# Attachment G.2

# SAPN_Bushfire mitigation - supporting evidence

## 03 July, 2015

SA Power Networks

**Table of Contents**

# 1. Additional information concerning our revised bushfire mitigation program

SA Power Networks provided a significant volume of evidence in support of our proposed bushfire mitigation program in our original regulatory proposal for the 2015-20 regulatory control period (**Original Proposal**).

This document contains further evidence which builds on the evidence submitted with our Original Proposal and provides detailed support in relation to the strategies which make up our revised bushfire mitigation program, as described in our revised regulatory proposal (**Revised Proposal**).

## 1.1 Introduction

In this report, we provide further evidence to address the AER's concerns that:

- we have not provided evidence to demonstrate that we are not currently complying, or in the future will not comply, with our regulatory obligations; and
- we have not demonstrated the prudency and efficiency of the strategies which make up our revised bushfire mitigation program.

We address these concerns as follows:

- **compliance with regulatory obligations** – first we discuss how we have assessed our current performance with regard to our regulatory obligations in relation to bushfire safety and then show why we must adopt each of the strategies which make up our revised bushfire mitigation program in order to ensure that we are complying with those regulatory obligations; and
- **prudency and efficiency** – second we explain how we have developed the revised program of work that is required to prudently and efficiently comply with our regulatory obligations relating to bushfire safety over the 2015-20 RCP.

# 2. Compliance with regulatory obligations

To support our Original Proposal we provided a significant amount of information concerning our current bushfire safety practices. This information included a comparison of our current practices with other Distribution Network Service Providers (**DNSPs**). This is presented most comprehensively in the Jacobs report[1], which the AER refers to in its criticisms of our original bushfire mitigation program.

We do not propose to repeat the breadth of the information contained in the Jacobs report in this document. Instead we have drawn out the relevant points from the Jacobs report and provided references where necessary.

In particular, we discuss:

- the recent events that confirm that our current practices are lagging behind 'good electricity industry practice';
- the risk analysis we have performed in assessing how our current practices contribute to bushfire risk; and
- the option analysis we have applied to determine what steps we need to take to comply with our regulatory obligations in relation to bushfire safety and by extension, whether we would not be complying with our safety regulatory obligations if we failed to implement our revised bushfire mitigation program.

## 2.1 Are our practices out of step with good electricity industry practice?

Yes.

This question was dealt with in considerable detail in the Jacobs Report. The AER did not disagree with the view expressed in the Jacobs Report that our current practices are different to practices of DNSPs elsewhere. Accordingly, the Jacobs Report stands as our primary source of evidence that compares our practices with those of other utilities.

In particular we have highlighted below those practices from the Jacobs Report that demonstrate we are lagging behind the interstate DNSPs, and the adverse consequences our current practices will have on fire start risk if we simply maintain those current practices.

## 2.2 Background information

***Reclosers***

In 2009, the Victorian Bushfires Royal Commission (**VBRC**) made a number of recommendations that were accepted by the Victorian Government. After the VBRC issued its report, SA Power Networks in conjunction with the SA Government reviewed the VBRC recommendations and amended some of our practices as a result of this review[2]. This review occurred prior to the Powerline Bushfire Safety Taskforce (**PBST**) work stream and therefore did not address the recommendations made by the PBST.

[1] Jacobs, *Recommended bushfire risk reduction strategies for SA Power Networks: Final Report*, October 2014 (**Jacobs Report**). (Attachment 11.8 to the Original Proposal).
[2] These changes are summarised in Table 3 of the Jacobs report.

The PBST was established by the Victorian Government to review how the following VBRC recommendations should be implemented:

- the progressive replacement of SWER and HV overhead conductors with aerial bundled cables, underground cables, or other technology to deliver greatly reduced bushfire risk *(VBRC recommendation 27*). The replacement program was to be completed in the areas of highest fire risk within 10 years and then continue in areas of lower risk; and

- disabling the reclose function on automatic circuit reclosers (**ACR**) on SWER and HV circuits on the highest fire start risk days (*VBRC recommendation 32*).

In their recommendations to the Victorian Government in December 2011, the PBST proposed that old manual ACRs be replaced with modern remotely controlled ACRs. Further the PBST recommended the installation of Ground Fault Neutralisers[3] (**GFN**) to reduce ignition probabilities on 3-phase HV networks. The Victorian Government accepted these recommendations.

Importantly, following Black Saturday, SA Power Networks refined the decision criteria for determining when and how to exercise the authority to switch off supply in accordance with the power granted to us under the *Electricity Act 1996* (SA). Specifically, the decision criteria were changed to make switching off supply more practicable and more targeted.

The PBST considered our practice of switching off supply as a possible alternative measure to reduce fire risks in Victoria but highlighted the risks associated with using this authority:

> *'under most circumstances, the potential impact on the community that may result from the deliberate turning off of powerlines on a temporary basis outweighs the risk of leaving them in service. There will only be limited circumstances where deliberate turning off of powerlines on a temporary basis is warranted on a —lowest overall risk basis. However, this precaution may be —reasonable and practicable in those limited circumstances.'*[4]

These risks have also been recognised by the medical community, with a peer reviewed article in the Medical Journal of Australia (**MJA**) finding *that '[c]utting off power during periods of high fire danger would lead to more deaths and higher costs to communities'*[5].

The MJA article also considered that functioning air conditioning was important in extreme heat, and switching off power to reduce bushfire risk may well create higher safety risks:

> *'[d]eaths from heat outweigh direct deaths from catastrophic bushfires … from a public health perspective, power cuts are more likely to lead to adverse health outcomes than maintaining power on potentially catastrophic bushfire days.'*[6]

This accords with our view that our authority to switch off must only be used as a last-resort due to the risks imposed on the community when power is switched off.  As such, we would not be taking reasonable steps if we simply relied on this authority to mitigate fire start risk when the adoption of other practices could better reduce the overall risk to the community.

---

[3] GFN is a specific supplier brand of the Rapid Earth Fault Current Limiter (**REFCL**) technology.
[4] PBST, *Final Report*, 30 September 2011 (**PBST Final Report**), pg 74.
[5] Medical Journal of Australia, *The definite health risks from cutting power outweigh possible bushfire prevention benefits*, , MJA 197 (8), 15 October 2012, pg 440.
[6] Ibid, pg 441.

