audit and inspection for the AusNet Services transmission network before the fire danger period and, like the distribution network audit, this audit was to confirm AusNet Services was managing its electric line clearance responsibilities effectively in HBRA.

The audit found one major non-compliance, one minor non-compliance and one opportunity for improvement. As with the distribution network, the non-compliances related to technical procedural deficiencies for vegetation clearing rectification timeframes and vegetation coding.

ESV concluded that AusNet Services was not strictly managing its line clearance responsibilities on its transmission network as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. That said, the field inspection component of the audit found there was little to no risk of fires being started by vegetation growing and contacting the network since the transmission network has large well-established clearance easements; the matters identified during the audit only came into play for vegetation that existed on the outer fringe of the required minimum clearance space.

ESV had not yet received a response to the audit and inspection findings at the time of writing this report,

B5.3 Bushfire mitigation

Transmission network

ESV reviewed 1,219 requested asset records from nominated transmission lines across Victoria. The review found no structures outside the inspection cycle timeframes identified in the AusNet Services bushfire mitigation plan.

ESV inspected 26 structures across AusNet Services transmission network from the nominated lines from Hazelwood to South Morang, Brunswick East Terminal Station to South Heatherton Terminal Substation and Eildon to Thomastown. The inspections found no serious issues and one minor issue of a missing circuit nameplate on a structure.

The visual inspection found the transmission assets to be generally in very good condition. The issue found was very minor in nature and would be identified and repaired as part of routine inspection and maintenance activities undertaken by AusNet Services. ESV recommended that AusNet Services ensure the issue is rectified.

Distribution network

ESV reviewed 20,302 requested asset records from the Wangaratta and Rubicon areas. The review found no structures outside the inspection cycle timeframes identified in the AusNet Services bushfire mitigation plan.

ESV inspected 147 structures across AusNet Services network from the above nominated areas. The inspections found no serious issues and 13 minor issues, including moisture ingress into fuses, rusting conductor ties and deteriorated or incorrectly positioned cables.

The issues found were minor in nature and would be expected to be identified and repaired as part of routine inspection and maintenance activities undertaken by AusNet Services. ESV recommended that AusNet Services rectify the identified issues in accordance with its priority maintenance practices.

B5.4 Work practices

In 2020-21, the work practices observations program was interrupted due to COVIDSafe requirements. During this time ESV undertook five observations of AusNet Services work practices across five sites. Three observations were on the AusNet Services transmission network and two were on the AusNet Services distribution network. All of the distribution and transmission network observations were planned observations.

The findings of these observations were as follows:

- AusNet Services distribution network
  - major non-compliances 0
  - minor non-compliances 2
  - opportunities for improvement 1
- AusNet Services transmission network
  - major non-compliances 2
  - minor non-compliances 1
  - opportunities for improvement 2

The key areas of concern identified by these observations related to:

- personal protective equipment with one major non-compliance
- use and testing of live line and operating equipment with one major non-compliance
- hazard identification with two minor non-compliances and two opportunities for improvement.

ESV recommends that AusNet Services work practices specifically focus on ensuring:

- appropriate personal protective equipment is used in all occasions when it is required
- the condition of live line and operating equipment is checked before use
- hazard identification is carried out effectively identifying all work related hazards.

B6 Safety indicators

Figure 33 shows the number of all serious electrical incidents reported to ESV via OSIRIS by AusNet Services during the 2020-2021 period, with the blue bars showing the numbers for 2020-21 and the orange bars showing the long-term average from 1 October 2010 to 30 June 2020. Figure 34 shows the same for those incidents that resulted in a ground or vegetation fire.

The most common incidents on the AusNet Services network in 2020-21 were HV fuse failures, tree contact, vehicle impacts[5] and other contact events. The numbers of all asset failure incidents were lower in 2020-21 than the long-term average, with the exception of HV fuse failures which were stable. Contact incidents were higher than the long-term average in all categories except vehicle impacts and lightning strike.

Tree contact, animal contact, connection faults and HV fuse failures were the most common causes of network-related fires. Fires from asset failure incidents were lower in 2020-21 than the long-term average in all categories. Fires from contact incidents were higher than the long-term average in three categories (tree contact, other contact events and vehicle impacts) and lower in two categories (animal contact and lightning strike).

While tree contact events are partly within the control of AusNet Services, such events are not fully within its control when they involve vegetation that has blown or fallen onto powerlines from outside the clearance space.

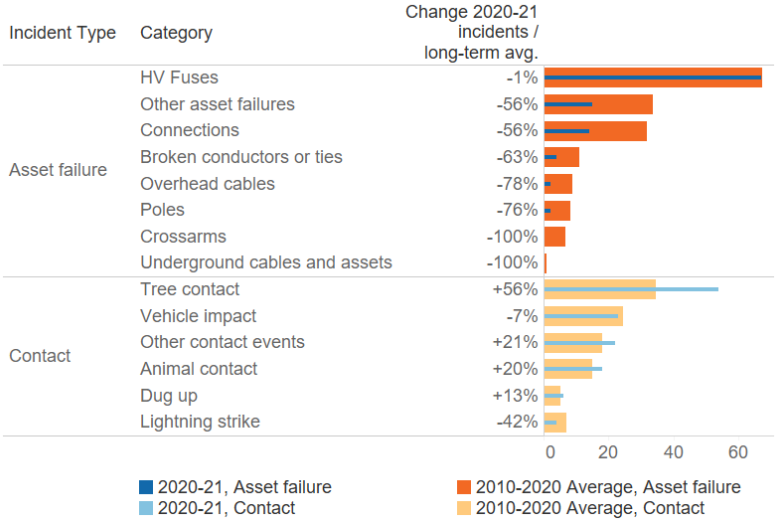

Figure 33 Incidents on the AusNet Services network

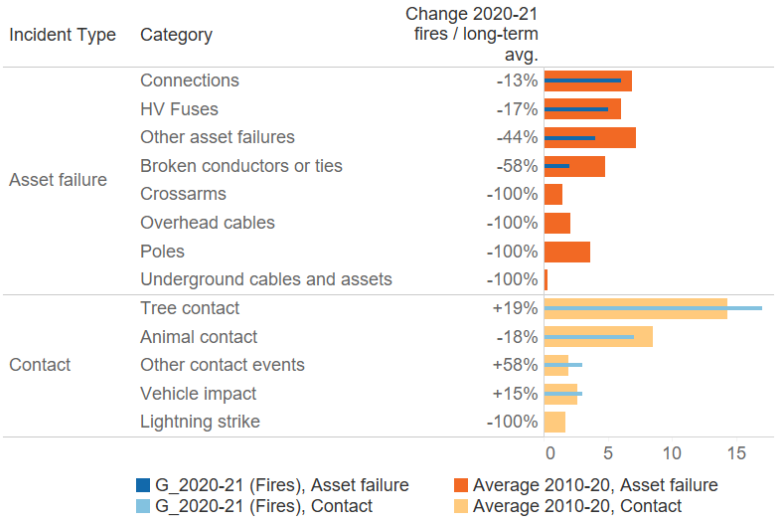

Figure 34 Incidents on the AusNet Services network resulting in ground fires

Appendix C : Basslink

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

Basslink owns and operates the HVDC interconnector between Victoria and Tasmania. In Victoria, its assets comprise the Loy Yang converter station connected to the 500kV transmission system via 3.2 km of overhead line. From the converter station, 57 km of overhead line and 6.4 km of underground cable connect to the submarine cables that cross Bass Strait to Tasmania (Figure 35). 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 been commissioned in April 2006.

Figure 35 Location of Basslink transmission assets (dark blue line)

C1 Plans and processes

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

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

Basslink provided an ESMS in March 2019 and ESV accepted the ESMS on 21 January 2020. The ESMS is due for renewal in January 2025.

Basslink submitted its 2019-2024 Bushfire Mitigation Plan to ESV on 27 August 2019. ESV reviewed the plan and, after Basslink made changes to address ESV comments, ESV accepted the plan on 19 December 2019. The Bushfire Mitigation Plan is due for renewal in December 2024.

Basslink submitted its 2020-2021 electric line clearance management plan to ESV in March 2020, and the plan was approved ahead of the fire danger period.

C2 Directions

ESV has not had cause to issue directions to Basslink.

C3 Bushfire mitigation regulations programs

There are no requirements on Basslink under the Electricity Safety (Bushfire Mitigation) Regulations 2013.

C4 Exemptions

Basslink has sought no exemptions from regulations.

C5 Audit performance

C5.1 Electricity Safety Management Scheme (ESMS)

ESV audited the Basslink governance process and procedures in September 2020. ESV found that the ESMS adequately described the Basslink governance process and procedures. ESV identified five opportunities for improvement, being:

- Basslink indicated that their Safety Observation Document (used as their auditing tool) is currently being reviewed and updated to improve visibility of smaller contractors and to better track corrective actions
- Basslink indicated their Health and Security Plan (SHES1001) is currently being reviewed and updated
- Basslink would benefit from a dedicated document detailing the process and procedure for carrying out audits or Works Practices Observations
- Basslink indicated their intention to implement a panel to assess personnel competencies
- Basslink indicated their intention to develop a handbook to assist in the Computerised Maintenance Management System (CMMS) being used consistently across the business.

Basslink provided a plan to address the audit findings and implement changes in 2021.

C5.2 Electric line clearance

Leading into the 2020-21 fire danger period, an audit and inspection was completed for the Basslink network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found Basslink was managing the network strictly according to its approved plan, and there were no non-compliances or opportunities for improvement.

ESV inspected 35 of the network's 142 spans all were found to be compliant. The easement was being managed to a high standard. ESV considered this to be excellent result, particularly given this has been the case for five consecutive years.

C5.3 Bushfire mitigation

ESV reviewed 142 asset records from the 400kV DC powerlines running between the Loy Yang converter station and the coastal transition station. The review found no structures outside the inspection cycle timeframes identified in the Basslink bushfire mitigation plan.

ESV inspected 23 structures along the 400kV DC powerline and found the transmission assets to be generally in very good condition. There were no serious issues and no minor issues.

C5.4 Work practices

The Basslink transmission line operates almost continually, with scheduled detailed inspections occurring every three years and unscheduled surveillance inspections occurring monthly. Maintenance activities are determine by the severity of defects identified.

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

C6 Safety indicators

Transmission infrastructure generally has a low level of incidents, due to the nature of the assets and the clearances maintained around these higher voltage assets. Transmission assets are concentrated in fewer, larger and better-defined easements than distribution assets, thereby reducing exposure to environmental threats and third-party impacts. This also makes them easier to maintain.

Compared to the AusNet Services transmission network, Basslink has the further advantage of having a relatively short transmission line in Victoria.

Given this, it is not unexpected that Basslink recorded no incidents on its transmission network during the 2020-21 period.

Appendix D : CitiPower

CitiPower/Powercor[9] is jointly owned by Cheung Kong Infrastructure, Power Assets Holdings and Spark Infrastructure. Cheung Kong Infrastructure and Power Assets Holdings are both part of the Cheung Kong Group of companies. They jointly own 51 per cent of CitiPower/Powercor, with the remaining 49 per cent held by Spark Infrastructure.

In May 2017, Cheung Kong Infrastructure purchased the DUET Group, thereby giving it majority ownership (66 per cent) of United Energy. This has resulted in some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls. Of most relevance from a safety perspective was the introduction into United Energy of CitiPower/Powercor procedures for vegetation management.

CitiPower and Powercor are managed by a single executive management team using common procedures and systems across the two distribution businesses. As a result, the Electricity Safety Management System (Section D5.1) and the work practices observations audits (Section D5.3) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the CitiPower network and have therefore been assessed independently of the Powercor assets.

The CitiPower distribution network covers an area of approximately 157 km^2, and includes Melbourne's central business district and inner suburbs (Figure 36). It comprises approximately 2,550 km of overhead line, 2,700 km of underground cable, 48,800 power poles and 9,000 public lighting poles. Most of this network (75 per cent) is in the central business district.

Figure 36 Service area for the CitiPower distribution network (orange area)

Jemena and United Energy service boundaries are shown as orange lines

[9] CitiPower Pty Ltd is the listed holder of the electricity distribution licence.

D1 Plans and processes

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

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

On 2 September 2019, CitiPower submitted their 2019-24 Bushfire Mitigation Plan for ESV review. ESV accepted the plan on 20 December 2019.

CitiPower submitted its 2021-22 electric line clearance management plan to ESV in March 2021, and the plan was approved in advance of the fire danger period.

D2 Directions

Two directions to CitiPower were due to be completed by 1 November 2020:

- 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.

CitiPower completed the installation of armour rods and vibration dampers in LBRA well ahead of schedule and completed the installation of spacers and spreaders by 1 November 2020.

D3 Powerline bushfire safety programs

There are no requirements on CitiPower under the Electricity Safety (Bushfire Mitigation) Regulations 2013.

D4 Exemptions

There are no outstanding exemptions applicable to CitiPower.

D5 Audit performance

D5.1 Electricity Safety Management Scheme (ESMS)

During the latter half of 2020, ESV audited CitiPower (together with Powercor, TOA and TOA2) on its contractor management process and procedures. The ESMS was found to adequately describe the contractor management processes and procedures and to be compliant in this area. ESV identified two opportunities for improvement, being:

- Where there are multiple contracted and subcontracted work parties present and live work is being undertaken, there is a benefit in having a worker assigned as the site leader.
- There may be benefit in noting on the lead contractor Job Safety Assessment (JSA) what other work parties are on site and noting that all parties have completed and signed onto their relevant JSA if they are not signed onto the lead contractor JSA. This will assist in ensuring all work parties have reviewed the work that is to be done and are aware of all the hazards and controls that are in place on the worksite.

CitiPower provided a plan to address the ESV audit findings and implemented these changes in 2020.

In June and July 2021, ESV audited CitiPower (together with Powercor, TOA and TOA2) on its construction planning process and procedures. The ESMS was found to adequately describe the construction planning processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- To enable the identification of potential site issues, there would be some benefit in encouraging an increased use of site visits by designers, construction project leaders and those involved in the construction job planning prior to construction crews attending site to undertake works.

- There is an opportunity for improvement to implement increased validation or cross checking of task descriptions dispatched to underground fault location crews.

CitiPower provided a plan to address the ESV audit findings and implement these changes in 2021.

D5.2 Electric line clearance

Network inspection

During the 2020-21 period ESV inspected 178 spans on the CitiPower network and identified 36 non-compliant spans. ESV issued all non-compliant spans it identified to CitiPower under section 86(1) notices and all were cleared by CitiPower as a matter of priority, resulting in the elimination of these potentially hazardous situations.

The rate of non-compliant vegetation has increased since last year (see Figure 10).

When ESV conducts inspections, it classifies non-compliance as major or minor non-compliance. A major non-compliance is regarded as high risk where vegetation is touching, or could soon touch, uninsulated conductors. This contrasts with minor non-compliance where vegetation is in the minimum clearance space required by the code but there is no immediate risk of contact with electric lines.

Figure 37 shows the rate of major non-compliances on the CitiPower network. While the rate of major non-compliance on the CitiPower network has been lower than the average across all of the distribution networks each year since ESV commenced collecting this data in 2017, ESV has noticed that there was an increased rate of non-compliance in 2020-21.

Figure 10 shows that the rates of non-compliance and major non-compliance both increased this year.

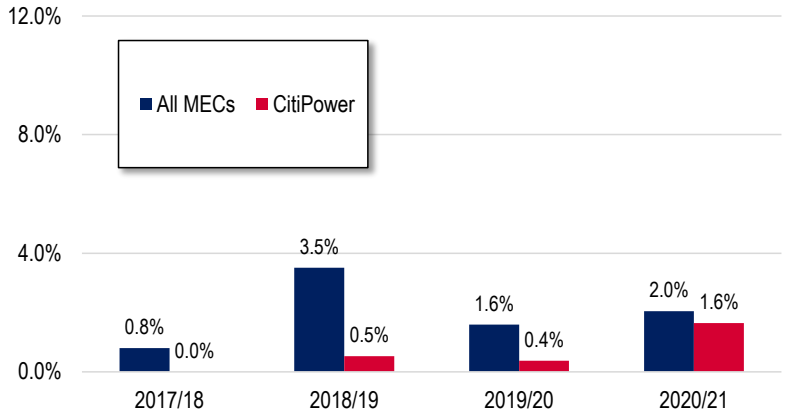

Figure 37 Rate of major non-compliances (LBRA)

D5.3 Bushfire mitigation

The CitiPower area is entirely urban and, although comprised of only low bushfire risk area, an annual bushfire mitigation audit is conducted to verify the inspection of above ground assets.

ESV reviewed 57,762 asset records from across the entire CitiPower network and found four LBRA structures outside the inspection cycle timeframes identified in the CitiPower bushfire mitigation plan. ESV recommended that CitiPower develop appropriate actions that will address these findings.

ESV inspected 68 structures from across the Kew and West Brunswick areas. The inspections found no serious issues and 23 minor issues, including loose and unsecured hardware, defective overhead services and a damaged public light.

The issues found were minor in nature and would be expected to be identified and repaired as part of routine inspection and maintenance activities undertaken by CitiPower. ESV recommended that CitiPower rectify the identified issues in accordance with its priority maintenance practices.

D5.4 Work practices

In 2020-21, the work practices observation program was interrupted due to COVIDSafe requirements. During this time ESV undertook four observations of CitiPower work practices across four sites, with two being planned observations and two being opportunistic observations.

The findings of these observations were:

- major non-compliances 0
- minor non-compliances 2
- opportunities for improvement 6

The key areas of concern identified by these observations related to:

- ESMS (non-electrical) findings with two minor non-compliances and one opportunity for improvement
- hazard identification with three opportunities for improvement
- earthing of metal clad switch gear with one opportunity for improvement.

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

- hazard identification is carried out effectively identifying all work related hazards
- ESMS findings are identified and prioritised
- earthing is carried out in compliance with the Blue Book.

D6 Safety indicators

Figure 38 shows the number of all serious electrical incidents reported to ESV via OSIRIS by CitiPower during the 2020-21 period, with the blue bars showing the numbers for 2020-21 and the orange bars showing the long-term average from 1 October 2010 to 30 June 2020. Figure 39 shows the same for those incidents that result in a ground or vegetation fire.

The most common incidents on the CitiPower network in 2020-21 were vehicle impacts[5], other contact events, connection faults and tree contact. One of these items is within the control of CitiPower (connection faults), one is partly within the control of CitiPower (tree contact) and two are not.

While tree contact events are partly within the control of CitiPower, such events are not fully within its control when they involve vegetation that has blown or fallen onto powerlines from outside the clearance space.

The numbers of incidents were higher in 2020-21 than the long-term average in three asset failure categories, lower in four categories and stable in one category. Contact incidents were lower in all categories except for tree contact events.

Fires from asset failures events were higher than the long-term average in two categories and lower than the long-term average in five categories. Fires from contact events were lower this year in all categories.

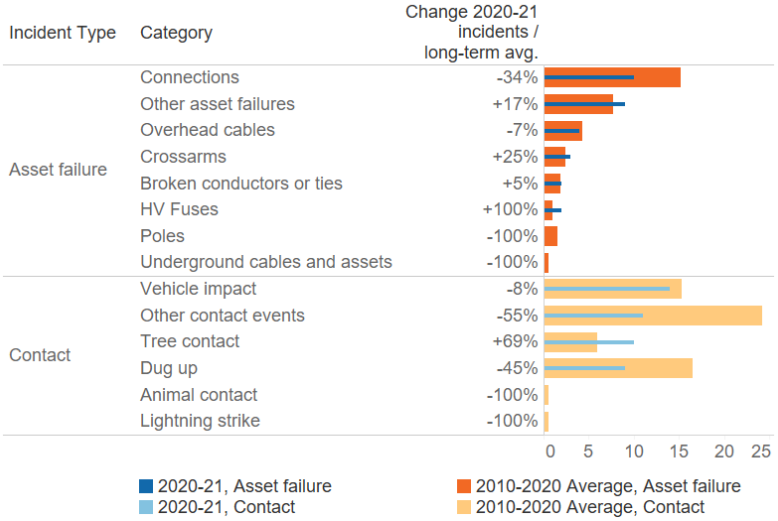

Figure 38 Incidents on the CitiPower network

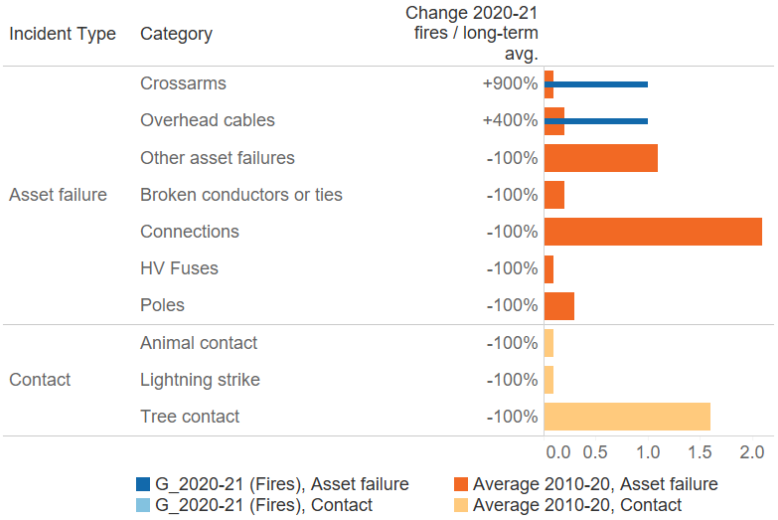

Figure 39 Incidents on the CitiPower network resulting in ground fires

Appendix E : Jemena

Jemena[10] is one of the subsidiaries of SGSP (Australia) Assets Pty Ltd, which is jointly owned by the State Grid International Development Australia Investment Company Limited (SGIDAIC) and Singapore Power International Pte Ltd (SPI). SGIDAIC holds a 60 per cent shareholding in SGSPAA and SPI holds the remaining 40 per cent.

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

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

The Jemena distribution network covers an area of approximately 950 km^2, across Melbourne's northern and western suburbs, including Melbourne International Airport (Figure 40). It comprises approximately 4,500 km of overhead line, 2,200 km of underground cable, 93,600 power poles and 28,700 public lighting poles. Most of this network (74 per cent) is in urban areas.

Figure 40 Service area for the Jemena distribution network (orange area)

CitiPower and United Energy service boundaries are shown as orange lines

[10] Jemena Electricity Networks (Vic) Ltd is the listed holder of the electricity distribution licence.

E1 Plans and processes

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

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

Jemena submitted a revised 2019-24 bushfire mitigation plan to ESV on 29 June 2019. ESV reviewed the plan and accepted the revised plan on 11 July 2019. The Bushfire Mitigation Plan is due for renewal in June 2024.