As we discuss further below, the adoption of remote controlled reclosers to a large extent is necessary to reduce the risks on the community associated with using our authority to switch off supply.

Appendix A provides a more detailed explanation of our 'switch off' procedures.

***Surge arrestors***

The Jacobs Report identified that we did not have a program to replace our older pole-mounted surge arrestors with modern equivalents. These older types of surge arrestors are a fire hazard[7].

There are no specific obligations in other states to replace older surge arrestors that may be a fire hazard. Nonetheless, the VBRC in its final report was critical of DNSPs and safety regulators for not adequately planning the retirement of older technologies that were shown to be a fire start hazard in bushfire risk areas.

***Metered mains***

The 2014 Parkerville bushfire event in Western Australia resulted from a pole failure on a private service line. This was a significant bushfire that destroyed more than 50 properties. The occurrence of that bushfire led us to undertake a review of similar assets known as metered mains.

Metered mains were originally installed to facilitate the reading of electricity consumption at multiple installations, particularly on South Australia's rural properties. Power lines were installed from those installations and terminated at one location. These lines are referred to as 'metered mains'. However, the presence of these metered mains has resulted in confusion over who is responsible for their maintenance (ie SA Power Networks or the customer).

This lack of clarity of responsibility for metered mains has always been a concern of ours. These assets were designed and constructed in accordance with various standards by local councils or others and deemed suitable at the time. They were installed (generally) on Stobie poles close or adjacent to a road to aid efficiency and ease of meter reading. Metered mains are typically supplied from SWER lines in rural areas, usually where multiple buildings and/or bore pumps are owned by a single customer, either supplied from a single meter or multiple meters (if there are multiple tariffs).

Prior to the privatisation of ETSA Utilities (now SA Power Networks), there were various agreements between the government owned ETSA corporation and councils for the transfer of electricity undertakings - from as far back as the 1940s. These agreements contained broad and general descriptions of the (then) councils' electricity distribution system, with no apparent distinction of metered mains and its demarcation of ownership (and relevant responsibilities and obligations) between the distribution network and the customer - consequently a number of these assets have either not been inspected and/or maintained.

The PBST has recognised that private overhead power lines have been implicated in fire starts in the past, such as the Parkerville event in WA. Should one of these metered mains fail and lead to a significant fire or public injury event, it is very likely we will be found to be the responsible party.

[7] This is discussed in Section 5.5 of the Jacobs Report. The fire hazard is due to an open spark gap in older units, which can be breached, typically by birds, which can often result in a fire.

***Summary of conclusions from these events***

Our key conclusions from these events are:

- adopting modern remotely controlled ACR and/or GFN devices is now 'good electricity industry practice';
- relying too heavily on our authority to switch off supply alone is not 'good electricity industry practice' and is not consistent with taking reasonable steps;
- our reliance on older surge arrestors in bushfire risk areas is not consistent with 'good electricity industry practice'; and
- resolving the ongoing uncertainty concerning who is responsible for metered mains constitutes a reasonable step to ensure that our distribution system is safe and safely operated, in line with current good electricity industry practice.

## 2.3 Bushfire risk analysis

We presented historical fire start data in our bushfire mitigation strategy document, which was provided in support of our Original Proposal[8]. To supplement this analysis, we have undertaken a further assessment to determine the sources of our fire starts and also explore the broader bushfire data history in South Australia.

Specifically we have:

- reviewed CFS data records of major South Australian bushfires going back over 50 years;
- reviewed more recent CFS data that provide more detailed records back to 2007/08;
- assessed our own fire starts database, which we have been using since 2007/08; and
- examined recent instances where we have used our authority to switch off power to determine if this mitigated the risk of fire starts on these days.

This analysis has highlighted:

- the broader fire start risk in South Australia;
- the causes of our fire starts, particularly in bushfire risk areas and during fire danger periods, and how our current practices contribute to this; and
- how changing to other practices, including those in our revised bushfire mitigation program could reduce fire starts in bushfire risk areas.

[8] Attachment 20.45 to the Original Proposal.

### 2.3.1 CFS major fire history

The CFS data on major bushfires from 1950 to 2015 indicates that there has been a major bushfire in South Australia 47 times over this 65 year period (ie a major bushfire in 7 years out of every 10).

While the CFS data does not readily indicate the cause of the fire start in each case, it does support our view that the general bushfire risk in South Australia is high.

#### 2.3.2 SA Power Networks fire data base

Figure 1 below shows the profile of the number of fire starts each year from 2007/08 to 2013/14.

**Figure 1:** Annual trend of number of fire starts from electricity assets in the period 2008-14, in bushfire risk areas