Jemena submitted its 2021-22 electric line clearance management plan to ESV in March 2021, and the plan was approved in advance of the fire danger period.

E2 Directions

There were two directions to Jemena due to be completed by December 2020:

- 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.[11]

Jemena completed the installation of armour rods, vibration dampers, spacers and spreaders in LBRA by 1 November 2020.

E3 Powerline bushfire safety programs

Figure 41 shows the progress of the Jemena REFCL installation program at 1 May 2019, 2020 and 2021, and its anticipated progress in the next 12 months.

The Sydenham base-level[12] REFCL is not prescribed in legislation.

Jemena also owns and operates three feeders originating from the AusNet Services prescribed Kalkallo zone substation; these will either be fully underground or REFCL-protected from Coolaroo zone substation.

E4 Exemptions

On 2 December 2020, ESV granted an exemption for the powerlines supplied from the Coolaroo zone substation from being REFCL protected, where those powerlines are located in low bushfire risk areas of greater Melbourne (as determined by the CFA). The remaining powerlines with bushfire ignition risk will be REFCL-protected by 1 May 2023. Any new powerlines supplied from Coolaroo and in a hazardous bushfire risk area must be covered or underground.

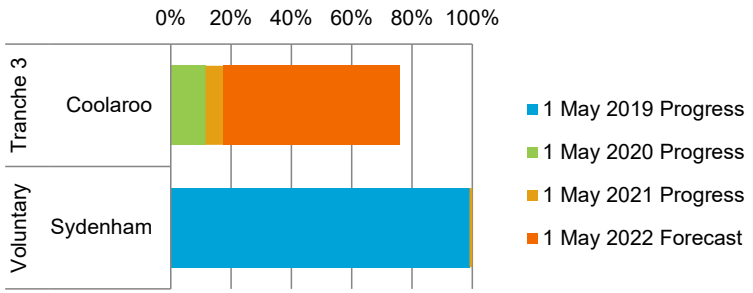

Figure 41 Status of the Jemena REFCL program

[11] The installation of armour rods, vibration dampers, spacers and spreaders in HBRA was completed by 1 November 2015.

[12] A base-level REFCL includes an arc suppression coil but does not include the power electronics that a complete REFCL uses for active fault compensation.

E5 Audit performance

E5.1 Electricity Safety Management Scheme (ESMS)

During November 2020, ESV audited Jemena on its contractor management process and procedures. The ESMS was found to adequately describe the contractor management processes and procedures and be compliant in this area. ESV identified opportunities for improvement, being:

- Jemena advised that a gap analysis audit focusing on contractor management has been completed, with actions and risk controls addressing the outcomes and findings of this audit to be implemented. ESV has requested details from Jemena on the steps for the implementation of the identified improvements in order for ESV to monitor completion.
- Jemena would benefit from the development of a documented procedure detailing the process for the evaluation of new contractors.
- Jemena identified the need to ensure designs comply with the requirements of the ESMS and have committed to developing a Design Management document. ESV has requested Jemena to provide details on the scope and steps for the implementation of this improvement; ESV will monitor its progress.
- Jemena has identified the need to improve its recording of contractor information and have committed to the development of a contractor management system with centralised document repository. ESV has requested details from Jemena on the steps for its implementation in order for ESV to monitor completion.
- Jemena should ensure that all field personnel have the ability to check the competencies, authorities and training dates of its personnel and contractors while on-site.
- Contractors would benefit from having the ability to check their own training is up to date while on site.
- Work crews should have access to the current construction manual(s) on site, either as a hardcopy or electronically on their tablet.

Jemena provided a plan to address the ESV audit findings and implement these changes in 2021.

E5.2 Electric line clearance

Network pre fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted on the Jemena network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found one major non-compliance, one minor non-compliance and two opportunities for improvement. The non-compliances related to technical procedural deficiencies for vegetation clearing rectification timeframes and vegetation coding.

ESV concluded that Jemena was not strictly managing its line clearance responsibilities as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. That said, the field inspection component of the audit found there was not a widespread risk of fires being started by vegetation contacting the network.

The procedural deficiencies identified by ESV have been addressed by Jemena in its 2021-2026 electric line clearance management plan. ESV will review the application of the revised procedures as part of the 2021-22 auditing and inspection program.

Network inspection

During the 2020-21 period, ESV inspected 950 spans on the Jemena network, with 330 in HBRA and 630 in LBRA.

ESV identified 17 non-compliant spans across the network (twelve in HBRA and five in LBRA). ESV issued all non-compliant spans it identified to Jemena under section 86(1) notices and all were cleared by Jemena as a matter of priority, resulting in the elimination of these potentially hazardous situations.

The rate of non-compliant vegetation on the Jemena network had declined from the previous year in HBRA and has remained stable and low in LBRA (see Figure 9 and Figure 10 respectively).

When ESV conducts inspections, it classifies non-compliance as major or minor non-compliance. A major non-compliance is regarded as high risk where vegetation is touching, or could soon touch, uninsulated conductors. This contrasts with minor non-compliance where vegetation is in the minimum clearance space required by the code but there is no immediate risk of contact with electric lines.

In 2020-2021 ESV observed further reduction of the already low rate of major non-compliance affecting the Jemena network. Figure 42 shows the combined rate of major non-compliances on the Jemena network.

The combined rate of major non-compliance on the Jemena network has been less than the average across all of the distribution networks since ESV began collecting this data in 2017. Jemena has also had the lowest rate of major non-compliances in three of the four years.

The rates of non-compliance have reduced this year in both HBRA (Figure 9) and LBRA (Figure 10).

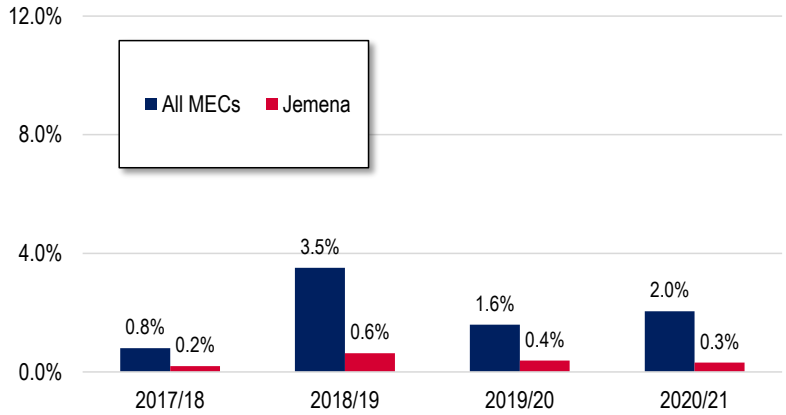

Figure 42 Rate of major non-compliances (HBRA and LBRA)

E5.3 Bushfire mitigation

ESV reviewed 111,088 asset records from across the entire Jemena network and found six LBRA structures outside the inspection cycle timeframes identified in the Jemena bushfire mitigation plan. Each structure was identified in Jemena's records with a rail authority as the owner of the structure and Jemena as responsible for its inspection. Jemena has advised that the identification in Jemena's systems of the responsibility for inspection was an error. ESV recommended that Jemena develop appropriate actions that will address these findings.

ESV inspected 71 structures across the network. The inspections found no serious issues and 13 minor issues, including loose pole-top hardware, fuse unit moisture ingress and fruiting fungal bodies on a wood pole.

The issues found were minor in nature and would normally be identified and repaired as part of routine inspection and maintenance activities undertaken by Jemena. ESV recommended that Jemena rectify the identified issues in accordance with its priority maintenance practices.

E5.4 Work practices

In 2020-2021, the work practices observation program was interrupted due to COVIDSafe requirements. During this time ESV undertook three observations of Jemena work practices. One of the observations was planned and the other two were opportunistic. The findings of the observations were as follows:

- major non-compliances 0
- minor non-compliances 4
- opportunities for improvement 2

The key areas of concern identified by these observations related to:

- meter and servicing work with three minor non-compliances related to tests not performed, fuses not removed and signage not used
- working near de-energised LV conductors and use of test equipment with one minor non-compliance
- hazard identification.

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

- meter and servicing work is carried out in compliance with processes and procedures
- LV work is carried out in compliance with processes and procedures
- hazard identification is carried out effectively identifying all work-related hazards.

E6 Safety indicators

Figure 43 shows the number of all serious electrical incidents reported to ESV via OSIRIS by Jemena during the 2020-21 period, with the blue bars showing the numbers for 2020-21 and the orange bars showing the long-term average from 1 October 2010 to 30 June 2020. Figure 44 shows the same for those incidents that result in a ground or vegetation fire.

The most common incidents on the Jemena network in 2020-21 were other contact events, vehicle impacts[5], dug-up cables and animal contact. All of these events are outside of the direct control of Jemena. Only dug-up cables and animal were higher this year than the long-term average.

There were fewer asset failure events in all categories than tree contact incidents, which was the second best performing category of contact event.

The most common fire incidents were vehicle impacts, connection failures, animal contacts and tree contacts. One of these is within the direct control of Jemena to manage, one is partly within its control and two are outside its control. Only vehicle impacts and connection failure fires were greater in 2020-21 than the long-term average.

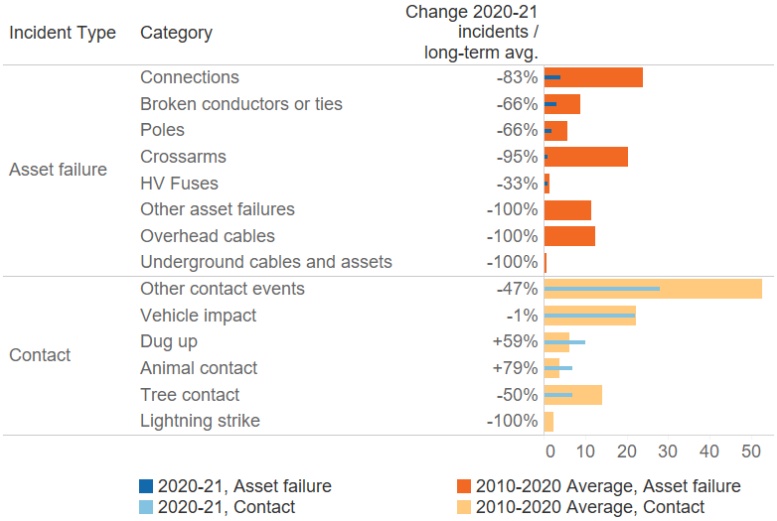

Figure 43 Incidents on the Jemena network

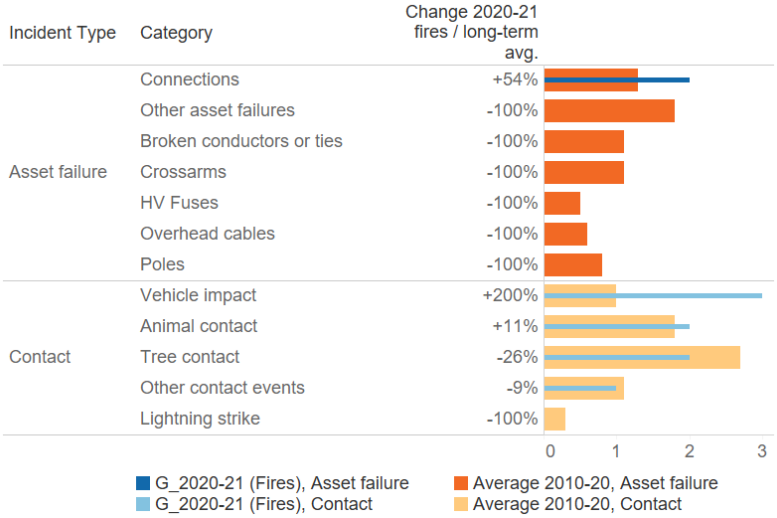

Figure 44 Incidents on the Jemena network resulting in ground fires

Appendix F : Powercor

CitiPower/Powercor[13] is jointly owned by Cheung Kong Infrastructure, Power Assets Holdings and Spark Infrastructure. Cheung Kong Infrastructure and Power Assets Holdings are both part of the Cheung Kong Group of companies. They jointly own 51 per cent of CitiPower/Powercor, with the remaining 49 per cent held by Spark Infrastructure.