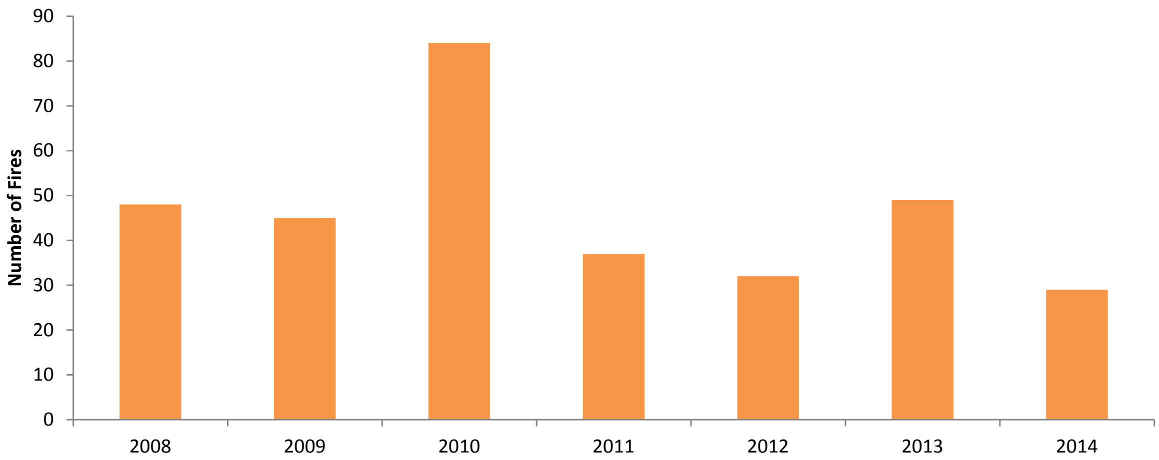
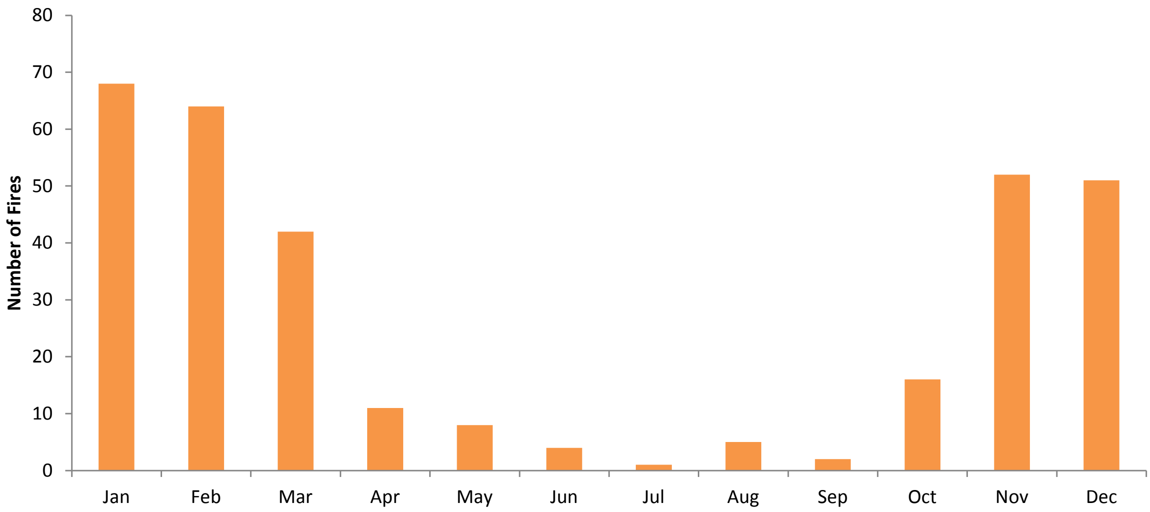



Figure 1 indicates that on average, over this period:

- we started 49 fires per year in bushfire risk areas;
- we started 45 of these fires during that year's fire danger season; and
- we started 7 of these fires on one of that year's total fire ban days.

These results show that we have started a significant number of fires in bushfire risk areas, and these fires are disproportionately high on extreme fire days. Figure 2 below clearly shows the bias of fire starts occurring during the nominal fire danger season of November to March.

**Figure 2:** Average monthly trend of number of fire starts, 2008-14




Our fire start data also indicates that, on average, the resulting bushfires burn over 189 hectares per annum. The largest fire over this period covered 932 hectares. These bushfires have resulted in insurance claims totalling $31 million, with the largest claim over this period being for $30 million. This indicates that the spread of risks is broad but that even over this short period, the possibility of a much larger event is always present.

Of particular note, at the time of the most recent use of our authority to switch off supply (2 January 2012), there were three fire start events in bushfire risk areas[9]. In one of these events a tree branch (outside the vegetation clearance zone) fell onto our lines – the branch smouldered but fortunately did not result in a fire start. This same scenario occurred on 31 December 2010, the previous time we used the authority to switch off supply – refer to Table 9.

Clearly while our authority to switch off *does* reduce risk in the areas where the supply is interrupted, the fire reduction is localised and does not prevent fires from starting in other bushfire risk area locations. However, our assets can and do still cause fires when they are energised, in geographically separate areas, when fire start conditions are at their most extreme. Hence the AER is overestimating the impacts that our authority to switch off supply has on mitigating fire starts. Appendix A expands on this further.

### 2.3.3 Comparisons with Victorian fire start statistics

Our *current* fire start performance is better than the historic Victorian fire start statistics published in the PBST report[10.] This is in part because of the differences in our constructions (ie Stobie poles and steel cross arms compared with wooden poles and wooden crossarms), and partly because we historically already apply a number of the recommendations from the VBRC.

However, comparisons of fire start statistics are not reasonable because:

- the PBST statistics are based on data for 2008 and 2009; and
- the PBST statistics do not allow for the significant improvements that will eventuate from the injection of operating and capital expenditure in Victoria to implement the bushfire risk

[9] We started two fires in high bushfire risk areas, one fire in a medium bushfire risk area, and another two on other parts of our network.
[10] PBST Final Report.

mitigation measures. An investment of approximately $750 million was approved by the Victorian government for a network not significantly greater than ours[11]. For perspective, our proposal to mitigate fire start risk is around $40 million.

Also whilst our fire start performance on Black Saturday looks reasonable compared with the Victorian fire starts, severe conditions were also experienced here which resulted in a number of network faults that, very fortunately, did not result in a fire. Our analysis of network faults on that day shows that eight of these faults could have resulted in a fire start.

Additionally, the VBRC were critical of DNSPs not investing where meaningful reduction in bushfire risk could be found:[12]

> *'It is not satisfactory that the distribution businesses can decide that a specific level of bushfire risk is 'acceptable and rely on the benefit of improved processes and technology to maintain that risk level (instead of reducing it) in order to decrease their operating costs or increase their profits. Distribution businesses should take all reasonable opportunities to reduce bushfire risk.'*

The VBRC is effectively highlighting that our better fire start performance compared to others should not stop continuous improvement to mitigate fire start risk. In particular we must evaluate our own circumstances and decide what steps we need to take to ensure that the distribution system is safe and can be operated safely in accordance with our regulatory obligations.

**Conclusions**

Continuing with our current practices and based on current trends, our electricity assets are likely to start approximately 1,350 fires in bushfire risk areas over the fire danger seasons in the next 30 years (ie the historical frequency of a catastrophic bushfire). Of these fires, 210 will likely start on total fire ban days during the fire danger season and on these days, 24 fires will likely start in areas not affected by our authority to switch off supply.[13]

These figures will increase further when allowing for climate change and the continued ageing of our network.

### 2.3.4 Bushfire cause analysis

We have analysed our own fire start database to determine what parts of our network are prone to start fires (ie what voltage levels) and what has historically caused fires. We have also considered these findings in light of the engineering and scientific findings made by the PBST and discussed in the Jacobs Report concerning the role of ACRs.

This analysis indicates that our current practices are contributing to our bushfire risk.

[11] In terms of the length of power lines in bushfire risk areas.

[12] Victorian Bushfires Royal Commission, *'The 2009 Victorian Bushfires Royal Commission Final Report'*, 31 July 2010, Vol II, Ch 4 (Electricity-Caused Fire), page 161.

[13] Obviously, these are not fires we will start on the parts of the network we have switched off, but are still fires we will start in bushfire danger areas under the most extreme bushfire danger conditions.

**Initiating event analysis**

Table 1 below summarises the causes of fire starts from our assets.

**Table 1:** Fire starts based on cause

| Asset Failure | Environmental | Animals | Third party | Other |
|---|---|---|---|---|
| 46% | 7% | 24% | 9% | 14% |

The key points are:

- 46% of fires are caused by asset failures; a proportion of these will be reduced through increasing the frequency of our inspection cycle and rectifying defects found in bushfire risk areas;
- nearly one third of those fires caused by animals are due to birds or animals resting between the open gaps in our older surge arrestors resulting in a fire start (which equates to an average of 4 fires per year); and
- the remaining 54% of fires are caused by other sources, that would be alleviated if faster protection was installed.

To gauge the potential reduction in fire starts from faster acting protection (eg modern reclosers or GFN technology), we have analysed our database to confirm whether or not a recloser operated for the fault that caused the fire. This analysis showed that reclosers operated for 46% of the faults that led to fires.

We have also cross referenced fires started from surge arrestors with recloser operations. The findings were that surge arrestor faults do not typically initiate a recloser operation. Hence it will not be sufficient to stop this fire start cause by just replacing older reclosers with new reclosers. Old style surge arrestors have to be replaced with the new fully enclosed surge arrestors as well.

**Network voltage cause analysis**

Table 2 below details total fire starts and fire starts per 1,000kms in bushfire risk areas, by voltage. The 11 kV and 7.6 kV networks cause the most number of fires, but on a per km basis the 33 kV network is most prone to start fires. Also on a fire starts per 1,000kms basis, the LV network is similar to 11/7.6kV but SWER is very much less prone to fire starts.

Hence the priority for our bushfire mitigation program is with our 33 kV network and then our 11/7.6 kV networks.

**Table 2:** Fire starts at network voltages in bushfire risk areas

| Voltage | Fire starts over bushfire season in bushfire risk areas | |
|---|---|---|
| | Fire starts[a] | Fire starts per 1000 km |
| 33 kV | 7.1 | 2.02 |
| 11 kV and 7.6 kV | 22.7 | 1.74 |
| SWER | 4.9 | 0.17 |
| LV | 10.4 | 1.66 |
| **Total** | **45.0** | **0.88** |

a – decimals are due to averaging across years and sampling

**Conclusions**

The key conclusions are:

- our 33 kV network is the highest priority construction for fire risk mitigation followed by 11kV and 7.6kV networks;
- the older surge arrestors are a noticeable contributor to our fire starts; and
- replacing old reclosers with new reclosers will not stop fires from older style surge arrestors unless the surge arrestor is replaced also.

**Metered mains**

With regard to our metered mains, it is more difficult to see empirical evidence in our historical fire start data because this covers a very small portion of our potential network (326 km of LV line out of the 6200 km of LV line in the bushfire risk area). Therefore, it is far less likely that an incident will have occurred over the short timeframe available in the fire start database. As far as we are aware, no reported incidents have occurred.

However, some caution is needed in relation to this finding as this could simply be because incidents have been small and therefore they have not been reported back to us. Consequently, the absence of empirical historical evidence is not sufficient to say the risk does not exist. Given the poor condition of these overhead assets and the fire start potential of other overhead lines in South Australia, it is reasonable to conclude that these lines pose a fire start threat significantly greater than our LV network. Continuing the current practices will only lead to these lines degrading further and this fire start risk increasing.

Importantly, the protection measures considered here are unlikely to reduce fire start risk associated with metered mains as there will typically be no devices to operate should a fault on these lines occur. Mitigating the fire start risk associated with metered mains needs to be seen largely in isolation. In other words, we need to ensure that the metered mains are safe and safely operated for all purposes, not just fire starts.

### 2.3.5 Strategy options analysis

The sections above have outlined where our current practices are out of step with good electricity industry practice and the fire start risk associated with these current practices.

What amounts to good electricity industry practice and reasonable steps will be determined by reference to (amongst other things) the extent to which a particular measure will reduce the fire start risk.

In Table 3 we summarise the various options we originally considered in our bushfire mitigation program. This table also indicates the coverage that each option has to reduce fire starts associated with our network.

**Table 3:** List of mitigation strategies considered vs coverage

| Option | Coverage | | | |
|---|---|---|---|---|
| | 33 kV | 11 kV/7.6 kV | SWER | Metered mains |
| Replacing older reclosers with modern, remote-controlled units (all distribution voltages, including SWER) | X | X | X | |
| Installing GFN devices (all distribution voltages, excluding SWER) | X | X | | |
| Replacing older, fire hazard surge arrestors with modern units (all distribution voltages, including SWER) | X | X | X | |
| Undergrounding the overhead network | X | X | X | |
| Replacing bare overhead conductor with insulated overhead conductor | X | X | | |
| Increase ability to switch off power | X | X | X | X |
| Metered mains rectification | | | | X |

The Jacobs Report discussed how these options mitigate fire starts in some detail. However, we summarise the most important matters associated with each option in Table 4 below. We also expand upon the matters covered in the Jacobs Report, particularly where there may be other cost, risk or opportunities associated with a particular option. We also expand upon the discussion in the Jacobs Report to provide our estimate of the reduction in fire starts for each option[14].

[14] It is important to note here that we are examining the potential for an option to reduce fire start risks. Therefore, the fact that a "do noting" option is not explicitly covered in this option list, does not mean we are not considering the do nothing option. If the costs associated with doing something were clearly disproportionate to the reduction in risk then we would be accepting the "do nothing" implicitly, by rejecting the "do something" option.