In May 2017, Cheung Kong Infrastructure purchased the DUET Group, thereby giving it majority ownership (66 per cent) of United Energy. This has resulted in some consolidation of activities and processes across the companies Cheung Kong Infrastructure controls. Of most relevance from a safety perspective was the introduction into United Energy of CitiPower/Powercor procedures for vegetation management.

CitiPower and Powercor are managed by a single executive management team using common procedures and systems across the two distribution businesses. As a result, the Electricity Safety Management System (Section F5.1) and the work practices observations audits (Section F5.4) have been undertaken jointly across the two businesses. The remaining sections within this appendix refer to the specific assets within the Powercor network and have therefore been assessed independently of the CitiPower assets.

The Powercor distribution network covers any area of approximately 145,700 km^2, and includes Melbourne's Docklands Precinct, west from Williamstown to the South Australian border, north to the Murray and south to the coast (Figure 45). It comprises approximately 68,700 km of overhead line, 9,200 km of underground cable, 489,000 poles and 100,100 public lighting poles. Most of this network (92 per cent) is in rural areas.

Figure 45 Service area for the Powercor distribution network (orange area)

[13] Powercor Australia Ltd is the listed holder of the electricity distribution licence.

F1 Plans and processes

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

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

On 15 April 2020, Powercor submitted a revised Bushfire Mitigation Plan. ESV accepted the plan on 18 June 2020. The Bushfire Mitigation Plan is due for renewal in June 2025.

Powercor submitted its 2021-22 electric line clearance management plan to ESV in March 2021, and the plan was approved in advance of the fire danger period.

F2 Directions

Three directions to Powercor were due to be completed by 1 November 2020:

- 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[14]
- ensure that all SWER ACRs have protection settings and reclose functions that can be controlled by Powercor's SCADA system.

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

Powercor completed installation of spacers and spreaders on 265 spans in LBRA areas by 1 November 2020.

Powercor also completed the direction to ensure that all SWER ACRs have protection settings and reclose functions that can be controlled by Powercor's SCADA system. To comply with this ACR direction, ESV had previously approved the use of FuseSavers as an alternative solution.

In late 2020, Powercor advised ESV that it had switched part of its Camperdown network to be supplied from the neighbouring Cobden zone substation to facilitate the connection of a wind farm. This resulted in this network section no longer being REFCL-protected.

ESV determined that Powercor's action had increased the bushfire ignition risk of this network section and, on 23 December 2020, ESV directed Powercor to reinstate REFCL protection on total fire ban days throughout the 2020-21 fire season. As a result, the wind farm would not be able to generate on these days.

ESV is now considering taking further action ahead of the 2021-22 fire season.

F3 Powerline bushfire safety programs

To meet its bushfire mitigation obligations, Powercor must implement REFCL technology at 22 nominated zone substations over three delivery tranches.

Figure 46 shows the progress of the Powercor REFCL installation program at 1 May 2019, 2020 and 2021, and its anticipated progress in the next twelve months.

By 30 June 2021, ESV had accepted sixteen zone substations as compliant.

[14] The installation of armour rods, vibration dampers, spacers and spreaders in HBRA was completed by 1 November 2015.

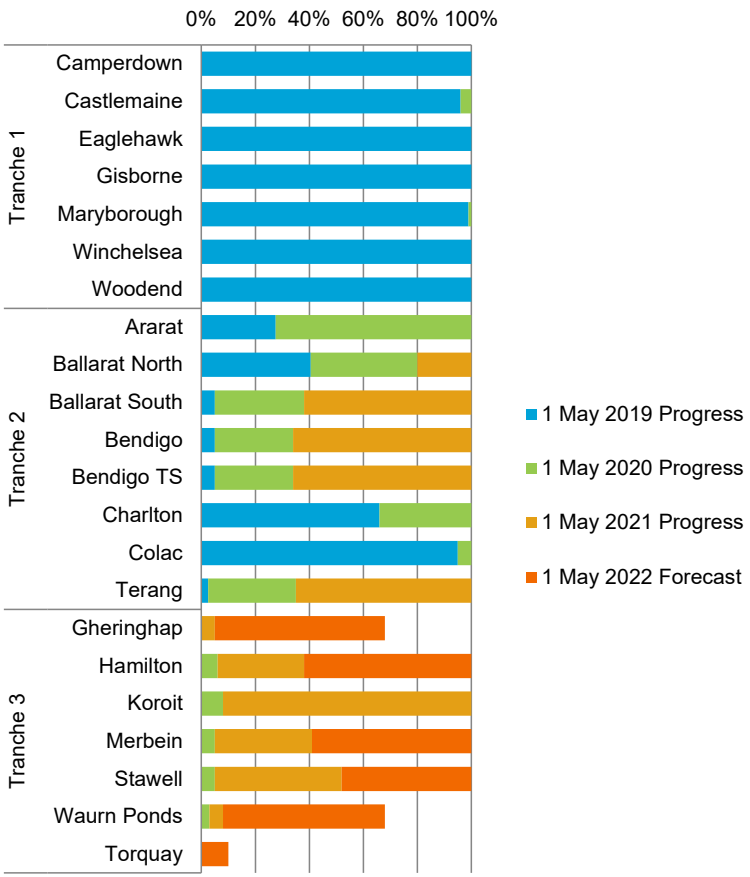

Figure 46 Status of the Powercor REFCL program

F4 Exemptions

In 2019-2020, ESV granted an exemption in regard to Powercor's obligation to install REFCLs at Corio and Geelong. Instead a REFCL will be installed at the new Gheringhap zone substation, which will supply those powerlines in hazardous bushfire risk areas. This reduced the number of Powercor REFCLs from 22 to 21.

This year, Powercor advised ESV that it will split the existing Waurn Ponds network and supply one half from a new REFCL-protected Torquay zone substation. An exemption is not expected to be required, as all powerlines will be REFCL-protected. This will now take the total number of Powercor REFCLs back up to 22.

F5 Audit performance

F5.1 Electricity Safety Management Scheme (ESMS)

During the latter half of 2020, ESV audited Powercor (together with CitiPower, TOA and TOA2) on its contractor management process and procedures. The ESMS was found to adequately describe the contractor management processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- Where there are multiple contracted and subcontracted work parties present and live work is being undertaken, there is a benefit in having a worker assigned as the site leader.
- There may be benefit in noting on the lead contractor JSA what other work parties are on site and noting that all parties have completed and signed onto their relevant JSA if they are not signed onto the lead contractor JSA. This will assist in ensuring all work parties have reviewed the work that is to be done and are aware of all the hazards and controls that are in place on the worksite.

Powercor provided a plan to address the ESV audit findings and implemented these changes in 2020.

In June and July 2021, ESV audited Powercor (together with CitiPower, TOA and TOA2) on its construction planning process and procedures. The ESMS was found to adequately describe the construction planning processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- To enable the identification of potential site issues, there would be some benefit in encouraging an increased use of site visits by designers, construction project leaders and those involved in the construction job planning prior to construction crews attending site to undertake works.
- There is an opportunity for improvement to implement increased validation or cross checking of task descriptions dispatched to underground fault location crews.

Powercor provided a plan to address the ESV audit findings and implement these changes in 2021.

F5.2 Electric line clearance

Network pre fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted on the Powercor network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found two major non-compliances, one minor non-compliance and two opportunities for improvement. The non-compliances related to technical procedural deficiencies for inspection timeframes, rectification timeframes and vegetation coding.

ESV concluded that Powercor was not strictly managing the network according to its approved plan. This compromised its ability to comply with the regulations and the code and therefore, as far as practicable, to manage its electricity safety risks.

Powercor has committed to addressing the procedural deficiencies identified by ESV through revised procedures in its electric line clearance management plan. In addition, it will procure additional resources to better enable it to manage its electric line clearance responsibilities.

ESV will review the application of these mitigation strategies as part of the 2021-2022 auditing and inspection programs.

Network inspection

During the 2020-2021 period ESV inspected 4461 spans on the Powercor network, with 2182 in HBRA and 2279 in LBRA.

ESV identified 315 non-compliant spans across the network; 195 in HBRA and 120 in LBRA. ESV issued all non-compliant spans it identified to Powercor under section 86(1) notices. All were cleared by Powercor as a matter of priority, resulting in the elimination of these potentially hazardous situations.

The rate of non-compliant vegetation in HBRA on the Powercor distribution network has been reducing steadily since 2018 (see Figure 9). This is also the case for LBRA (see Figure 10).

When ESV conducts inspections it classifies non-compliance as major or minor non-compliance. A major non-compliance is regarded as high risk where vegetation is touching, or could soon touch, uninsulated conductors. This contrasts with minor non-compliance where vegetation is in the minimum clearance space required by the code but there is no immediate risk of contact with electric lines.

In 2020-21, ESV observed a steady decline in the overall rate of major non-compliance affecting the Powercor distribution network (Figure 47). The rate of major non-compliance on the Powercor distribution network was also lower than the average across all of the distribution networks for HBRA and LBRA combined.

The rates of non-compliance and major non-compliance have reduced this year in both HBRA (Figure 9) and LBRA (Figure 10).

While ESV is closely monitoring the performance of Powercor through its safety regulation programs, it is noted that Powercor management of its electric line clearance risks is steadily improving.

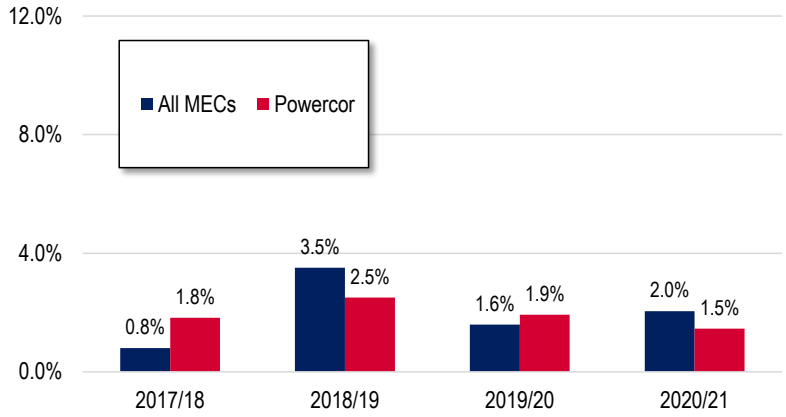

Figure 47 Rate of major non-compliances (HBRA and LBRA)

F5.3 Bushfire mitigation

ESV reviewed 587,592 asset records from across the entire Powercor network and found five LBRA structures outside the inspection cycle timeframes identified in the Powercor bushfire mitigation plan. ESV recommended that Powercor develop appropriate actions that will address these findings.