We understand that our reduction assumptions are in line with assumptions made by the PBST when making similar calculations[15].

[15] Section 4 of the PBST final report, dated 30 Dec 2011.

**Table 4:** Options discussion– benefits, risks and costs

| Option | Fire start risk reduction | Other costs, risks and opportunities |
|---|---|---|
| Replace old reclosers with modern remotely controlled reclosers | This reduces fire starts by:<br>• isolating faults more quickly<br>• altering/disabling reclose cycle<br><br>Fire start reduction 50% of those where reclose operated | Benefits:<br>• reduces time and customer numbers switched off under catastrophic conditions – and reduction in risks associated with switching off supply (see below)<br>• reduces costs associated with manual changes to protection settings and switch off<br>• avoids safety risks associated with crews performing manual operations. |
| Install GFN | This reduces fire starts by:<br>• reducing fault current for conductor-to-earth faults very quickly<br><br>Fire start reduction 70%. | Benefits:<br>• reduces time and customer numbers switched off under catastrophic conditions – and reduction in risks associated with switching off supply (see below)<br>Risks and cost:<br>• still significant uncertainty as to its suitability for SA conditions– as such the estimated fire start reduction could be considerably less until operational issues are resolved. |
| Replace old surge arrestors | This reduces fire starts by:<br>• removing fire-start fault mode.<br><br>Fire start reduction 95% of surge arrestor failures associated with older open contact technology. | Benefits:<br>• improved quality of supply performance by removing this fault type |
| Underground | This reduces fire starts by:<br>• removing almost all fire-start fault modes.<br><br>Fire start reduction 99% of network being undergrounded. | Benefits:<br>• removes need to switch off supply, but only for zones that are undergrounded |

| Option | Fire start risk reduction | Other costs, risks and opportunities |
|---|---|---|
| Insulate overhead conductor | This reduces fire starts by:<br>• removing many fire-start fault modes.<br><br>Fire start reduction 90% of network being insulated. | Benefits:<br>• significantly reduces need to switch off supply, but only for zones that have insulated overhead conductors |
| Increase authority to switch off | This reduces fire starts by:<br>• removing all fire-start fault modes in the switch off zone.<br><br>Depends on increased frequency of use. | Risk and cost:<br>• significant increase in safety risks associated with switching off supply to communities under extreme heat and fire danger conditions<br>• deteriorates supply reliability. |
| Repairing Metered mains | This reduces fire starts by:<br>• remediating asset condition to safe standards, and so reduces likelihood of asset failure.<br><br>Fire start reduction – difficult to quantify, but should bring into line with other LV network assets[a]. | Benefits:<br>• removes unresolved responsibility that has resulted in assets being in poor condition presently. |

a – for metered mains, we have assumed these lines are performing twice as poorly as our LV lines and will be brought in line with our LV lines following remediation.

To assess what constitutes reasonable steps, we need to determine if the costs of implementing each option are disproportionate to the risk reduction (allowing for the other risks, costs and opportunities that the option provides). As discussed in the Revised Proposal, the requirement to consider all steps where the associated cost is not 'grossly disproportionate' to the risk is important in the case of bushfire mitigation as we cannot quantify with any certainty the economic value of the risks.

Our approach is therefore to consider the cost against the potential to reduce fire starts, for various bushfire risk conditions. By considering when disastrous fire events have occurred in South Australia, we believe it is reasonable to make the analysis over a 30 year period because the typical period between catastrophic bushfire events is around 30 years.

With this in mind, Table 5 below shows the costs and fire start risk reduction for each option, with a qualitative indication of other risks or benefits associated with the option that need to be considered.

To enable consistency between options, we have scaled the volume of each option to reflect a similar quantum of work. That is, the table shows the level of fire start risk reduction for a $10 million investment in that option. For example, for replacing old surge arrestors, replacing a single unit has only a very small effect on reducing fire starts, but for an equivalent level of investment to undergrounding, we can replace a lot of units and so achieve considerably better cost-benefit ratio.

**Table 5:** Options – Costs vs Risk reduction

| Option | Cost ($ millions) | Risk reduction (events per 30 years) | | | Other cost or risks |
|---|---|---|---|---|---|
| | | Fire danger season | Total fire ban | Catastrophic | |
| Replace old reclosers | $10.0 | 35.4 | 5.5 | 0.8 | significant additional benefits to switch off authority |
| Install GFN | $10.0 | 19.9 | 3.1 | 0.4 | additional benefits to switch off authority additional risks of applicability |
| Replace old surge arrestors | $10.0 | 23.1 | 3.9 | 1.2 | additional benefits in improved reliability performance by removing fault mode. |
| Underground | $10.0 | 0.6 | 0.1 | 0.0 | significant additional benefits as it avoids the need to switch off areas |
| Insulate overhead conductor | $10.0 | 1.2 | 0.2 | 0.0 | significant additional benefits avoids the need to switch off areas |
| Increase application of switch off procedure | NA | NA | NA | NA | significant additional risks associated with switch off authority |
| Remediate metered mains | $10.0 | 23.8 | 3.7 | 0.7 | |

Based upon this analysis, we have rejected a number of options as 'reasonable steps' required to be undertaken in accordance with our safety regulatory obligations and requirements:

- **Undergrounding and insulated overhead conductor** – We have rejected these two options as the costs are very high compared to the reduction in fire starts. That said, in the specific case of Bushfire Safe Places in the highest risk bushfire zones, the additional benefits for community safety provided by removing the need to switch off power under extreme conditions is sufficient to justify this extra cost. This additional driver (being community safety), does not however relate specifically to the reduction of our bushfire risks and therefore we have removed this program from our bushfire mitigation strategy, and instead included a modest amount in our broader safety program[16].

- **Increase time when we switch-off supply** – This is a very low cost option for us. However, we have rejected this option as its ability to reduce fire start risk is limited to catastrophic conditions. Furthermore, it will not eliminate the risk unless it is implemented far more widely and readily. Nevertheless, as detailed in Table 9, even when we *have* switched off supply, our assets have still started fires in locations that were not switched off. Our key concern however is the additional risks this option imposes on the community. When the PBST considered this option, they largely rejected it due to these risks. We discuss this in more detail in Appendix A.

With regard to replacing older surge arrestors and upgrading metered mains, the costs are not clearly disproportionate to the reduction in fire start risks. Importantly for metered mains, we are very concerned that these assets are well below our safety standards and so pose a significant risk to the community that will only deteriorate further without action. Therefore, we consider undertaking this strategy is a reasonable step to comply with our safety regulatory obligations and requirements. Furthermore, for surge arrestors and metered mains the benefits in fire start risk reduction do not overlap with other programs.

On this basis we have retained the replacement of surge arrestors and remediation of metered mains in our Revised Proposal.

The costs of installing GFN and replacing older reclosers are also not disproportionate to the reduction in risks. As such, both programs have been considered in our Revised Proposal. However, there is an overlap in fire start reduction on 3 phase networks (33kV, 11kV and 7.6kV) between these two options.

The PBST recommended replacing reclosers only on SWER and using GFN for 3-phase networks. However, we are concerned that GFN technology has still not been proven by the Victorian DNSPs. Furthermore due to the design of our network, we have unique challenges to overcome in the integration of GFN technology before it can be used effectively. This will take time to resolve and therefore, if we rely solely on implementing GFN to reduce fire start risks from our 3-phase networks, we may not achieve any substantial benefits over the next regulatory period, and instead we may incur significant costs from an unwanted fire. Also implementing only GFN technology does not overcome the problem of switching off supply to more customers than necessary because our older manual reclosers are not remotely operable.

Therefore, our revised proposal is to take a more cautionary approach to using GFN devices. We propose to defer the trial of this technology and continue to monitor its progress and performance in Victoria over the 2015-20 RCP. Our preferred strategy is to replace reclosers on the 3-phase and

[16] Refer to Chapter 7, Section 7.7 (Bushfire safer places) of the Revised Proposal.

SWER networks in the highest bushfire risk areas of South Australia. As evidenced in Table 5, this provides good fire start risk reduction and the additional benefits of switching off fewer customers when we use our authority to switch off supply. We believe these additional benefits are significant and would be realised early in the implementation.

Based upon this reasoning, our bushfire mitigation strategy constitutes the reasonable steps we need to take over the 2015-20 RCP to ensure our distribution system is safe and safely operated. These actions are a prudent approach to address fire start risks, where the costs are not clearly disproportionate to the benefits.

It is important to note that the reductions discussed above are based on recent fire start statistics. As discussed earlier, the BOM and Climate Council forecasts increasing adverse weather that will impose additional pressures on our fire start risk over the 2015-20 RCP. Therefore the risk reductions suggested above should be considered a more conservative estimate of fire start risk. Of most note:

- The AER's own repex modelling has found our overhead network is ageing, even allowing for the increases in replacement expenditure we have proposed in our Revised Proposal. While our improved inspection program should highlight which assets need to be fixed before they fail, an ageing network is likely to have more failures in extreme weather as more assets are reaching the end of their engineering life.

- As already mentioned, this scenario is exacerbated by the BOM and CSIRO forecasts of increasing severe fire danger days which could in turn lead to catastrophic fire consequences.

# 3. Prudency and efficiency concerns

In the previous section we have explained why our revised bushfire mitigation program is necessary to achieve ongoing compliance with our safety obligations. We have also explained why the programs we have selected are prudent measures, given other alternatives.

In this section, we explain why the program of works that constitutes the capex forecast for this strategy over the 2015-20 RCP, represents a prudent and efficient implementation of our revised bushfire mitigation program.

Importantly, this program of work is a targeted and prioritised program of work that is aimed at addressing the areas of our network that have the highest fire start risk, due to their poorer fire start performance and/or their higher bushfire consequence.

Due to matters that differ between the programs, we will discuss the programs as follows:

- reclosers and surge arrestor replacements; and
- remediate metered mains.

## 3.1 Recloser and surge arrestor replacements

The recloser and surge arrestor replacement programs have been developed through an iterative process that is aimed at producing a profile of work over the 2015-20 RCP that is targeted at replacing the highest risk reclosers and surge arrestors in an efficient manner.

The key elements of this process involve:

- analysis using a feeder risk model, which measures and ranks the fire start risk of every feeder on our network;

- recloser zone optimisation, which involves engineering assessments of which reclosers within a zone would provide the most benefit from installing remote-control facilities in order to optimise our authority to switch off supply; and

- delivery considerations, which involves us assessing the proposed replacements to confirm that they can be delivered efficiently.

A critical part of this process is our feeder risk model. This was discussed in the bushfire mitigation strategy business case that was provided in support of our Original Proposal[17]. To aid the more detailed discussion in that document, the following points may be helpful:

- the model is used to gauge and rank the fire start risk[18] for every feeder on our network;

- each feeder represents a line item in the model;

- various parameters are inputs for each feeder;

[17] Attachment 20.45 to the Original Proposal.
[18] The risk score in this model is a combined risk that allows for the bushfire risk, the risk of not supplying a designated Bushfire Safety Place, and the recloser risk/benefit associated with using our ability to switch off supply.

- these parameters relate to the likelihood of fire start from that feeder and the magnitude of the fire consequence should that feeder start a fire;

- the likelihood factors and consequence factors are combined (via a formula we developed) to produce a pseudo-quantitative indication of fire start risk associated with each feeder;

- the feeder risk measure is not an economic risk score; however, we believe it is sufficiently robust for targeting and ranking purposes;

- the feeder bushfire likelihood factors cover the average number of total fire ban days affecting the feeder, the feeder reliability, average fire starts due to the feeder, the feeder length, and recloser's distance from a depot; and

- the feeder consequence factors cover whether it runs through high or medium bushfire risk areas, the maximum probable loss as defined by the Willis analysis, how many Bushfire Safer Places are supplied by the feeder, whether or not the feeder goes through a National Park, how many CFS fire stations are around that Bushfire Safer Place, and the number of customers supplied by that feeder.