ESV inspected 120 structures from across the Horsham and Bacchus Marsh areas. The inspections found no serious issues and 20 minor issues, including fuse moisture ingress, deteriorated service lines and deteriorated or damaged insulators.

The issues found were minor in nature and would be expected to be identified and repaired as part of routine inspection and maintenance activities undertaken by Powercor. ESV recommended that Powercor rectify the identified issues in accordance with its priority maintenance practices.

F5.4 Work practices

In 2020-21, the work practices observation program was interrupted due to COVIDSafe requirements. During this time ESV undertook five observations of Powercor work crews across five sites. Three of the observations were planned and two were opportunistic.

The findings of the observations were as follows:

- major non-compliances 0
- minor non-compliances 0
- opportunities for improvement 6

The key areas of concern identified by these observations related to:

- hazard identification
- ESMS (non-electrical) findings
- electrical access procedures.

ESV recommended that Powercor's work practices (and those of its contractors) specifically focus on ensuring:

- hazard identification is carried out effectively identifying all work related hazards
- ESMS findings are identified and prioritised
- electrical access permits identify all protection devices and whether they have been removed.

F6 Safety indicators

Figure 48 shows the number of all serious electrical incidents reported to ESV via OSIRIS by Powercor during the 2020-21 period, with the blue bars showing the numbers for 2020-21 and the orange bars showing the long-term average from 1 October 2010 to 30 June 2020. Figure 49 shows the same for those incidents that result in a ground or vegetation fire.

The most common incidents on the Powercor network in 2019-20 were vehicle impacts[5], connection faults, HV fuse failures and tree contact. Two of these items are not within the control of the Powercor. The numbers of incidents were lower in 2020-21 than the long-term average in ten categories, stable in two categories and higher in two categories.

Connection faults, animal contact, tree contact, and vehicle impacts were the most common causes of network-related fires. One of these (connection faults) is within full control of Powercor to manage. While two are partially in its control (animal and tree contacts), the greater contribution to tree contacts is from branches blown or trees falling onto powerlines from outside the clearance space.

The numbers of fires in the period were also stable or lower than the long-term average of all categories except for connection faults, vehicle impacts and fires from other contact events.

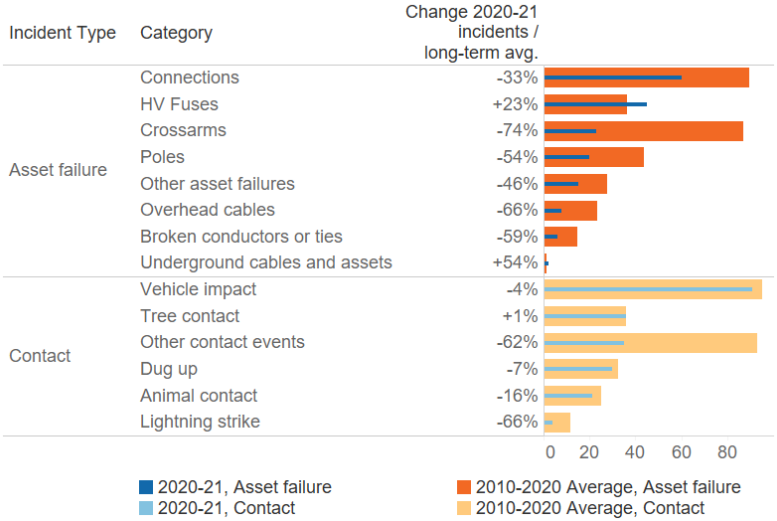

Figure 48 Incidents on the Powercor network

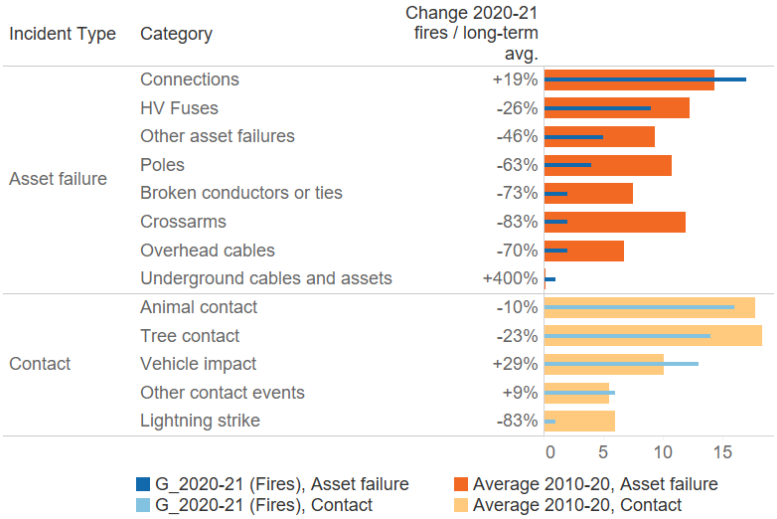

Figure 49 Incidents on the Powercor network resulting in ground fires

Appendix G : TransGrid

TransGrid[15] is jointly owned by Canadian pension fund CDPQ (25 per cent), Utilities Trust of Australia (20 per cent), investment vehicles Tawreed Investments Limited and Wren House Infrastructure (20 per cent each) and Australian infrastructure manager Spark Infrastructure (15 per cent). Tawreed Investments Limited is a wholly-owned subsidiary of the Abu Dhabi Investment Authority, and Wren House Infrastructure is a wholly-owned subsidiary of the Kuwait Investment Authority.

TransGrid operates and manages the high voltage electricity transmission network in NSW and the ACT. Recently, TransGrid has expanded its asset base to include assets in Victoria where it is servicing specific customer projects. These assets include the Deer Park Terminal Station, the Kiamal Terminal Station and the Berrybank Terminal Station and Zone Substation. TransGrid also operates a 7.5 km 220kV overhead transmission line from Berrybank Terminal Station to Berrybank Zone Substation (Figure 50).

Figure 50 Locations of TransGrid assets (orange squares)

[15] TransGrid Services Pty Ltd is the listed holder of the electricity transmission licences.

G1 Plans and processes

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

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

TransGrid submitted an updated ESMS for review in June 2020. The ESMS was updated to include details of new assets that TransGrid were constructing and for which they would be the owner/operator. The new assets were the Berrybank Terminal Station and Zone Substation, and a 7.5 km 220kV overhead transmission line from Berrybank Terminal Station to Berrybank Zone Substation. ESV reviewed the updated ESMS and accepted the ESMS on 30 July 2020. The ESMS is due for renewal in July 2025.

TransGrid submitted an updated Bushfire Mitigation Plan for review in April 2020. The plan was updated to include details of the new assets listed above. ESV reviewed the plan and accepted the revised plan on 27 May 2020. The Bushfire Mitigation Plan is due for renewal in May 2025.

TransGrid submitted its 2020-2021 electric line clearance management plan to ESV in March 2021, and the plan was approved in advance of the fire danger period.

G2 Directions

ESV has not had cause to issue directions to TransGrid.

G3 Powerline bushfire safety programs

There are no requirements on TransGrid under the Electricity Safety (Bushfire Mitigation) Regulations 2013.

G4 Exemptions

TransGrid has sought no exemptions from regulations.

G5 Audit performance

G5.1 Electricity Safety Management Scheme (ESMS)

As the TransGrid assets are new and require little maintenance at this early stage of their lifecycle, ESV determined there was greater merit in deploying resources to audits of the other distribution and transmission ESMSs this year, given COVIDSafe requirements were in place.

G5.2 Electric line clearance

Network pre-fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted on the TransGrid transmission network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found one minor non-compliance related to technical procedural deficiencies for vegetation coding.

ESV concluded that TransGrid was not strictly managing its line clearance responsibilities as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. That said, the field inspection component of the audit found there was not a widespread risk of fires being started by vegetation contacting the network.

TransGrid has committed to addressing the procedural deficiencies identified by ESV through revised procedures in its electric line clearance management plan.

ESV will review the application of these mitigation strategies as part of the 2021-22 auditing and inspection programs.

Network inspection

During the 2020-21 period ESV inspected 25 spans on the TransGrid transmission network, and two of those inspected were found to be non-compliant.

ESV issued the non-compliant spans it identified to TransGrid under section 86(1) notices and all were cleared by TransGrid as a matter of priority, resulting in the elimination of these potentially hazardous situations.

TransGrid is a new transmission network that has large and typically well-established clearance easements. The matters identified during the inspections only related to vegetation that existed on the outer fringe of the required minimum clearance space and, therefore, did not create a significant risk.

This is the first year ESV has inspected the TransGrid transmission network and is not able to establish a performance comparison; however, the effectiveness of its management electric line clearance appeared sound.

G5.3 Bushfire mitigation

As the TransGrid assets are new station assets and require little maintenance at this early stage of their lifecycle, ESV determined there is greater merit in deploying resources to audits of the other distribution and transmission bushfire mitigation plans.

G5.4 Work practices

ESV is yet to undertake a work practice observation of TransGrid as its assets are relatively new (commissioned in 2017) requiring very little maintenance at this stage of its life cycle.

G6 Safety indicators

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

The risks associated with TransGrid are reduced by it currently comprising only terminal station and zone substation assets and only having been operating for a short time. As such, TransGrid's Victorian assets also have not entered a phase of their life cycle where major maintenance is required.

It is, therefore, not unexpected that TransGrid recorded no incidents involving its network assets during the 2020-21 period.

Appendix H : Transmission Operations Australia

Transmission Operations (Australia)[16] (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. Trading together as Australian Energy Operations, they also own Transmission Operations (Australia) 2.

Together they hold a majority ownership (51 per cent) of the CitiPower/Powercor Group of companies, which are contracted to provide services in support of ongoing TOA operations. As of May 2017, Cheung Kong Infrastructure also holds majority ownership (66 per cent) of United Energy.

TOA owns and operates the connections from the Mt Mercer Wind Farm and from the Moorabool North and South Wind Farms to the electrical transmission network (Figure 51). The Mt Mercer transmission line is a 22km 132kV powerline and the Moorabool North and South transmission line is a 30km 132kV powerline. Both connect to 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 2-3 per cent of the towers and poles that AusNet Services owns and maintains. Its assets are also newer, with the Mt Mercer transmission line having been commissioned in November 2013 and the Moorabool North and South transmission line being commissioned in July 2020.

Figure 51 Location of TOA transmission assets (orange square)

[16] Transmission Operations (Australia) Pty Ltd is the listed holder of the electricity transmission licence.

H1 Plans and processes

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

- an Electricity Safety Management Scheme (ESMS) before 2 October 2018
- a bushfire mitigation plan every five years commencing from the date of the most recent acceptance of a bushfire mitigation plan
- an electric line clearance management plan by 31 March each year.

TOA submitted a joint TOA/TOA2 ESMS for review in May 2019. ESV performed a validation audit during June 2020 on the joint ESMS. The ESMS was updated based on the findings of ESV's audit, with final acceptance of the ESMS granted by ESV on 26 October 2020. The ESMS is due for resubmission in October 2025.

TOA/TOA2 submitted an updated 2019-2024 Bushfire Mitigation plan on 23 July 2019. The plan was updated to include both TOA and TOA2 assets in the same plan. ESV accepted the revised plan on 21 May 2020. The Bushfire Mitigation plan is due for resubmission in October 2025.