Based upon this analysis, over the next period we are planning to replace:

- **22% of our 687 older reclosers in bushfire risk areas** – this equates to 30 reclosers per annum over the 2015-20 RCP; this will target our highest risk feeders, moving progressively from our 33 kV to 11/7.6 kV lines and then to our SWER networks; and

- **25% of our 12,000 older surge arrestors in bushfire risk areas** – this equates to approximately 600 surge arrestors per annum.

The replacement unit cost estimates for these programs have been developed from our historical costs for undertaking similar replacements. We believe the AER can accept these unit costs as efficient because:

- the AER's own benchmarking indicates that our historical costs benchmark favourably against other DNSPs; and

- the AER has accepted that our historical replacement unit costs reflect efficient costs in its preliminary decision on the component of our replacement expenditure forecast that it assessed through its repex model.

Table 6 below shows the replacement capex forecast over the 2015-20 RCP.

**Table 6:** Recloser and Surge Arrestors expenditure forecast, June 2015, $ million

| Capital forecast | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | Total |
|---|---|---|---|---|---|---|
| Replace reclosers | 3.5 | 3.6 | 3.6 | 3.7 | 3.7 | **18.1** |
| Replace surge arrestors | 2.4 | 2.4 | 2.5 | 2.5 | 2.5 | **12.4** |

## 3.2 Metered mains

Subsequent to our Original Proposal, we have commenced field inspections and recording of these assets to assist with our business case for the remedial works associated with metered mains.

We have updated our metered mains business case which can be found in Attachment G.4 to the Revised Proposal.

The findings from our field investigations have led to us significantly reduce the number of metered mains that we plan to remediate over the 2015-20 RCP from that proposed in our Original Proposal.

The metered mains program will be developed to target the highest risk areas across South Australia in an efficient manner.

The key elements of this process involve:

- an inspection procedure to be created, which provides instructions to power line inspectors for determining where the customer connection point shall be located;
- for each property, the line inspectors will draw a map indicating the spans located between the meter and established a connection point(s) - this will require a geospatial based data capturing; and
- the results will be used to issue work packages to field crews, instructing the location and volume of spans and assets to be remediated.

Remediating a metered main span will require a combination of pole plating/replacement, and conductor repair/replacement. The beta distribution methodology[19] has been used to determine a unit cost per span and is based on historical costs, as the exact volume of required pole interventions and conductor repairs has not been finalised – we expect this to be completed by 2015. The unit cost per span derived is $2,000.

There are approximately 4,840 customers supplied by metered mains, of which we are targeting customers with two or more spans[20]. Table 7 below summarises the customer numbers and their number of spans, calculations of the total spans for remedial works, and the estimated costs using our derived unit cost rate.

[19] The beta distribution method is a three point estimation technique that uses the most likely, optimistic, and pessimistic costs. This method was used to determine the unit cost because we cannot quantify the total number of platings, pole replacements and conductor repairs required for the entire volume.

[20] We have excluded the 0-1 span as the fire risk start risk is very low because the span starts from SA Power Networks' asset and continue to a fixed structure eg a shearing shed or pump house, and therefore presents a low risk of failure.

**Table 7:** Total cost to repair and remediate metered mains, June 2015 $million

| Metered Mains Spans | Number of Customers Supplied | Total Spans to Remediate | Cost |
|---|---|---|---|
| 0-1 | 3350 | 0 | $0 |
| 2 | 781 | 1562 | $3.12M |
| 3 | 274 | 822 | $1.64M |
| 4 | 107 | 428 | $0.86M |
| 5 | 197 | 985 | $1.97M |
| 6 | 12 | 72 | $0.14M |
| 7 | 5 | 35 | $0.07M |
| 8 | 3 | 24 | $0.05M |
| 10 | 111 | 1110 | $2.22M |
| | | **Total Cost:** | **$10.1M** |

Our forecast expenditure over the 2015-20 RCP is shown in Table 8 below:

**Table 8:** Metered mains capex forecast, June 2015 $ million

| Capital forecast | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | Total |
|---|---|---|---|---|---|---|
| Metered mains | 1.2 | 2.5 | 2.5 | 2.6 | 1.3 | **10.1** |

Further details of the cost estimate, and the underlying methodology and assumptions, are provided in our updated metered mains business case.

# Appendix A – SA Power Networks authority to switch off supply

In this appendix, we provide some background material to help the AER understand:

- how we apply our authority to switch off supply under extreme bushfire conditions;
- how switching off supply affects our fire risks, but incurs other risks and costs; and
- why our program to install remote-controlled reclosers is vital to the prudent and efficient ongoing use of this authority.

**Power to turn off electricity supply**

Section 53 of the *Electricity Act 1996* (SA) states that:

> *(1) An electricity entity may, without incurring any liability, cut off the supply of electricity to any region, area, land or place if it is, in the entity's opinion, necessary to do so to avert danger to person or property.*
>
> *(2) If an electricity entity proposes to cut off a supply of electricity in order to avert danger of a bush fire, the entity should, if practicable, consult with the Chief Officer of the South Australian Country Fire Service before doing so.*

**Disconnection procedures**

On extreme and catastrophic bushfire danger days, we are in a state of heightened preparedness for responding to an escalating fire start risk. We have a three tiered process that must be followed before we authorise the switch off of supply:

1. the CFS has declared a Total Fire Ban day in the districts we are considering for switch off;
2. the Fire Danger Index is above 50 as calculated by the Bureau of Meteorology (**BOM**) in at least one of the BOM's Automatic Weather Stations (**AWS**) within that district; and
3. a series of criteria have been satisfied relevant to the specific feeders being considered for switch off.

Satisfying the criteria in the third tier is critical to us deciding to switch off supply for any feeder (or group of feeders). These criteria are important as they relate to both the risk that we will start a fire and the risks (to others) of us switching off power.

The criteria can be considered in two forms:

1. wind speed measurements, which relates to the risk our network will start a fire and the fire will propagate; and
2. a series of other factors we consider, which relate to the risks of starting a fire and the risk of switching off power.

A commissioned CSIRO investigation concluded that the likelihood of vegetation causing network faults increases significantly as the wind speed and wind turbulence escalates. Wind speed observations are monitored from the BOM AWS, which are located throughout the State. Each feeder is assigned to an AWS and when the weather observations at that AWS exceed certain thresholds, then the other factors are reviewed.