TOA submitted its 2021-22 electric line clearance management plan to ESV in March 2021, and the plan was approved in advance of the fire danger period.

H2 Directions

ESV has not had cause to issue directions to TOA.

H3 Powerline bushfire safety programs

There are no requirements on TOA under the Electricity Safety (Bushfire Mitigation) Regulations 2013.

H4 Exemptions

TOA has sought no exemptions from regulations.

H5 Audit performance

H5.1 Electricity Safety Management Scheme (ESMS)

During the latter half of 2020, ESV audited TOA (together with CitiPower, Powercor and TOA2) on its contractor management process and procedures. The ESMS was found to adequately describe the contractor management processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- Where there are multiple contracted and subcontracted work parties present and live work is being undertaken, there is a benefit in having a worker assigned as the site leader.
- There may be benefit in noting on the lead contractor JSA what other work parties are on site and noting that all parties have completed and signed onto their relevant JSA if they are not signed onto the lead contractor JSA. This will assist in ensuring all work parties have reviewed the work that is to be done and are aware of all the hazards and controls that are in place on the worksite.

TOA provided a plan to address the ESV audit findings and implemented these changes in 2020.

In June and July 2021, ESV audited TOA (together with CitiPower, Powercor and TOA2) on its construction planning process and procedures. The ESMS was found to adequately describe the construction planning processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- To enable the identification of potential site issues, there would be some benefit in encouraging an increased use of site visits by designers, construction project leaders and those involved in the construction job planning prior to construction crews attending site to undertake works.

- There is an opportunity for improvement to implement increased validation or cross checking of task descriptions dispatched to underground fault location crews.

TOA provided a plan to address the ESV audit findings and implement these changes in 2021.

H5.2 Electric line clearance

Network pre-fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted for the TOA transmission network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found one non-compliance, one minor non-compliance and one opportunity for improvement. The non-compliances related to technical procedural deficiencies for vegetation coding.

ESV concluded that TOA was not strictly managing its line clearance responsibilities as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. That said, the field inspection component of the audit found there was little to no risk of fires being started by vegetation growing and contacting the network.

The TOA transmission network has large well-established clearance easements, and the non-compliance identified during the audit only came into play for vegetation that existed on the outer fringe of the required minimum clearance space.

TOA has committed to addressing the procedural deficiency identified by ESV through revised procedures in its electric line clearance management plan. ESV will review the application of these mitigation strategies as part of the 2021-22 auditing and inspection programs.

Network inspection

During the 2020-21 period ESV inspected 75 of the 262 spans on the TOA transmission network. Five of those inspected were found to be non-compliant. ESV issued all non-compliant spans it identified to TOA under section 86(1) notices and all were cleared by TOA as a matter of priority, resulting in the elimination of these potentially hazardous situations.

The TOA transmission network has large and typically well-established clearance easements. The non-compliances identified during the inspections related to vegetation that existed on the outer fringe of the required minimum clearance space and, therefore, did not create a significant risk.

ESV also identified a defect at the base of a ground guy.

Last year, ESV noted that there had been a steady increase in the rate of non-compliant vegetation on this network each year since 2016-17.This year, we found the upward trend had been addressed with a reduced non-compliance rate being observed (Figure 52). This means ESV intervention will not be required provided TOA continues to maintain its improved performance.

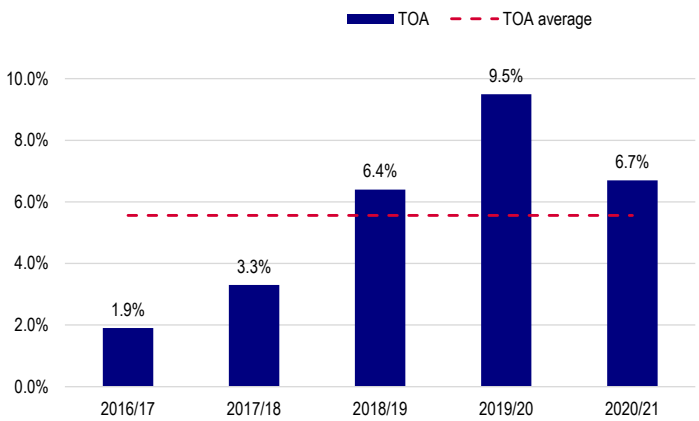

Figure 52 Non-compliance rates for TOA

H5.3 Bushfire mitigation

ESV reviewed 371 asset records for each of the TOA lines running from the Elaine Terminal Station, one to the Mt Mercer Wind Farm and the other to the Moorabool North and South wind farms.

The review found that the TOA assets were being managed with a one-month tolerance to the inspection cycle timeframe identified in the joint TOA/TOA2 bushfire mitigation plan. ESV identified the one-month tolerance was not included in the bushfire mitigation plan as it is common practice in the industry. ESV has recommended that TOA updates its documentation.

ESV inspected 18 structures across the TOA network from the nominated areas listed above. The inspections identified no serious issues, and generally found the lines to be in good condition, as would be expected given they are relatively new assets. That said, ESV did identify a minor issue regarding the use of inspection documentation that was not referenced in the TOA/TOA2 bushfire mitigation plan. ESV recommended that documentation also be updated to rectify this issue.

H5.4 Work practices

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

H6 Safety indicators

Transmission infrastructure generally has a low level of incidents due to the nature of the assets and the clearances maintained around these higher voltage assets. Transmission assets are concentrated in fewer, larger and better defined easements than distribution assets, thereby reducing exposure to environmental threats and third-party impacts. This also makes them easier to maintain.

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

It is, therefore, not unexpected that TOA recorded no incidents on its transmission network during the 2020-2021 period.

Appendix I : Transmission Operations Australia 2

Transmission Operations (Australia) 2[17] (TOA2) is jointly owned by Cheung Kong Infrastructure Holdings Ltd (50 per cent) and Power Assets Holdings Ltd (50 per cent). Both are part of the Cheung Kong Group of companies. Trading together as Australian Energy Operations, they also own Transmission Operations (Australia).

Together they hold a majority ownership (51 per cent) of the CitiPower/ Powercor Group of companies, which are contracted to provide services in support of ongoing TOA2 operations. As of May 2017, Cheung Kong Infrastructure also holds majority ownership (66 per cent) of United Energy.

TOA2 owns and operates the connection from the Ararat Wind Farm to the electrical transmission network (Figure 53). This includes a 21 km 132kV powerline and the Ararat Terminal Station, which steps the voltage up from 132kV to 220kV for injection into the AusNet Services transmission network.

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

Figure 53 Location of TOA2 transmission assets (orange square)

[17] Transmission Operations (Australia) 2 Pty Ltd is the listed holder of the electricity transmission licence.

I1 Plans and processes

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

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

TOA2 submitted a joint TOA/TOA2 ESMS for review in May 2019. ESV performed a validation audit during June 2020 on the joint ESMS. The ESMS was updated based on the findings of ESV's audit, with final acceptance of the ESMS granted by ESV on 26 October 2020. The ESMS is due for resubmission in October 2025.

TOA/TOA2 submitted an updated 2019-2024 Bushfire Mitigation plan on 23 July 2019. The plan was updated to include both TOA and TOA2 assets in the same plan. ESV accepted the revised plan on 21 May 2020. The Bushfire Mitigation plan is due for resubmission in October 2025.

TOA2 submitted its 2021-22 electric line clearance management plan to ESV in March 2021 and the plan was approved in advance of the fire danger period.

I2 Directions

ESV has not had cause to issue directions to TOA2.

I3 Powerline bushfire safety programs

There are no requirements on TOA2 under the Electricity Safety (Bushfire Mitigation) Regulations 2013.

I4 Exemptions

TOA2 has sought no exemptions from regulations.

I5 Audit performance

I5.1 Electricity Safety Management Scheme (ESMS)

During the latter half of 2020, ESV audited TOA2 (together with CitiPower, Powercor and TOA) on its contractor management process and procedures. The ESMS was found to adequately describe the contractor management processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- Where there are multiple contracted and subcontracted work parties present and live work is being undertaken, there is a benefit in having a worker assigned as the site leader.
- There may be benefit in noting on the lead contractor JSA what other work parties are on site and noting that all parties have completed and signed onto their relevant JSA if they are not signed onto the lead contractor JSA. This will assist in ensuring all work parties have reviewed the work that is to be done and are aware of all the hazards and controls that are in place on the worksite.

TOA2 provided a plan to address the ESV audit findings and implemented these changes in 2020.

In June and July 2021, ESV audited TOA2 (together with CitiPower, Powercor and TOA) on its construction planning process and procedures. The ESMS was found to adequately describe the construction planning processes and procedures and be compliant in this area. ESV identified two opportunities for improvement, being:

- To enable the identification of potential site issues, there would be some benefit in encouraging an increased use of site visits by designers, construction project leaders and those involved in the construction job planning prior to construction crews attending site to undertake works.
- There is an opportunity for improvement to implement increased validation or cross checking of task descriptions dispatched to underground fault location crews.

TOA2 provided a plan to address the ESV audit findings and implement these changes in 2021.

I5.2 Electric line clearance

Network pre fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted for the TOA2 transmission network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found one non-compliance, one minor non-compliance and one opportunity for improvement. The non-compliances related to technical procedural deficiencies for vegetation coding.

ESV concluded that TOA2 was not strictly managing its line clearance responsibilities as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. That said, the field inspection component of the audit found there was little to no risk of fires being started by vegetation growing and contacting the network.

The TOA2 transmission network has large well-established clearance easements, and the non-compliance identified during the audit only came into play for vegetation that existed on the outer fringe of the required minimum clearance space.

TOA2 has committed to addressing the procedural deficiency identified by ESV through revised procedures in its electric line clearance management plan. ESV will review the application of these mitigation strategies as part of the 2021-22 auditing and inspection programs.

Network inspection

During the 2020-21 period ESV inspected 23 of the 106 spans on the TOA2 transmission network. None of those inspected was found to be non-compliant. Being a relatively new transmission network, TOA2 was found to have large and typically well-established clearance easements.

ESV considered this to be an excellent result, especially given the non-compliance rate for TOA2 has been zero since 2016-2017 except for 2017-18 when it had a non-compliance rate of 1.3 per cent.

No recommendations were made as a result of the audit.

I5.3 Bushfire mitigation

ESV reviewed 160 asset records being the full TOA2 132kV line from Ararat Wind Farm to Ararat Terminal Station, which is situated entirely within hazardous bushfire risk area. The review found no assets outside the inspection cycle timeframes identified in the joint TOA/TOA2 bushfire mitigation plan.

ESV inspected 14 structures across TOA2 network from the above nominated areas. The inspections identified no serious issues, and generally found the line to be in good condition and reflective of its relatively young age (commissioned in July 2016). That said, one minor issue was identified relating to surface tracking on three strain insulators.

The issue was minor in nature and ESV recommended that TOA2 rectify the identified issue in accordance with its maintenance review practices.

ESV identified a problem with the inspection documentation being used on site, in that the documentation provided inadequate guidance to TOA Asset Inspectors that would allow them to prioritise the issue. On further investigation ESV identified the use of inspection documentation that was not referenced in the TOA/TOA2 bushfire mitigation plan, and has recommended that documentation be updated to rectify this issue.

I5.4 Work practices

ESV is yet to undertake a work practice observation of TOA2 as the transmission line is expected to be operational almost all the time, and is a relatively new asset (commissioned in June 2016) requiring very little maintenance at this stage of its life cycle.