These other factors include:

- successful Reclose operations on feeder(s) associated with that AWS;
- reports of power outage(s) on feeder(s) associated with that AWS;
- reports of fires in the vicinity of a feeder associated with that AWS;
- reports of property damage, fallen trees, flying debris or other wind effects;
- reports of fires in the vicinity of that AWS;
- severity of wind gusts;
- Fire Danger Rating (whether Severe, Extreme or Catastrophic);
- an expected improvement or deterioration in fire danger conditions in the near future; and
- health related factors for aged and life support customers.

Finally, if all criteria have been satisfied and the necessary internal paper work has been prepared and signed off, the authorised delegate of the CFS will be consulted (if practicable). Where following that discussion we form the opinion that it would be unsafe to maintain supply, a recommendation is made to our CEO to authorise switching off feeder(s). Switching off feeders will not commence until SA Power Networks' CEO has authorised the switching off. (The SA Power Networks Board has delegated authority to switch off only to the CEO or other persons in accordance with a Board delegation directive.)

Importantly it takes time and careful consideration to decide to switch off supply. This is necessary to reduce other risks associated with switching off supply. But because of the need to ensure all checks have been taken, the fire risk cannot be eliminated. Switching off addresses a number of fire start causes from the network on an extreme bushfire day, but many remain – refer to Table 9 below. Therefore, in wide-spread and rapidly evolving conditions such as those on Black Saturday in Victoria, when CFS resources would be severely challenged, any one of these fires could result in a major bushfire event.

**Recent events**

We have used this authority twice since 2009, once in 2010 and once in 2012. Table 9 summarises key parameters associated with each event.

**Table 9:** Key parameters associated with each extreme weather disconnection event

| Extreme weather disconnection | Event 1 | Event 2 |
|---|---|---|
| Date | 31 December 2010 | 2 January 2012 |
| Region affected | Lower South East | Port Elliot, Goolwa, Hindmarsh Island |
| Feeders interrupted | 3 (part) feeders | 2 feeders |
| Duration | 6 hours | 6.5 hours |
| Customers interrupted | 300 | 3,300 |
| Wind speed | 55 km/hr | 67 km/hr |
| Other nearby fires and near misses during switch off event | Three fire incidents from SA Power Networks assets<br>(1) Tree outside clearance zone fell on line, smouldered but did not start fire (**HBFRA**)<br>(2) Fire started when bird fouled transformer (**HBFRA**)<br>(3) Fire started when protection cleared a fault (**MBFRA**) | Three fire incidents from SA Power Networks assets<br>(1) Fire started when failed conductor contacted fence (**MBFRA**)<br>(2) Fire started from failed transformer (**HBFRA**)<br>(3) Tree outside clearance zone fell on line, smouldered but did not start fire (**HBFRA**) |

The important points from the above are:

- we only switch off electricity supply as a last resort;
- a large number of customers can lose supply when we switch off, and supply will be off for around 7 hours while lines are patrolled, repaired and re-energised; and
- we still start a number of fires on other parts of the network while the power is switched off.

**Risks associated with switching off supply**

As we noted above, switching off supply during extreme bushfire conditions imposes its own costs and risks on the community.

We are concerned that the AER may be viewing these simply as the value of customer reliability. The reliability cost is certainly not insignificant. For example, for the second event above, 3,300 customers were off supply for almost 7 hours. However, the more significant issue is the increased safety risks on the community when switching off supply. This is because we will be switching off supply under extreme temperatures, extreme winds, and at a time when local communities and emergency services are most active and in need of a reliable supply of electricity.

For example, the loss of supply can effect:

- air conditioners, at the times when the aged and the infirmed will need them most;
- communications when they may be the most critical;
- electric doors and gates when quick access may be most critical;
- transport controls (eg traffic lights) when evacuations may be most necessary; and
- the possible disruption of other utilities such as water supply.

The issues associated with switching off supply were recognised by the PBST when they were considering options to reduce bushfire risks. The PBST did not recommend the use of this option stating that:

> *"under most circumstances, the potential impact on the community that may result from the deliberate turning off of powerlines on a temporary basis outweighs the risk of leaving them in service. There will only be limited circumstances where deliberate turning off of powerlines on a temporary basis is warranted on a —lowest overall risk basis. However, this precaution may be —reasonable and practicable in those limited circumstances."*[21]

Importantly, the PBST were recommending the highest cost alternatives of undergrounding in high risk areas over the wider use of switch-off supply.

These risks have also been recognised by the medical community, with a peer reviewed article in the Medical Journal of Australia finding that "(*c)utting off power during periods of high fire danger would lead to more deaths and higher costs to communities"*[22]. The authors considered that functioning air conditioning was important at times of extreme heat and considered that reducing bushfire risk by switching off power may well incur higher safety risks due to the loss of air conditioners, stating *"(d)eaths from heat outweigh direct deaths from catastrophic bushfires … from a public health perspective, power cuts are more likely to lead to adverse health outcomes than maintaining power on potentially catastrophic bushfire days."*[23]

**The vital role of remote controlled reclosers**

Remote control reclosers are vital to the prudent and efficient implementation of switching off power under extreme or catastrophic bushfire conditions.

There are significant risks when manually switching a recloser because our crews may need to travel and work in extreme weather conditions when the risks to their safety are highest. As a result, we typically have to switch off supply at a remotely controlled device upstream of the high bushfire risk area.

Replacing our older manual reclosers with remote controlled units will mean we can be more selective with switching, and only switch off those parts of the network that have the greatest fire

[21] PBST Final Report, pg 74.
[22] Medical Journal of Australia, *The definite health risks from cutting power outweigh possible bushfire prevention benefits*, 15 October 2012, MJA 197 (8), pg 440.
[23] Ibid, pg 441.

start risk. This will reduce the number of customers impacted by the electricity supply being turned off, thereby significantly reducing the safety risks discussed above.

Unfortunately, it is difficult to quantify the improvement in community safety from implementing this strategy. However, it is material and should be factored into any evaluation of the benefits of replacing older manual reclosers with remotely controlled reclosers. The AER has previously accepted this benefit in the 2010-15 RCP and approved a program to install reclosers on the boundary of non bushfire risk areas and high bushfire risk areas.