I6 Safety indicators

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

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

It is, therefore, not unexpected that TOA2 recorded no incidents on its transmission network during the 2020-21 period.

Appendix J : United Energy

United Energy[18] is jointly owned by Cheung Kong Infrastructure (66 per cent) and SGSP (Australia) Assets Pty Ltd (34 per cent).

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

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

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

Historically, United Energy engaged EDI Downer and Zinfra as subcontractors to manage aspects of its operations and maintenance services. United Energy consolidated all of these services with Zinfra in January 2018. Any reference to United Energy within this section also encompasses Zinfra operations on United Energy assets.

The distribution network covers an area of approximately 1,470 km^2 across Melbourne's eastern and south-eastern suburbs and the Mornington Peninsula (Figure 54). It comprises approximately 9,920 km of overhead line, 4,010 km of underground cable, 168,500 poles and 35,000 public lighting poles. Most of the network is urban and semi-rural (68 per cent).

Figure 54 Service area for the United Energy distribution network (orange area)

Jemena and CitiPower service boundaries are shown as orange lines

[18] United Energy Distribution Pty Ltd is the listed holder of the electricity distribution licence.

J1 Plans and processes

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

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

United Energy submitted a revised bushfire mitigation plan in March 2018. ESV reviewed the revised plan and accepted the plan on 12 August 2019. The Bushfire Mitigation plan is due for resubmission in August 2024.

United Energy submitted its 2021-22 electric line clearance management plan to ESV in March 2021, and the plan was approved in advance of the fire danger period.

J2 Directions

Two directions to United Energy were due to be completed in 2020:

- 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.[19]

United Energy completed the installation of vibration dampers and armour rods on 495 spans by the end of December 2020.

Last year, we reported that United Energy had already installed spacers and spreaders on 10 spans in LBRA, which was well ahead of the required completion date.

J3 Powerline bushfire safety programs

United Energy has no regulatory obligation to install REFCLs at any of its zone substations. Even so, United Energy has elected to install REFCLs at Frankston South, Mornington and Dromana zone substations.

The last of the three installations (Dromana) was completed in December 2019.

J4 Exemptions

There are no exemptions currently applicable to United Energy.

J5 Audit performance

J5.1 Electricity Safety Management Scheme (ESMS)

During October 2020, ESV audited United Energy on its contractor management process and procedures. The ESMS was found to adequately describe the contractor management processes and procedures and be compliant in this area. ESV identified one opportunity for improvement, being:

- There is an opportunity for additional contractor engagement such as an all-in contractor forum to provide an opportunity for greater interaction between contractor teams that perform work on the United Energy network to facilitate shared learnings.

United Energy provided a plan to address the ESV audit findings and implement these changes in 2021.

[19] The installation of armour rods, vibration dampers, spacers and spreaders in HBRA was completed by 31 December 2015.

J5.2 Electric line clearance

Network pre fire danger period audit

Leading into the 2020-21 fire danger period, an audit and inspection was conducted on the United Energy network to confirm it was managing its electric line clearance responsibilities effectively in HBRA.

The audit found one major non-compliance and three opportunities for improvement. The non-compliance related to technical procedural deficiencies for vegetation clearing rectification timeframes and vegetation coding.

ESV concluded that United Energy was not strictly managing its line clearance responsibilities as required by its approved plan. This compromised its ability to comply with the regulations and the code and, as far as practicable, to manage its electricity safety risks.

This is particularly important during a declared fire danger period as it increases the risks of bushfires. While a fire did not occur on the United Energy network in 2020-21 due to vegetation growing into electric lines, the ESV field inspection component of the audit found there was an increasing risk of vegetation contacting the network.

United Energy has committed to addressing the procedural deficiencies identified by ESV through revised procedures in its electric line clearance management plan. In addition, it will secure additional resources to better enable it to manage its electric line clearance responsibilities.

ESV will review the application of these mitigation strategies as part of the 2021-22 auditing and inspection programs. It is closely monitoring this situation to identify what intervention maybe necessary to ensure United Energy addresses this increasing risk and delivers a trajectory of improved performance.

Network inspection

During the 2019-20 period, ESV inspected 1616 spans on the United Energy network; 1135 in HBRA and 481 in LBRA.

ESV identified 168 non-compliant spans across the network; 155 in HBRA and 13 in LBRA. ESV issued all non-compliant spans it identified to United Energy under section 86(1) notices and all were cleared by United Energy as a matter of priority, resulting in the elimination of these potentially hazardous situations.

While the rate of non-compliant vegetation on the United Energy network in HBRA had decreased during 2019-20, it had increased significantly in 2020-21 (see Figure 9). The rate of non-compliant vegetation dropped in LBRA for a second consecutive year (see Figure 10).

When ESV conducts inspections, it classifies non-compliance as major or minor non-compliance. A major non-compliance is regarded as high risk where vegetation is touching, or could soon touch, uninsulated conductors. This contrasts with minor non-compliance where vegetation is in the minimum clearance space required by the code but there is no immediate risk of contact with electric lines.

In 2020-21, ESV observed a decrease in the rate of major non-compliance affecting the United Energy network (Figure 55). The combined major non-compliance rate was lower than the average across all distribution networks.

That said, the rate of major non-compliance in HBRA increased this year, jumping from 0.4 per cent to 1.7 per cent (Figure 9), which was significantly greater than the industry average. The overall decrease in United Energy major non-compliance was entirely due to its improved performance in LBRA (Figure 10).

ESV is closely monitoring this situation through its safety regulation programs and is meeting regularly with United Energy to discuss its progress and to inform possible future enforcement outcomes.

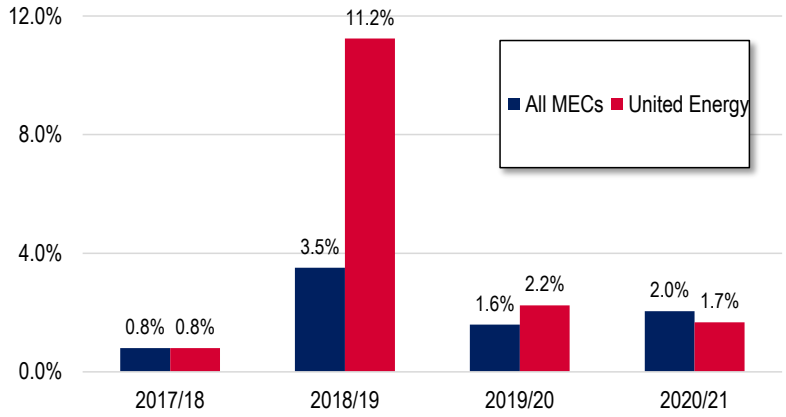

Figure 55 Rate of major non-compliances (HBRA and LBRA)

J5.3 Bushfire mitigation

ESV reviewed 213,726 asset records from across the entire United Energy network and found two LBRA structures outside the inspection cycle timeframes identified in the United Energy bushfire mitigation plan. ESV recommended that United Energy develop appropriate actions that will address these findings.

ESV inspected 100 structures across the Sorrento and Mornington areas. The inspections found six instances, in close proximity to a coastal environment, where assets were exhibiting signs of rapid deterioration. ESV recommended that United Energy rectify these identified issues in accordance with its priority maintenance practices. ESV also recommended that United Energy review the appropriateness of their inspection intervals in areas of harsh environmental conditions that can rapidly deteriorate the condition of assets.

ESV also found two instances of missing low-voltage spreaders in a hazardous bushfire risk area. This scenario was also identified in last year's bushfire mitigation inspections. ESV recommended these issues be rectified and to consider actions to reduce or prevent reoccurrence.

J5.4 Work practices

In 2020-21, the work practices observation program was interrupted due to COVIDSafe requirements. During this time ESV undertook four observations of United Energy work crews across four sites. Two of the observations were planned and two were opportunistic. The findings of these observations were as follows:

- major non-compliances 0
- minor non-compliances 0
- opportunities for improvement 1

The key area of concern identified by these observations related to hazard identification.

ESV recommended that United Energy's work practices specifically focus on ensuring hazard identification is carried out effectively and identifies all work-related hazards.

J6 Safety indicators

Figure 56 shows the number of all serious electrical incidents reported to ESV via OSIRIS by United Energy during the 2020-21 period, with the blue bars showing the numbers for 2020-21 and the orange bars showing the long-term average from 1 October 2010 to 30 June 2020. Figure 57 shows the same for those incidents that result in a ground or vegetation fire.

The most common incidents on the United Energy network in 2020-21 were tree contact, connection faults, vehicle impacts and other contact events. One of these items is within the full control of the United Energy, tree contacts are partially within its control and other two are outside its control.

The numbers of all asset failure incidents were lower in 2020-21 than the long-term average, with the exception of broken conductors or ties. Contact events were lower in one category, stable in one category and higher in four categories.

Tree contact, connection faults, animal contact and other asset failures were the most common causes of network-related fires. Two of these are within the full control of United Energy, and two are partially within its control (tree and animal contact). Fires are higher than the long-term average in five categories and lower in eight categories.

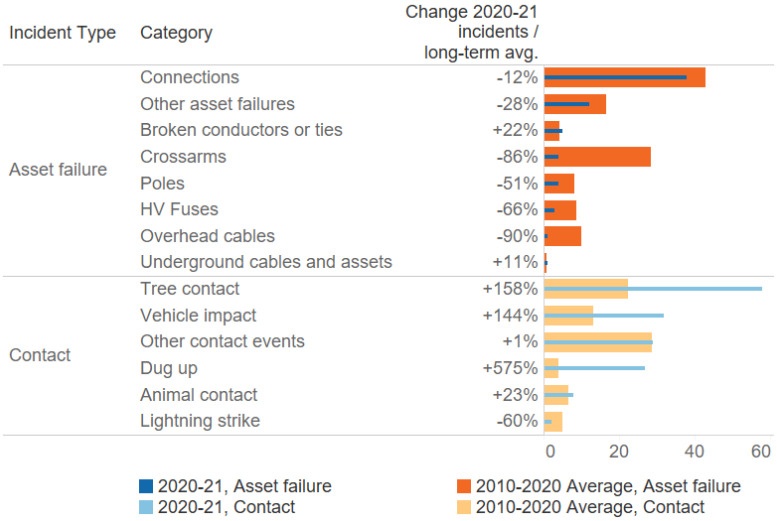

Figure 56 Incidents on the United Energy network

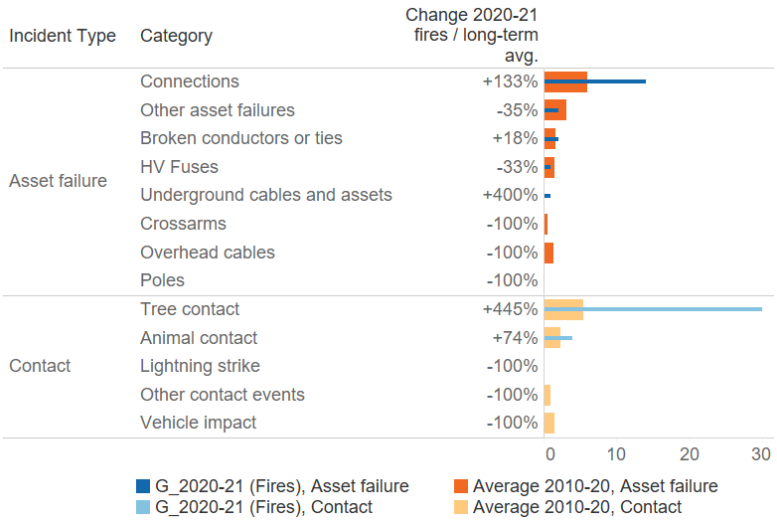

Figure 57 Incidents on the United Energy network resulting in ground fires

Appendix K : Weather modelling and ‘at risk’ days

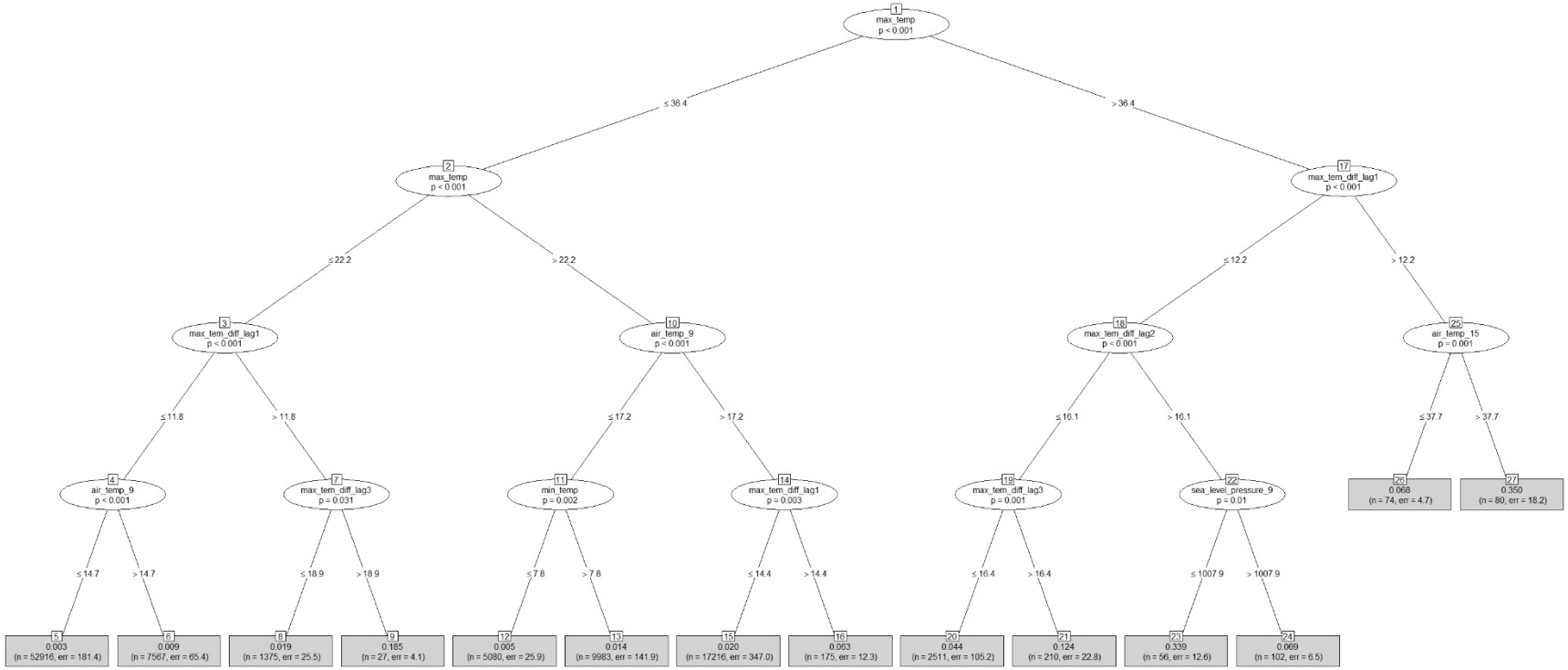

Figure 58 Partitioning of asset failure fires based on the contribution of different environmental factors

Asset failure fires

Asset failure fires were most likely to arise when the maximum daily temperature exceeded 36.4 degrees Celsius (Figure 58).

There was also contribution when the maximum temperature was less than 22.2 degrees Celsius, the temperature difference with the preceding day was more than 11.8 degrees Celsius and the difference with three days prior is more than 18.9 degrees Celsius.

The conditions that we determined would define an asset failure ‘at risk’ day comprised clusters 27, 23, 9, 21, 24, 26, and 20 in order from most to least importance.

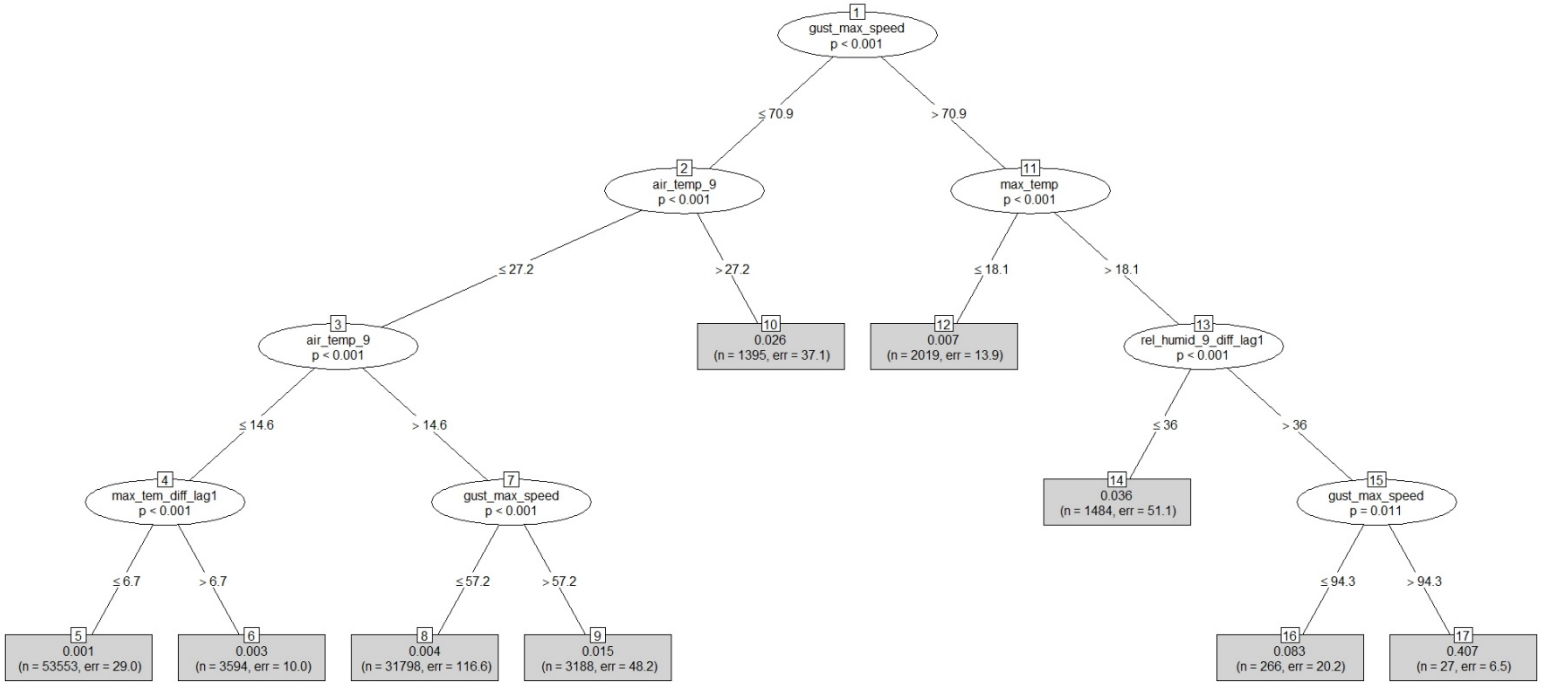

Figure 59 Partitioning of vegetation contact fires based on the contribution of different environmental factors

Vegetation contact fires

Vegetation contact fires were most likely to arise when the maximum wind gust was in excess of 70.9 km/h, the maximum temperature exceeded 18.1 degrees Celsius and the difference in morning humidity from the previous day exceeded 36 per cent (Figure 59).

The conditions that we determined would define a vegetation contact 'at risk' day comprised cluster 17 and 16 in order from most to least importance.

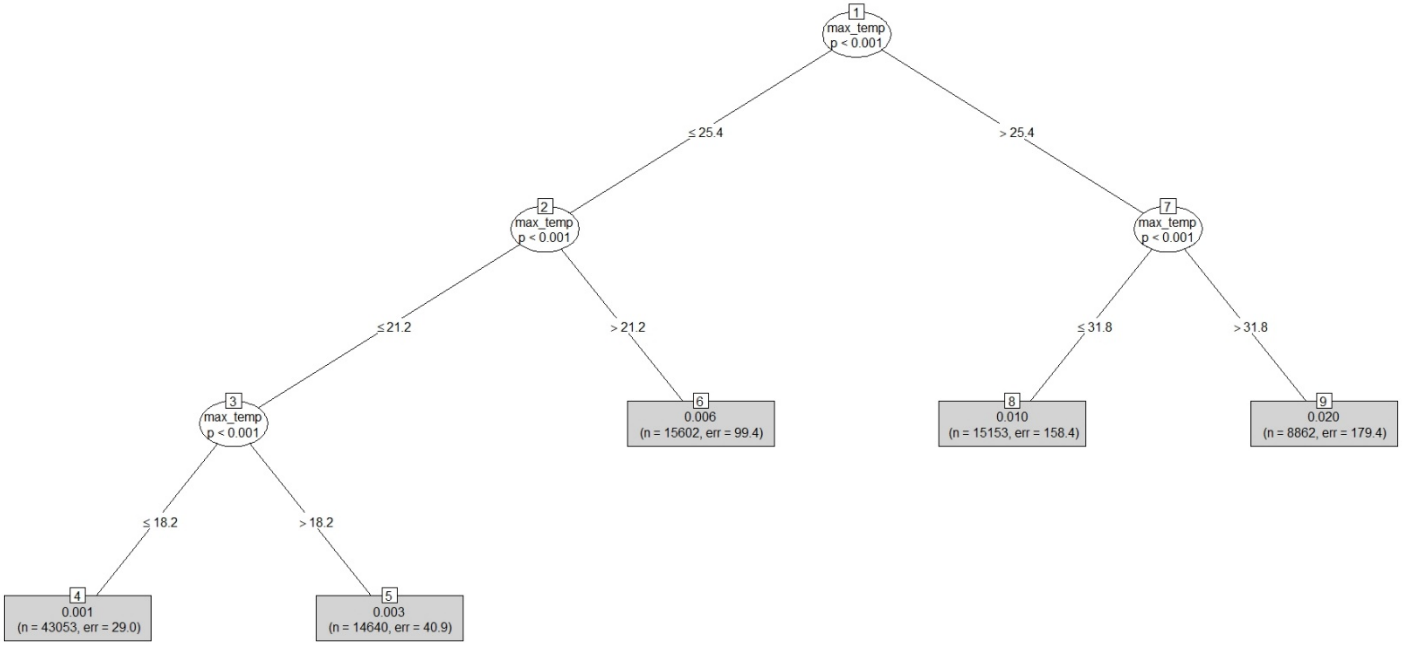

Figure 60 Partitioning of other contact fires based on the contribution of different environmental factors

Other contact fires

Other contact fires were most likely to arise when the maximum daily temperature exceeded 31.8 degrees Celsius (Figure 60).

The conditions that we determined would define an ‘at risk’ day for other contact fires comprised cluster 9.