ISSC 33

Guide for Network Configuration During Total Fire Ban Days

September 2024

Contributions

In the development of this guide, discussions were held with the following parties:

Network operators

Ausgrid

Endeavour Energy

Essential Energy

Sydney Trains

Transgrid

Regulators

NSW Department of Climate Change, Energy, the Environment and Water

Disclaimer

While due care has been exercised in compiling this guide, much of the content has been sourced from outside the Electricity Industry Safety Steering Committee (ISSC) working group formed to compile the guide; therefore the working group cannot accept responsibility for the content.

This guide is designed on the basis that it will be used in its entirety, and people who use or observe parts of the publication without paying heed to its entirety do so at their own risk.

The guide has been prepared on the basis that the user will have a certain minimum level of technical qualifications or experience. The guide is not intended for use by untrained or unqualified people and anyone in that category using the guide does so at their own risk.

This guide does not purport to ensure compliance with all the relevant statutes and regulations such as occupational health and safety laws. Users must satisfy themselves as to the requirements of all relevant laws.

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Revision history

The December 2007 version of this guide was prepared for the Industry Safety Steering Committee (ISSC) by a working group of NSW electricity distribution network operators facilitated by the then Department of Water and Energy (DWE). Their final draft was forwarded to all affected industry parties for review, with comments and alterations incorporated in the final document. The electricity network operators included are responsible for the design, construction, operation and maintenance of electricity network infrastructure, including overhead powerlines, for the purpose of supplying electricity to customers.

Following the Victorian 2009 'Black Saturday' bush fires and subsequent Royal Commission, the ISSC reconvened the working group to examine whether this guide required update or amendment. This resulted in republication of the guide in 2010 with minor amendments.

In 2022 the ISSC again called for a review of this guide due to the time elapsed since the previous review, and to keep up to date with advances in network technologies, protection systems, system device capabilities, the 2019–20 'Black Summer' fire season, and climate change forecasts.

Purpose

This guide has been produced to provide guiding principles to NSW electricity network operators for making decisions relating to network operation and configuration during TOBAN days.

Introduction

Powerlines are a potential cause of bush fires. For network operators with rural feeders, or feeders in densely vegetated areas near urban interfaces, the risk can be very high. However, any potential bushfire risk needs to be considered against the risk of the loss of supply as communities under threat from fires also need power to help in fighting fires. Therefore, customer and community expectations of an appropriate balance between bush fire safety, reliability, electrical supply and cost need to be carefully considered and appropriate measures implemented.

This guide presents a preferred approach to be used by network operators. It does not substitute for, nor override, any relevant legislation, regulation or safety rules implemented by regulators or network operators. Therefore, this guide should be read in conjunction with other standards and guides which refer to the specific kind of work concerned.

1 Definitions

Auto-reclose: The automatic closure of a circuit breaker after a defined period of time after it has tripped to interrupt a fault.

Electricity network: Transmission and distribution systems consisting of electrical apparatus which are used to convey or control the conveyance of electricity between the generator's points of connection and customers' points of connection.

High risk feeder: A feeder or segment of feeder identified by the Network Operator as being of high bush fire risk.

Network operator: The owner, controller or operator of an electricity network.

TOBAN: Total fire ban as may be declared by the Commissioner of the NSW Rural Fire Service for one or more TOBAN areas.

Reclosing devices: A circuit breaking device that interrupts supply when a fault on the network occurs downstream of the device. Reclosing devices (if enabled) will, after a predetermined time, re-establish supply automatically. If the fault persists, the reclosing device will open and reclose again in a pre-determined manner until permanently interrupting supply for a persistent fault.

Bush fire prone areas: An area of land that can support a bush fire or is likely to be subject to bush fire attack, as designated on a map of bush fire prone land. A bush fire prone area may also be defined by the network operator using data, advice and mapping information provided by the Rural Fire Service or other available relevant sources – refer to ISSC3 2016.

Radial distribution and transmission networks: Typically, 11kV, 22kV, SWER and 33kV networks where feeders are run in radial configuration. These types of networks may have auto-reclosing and sensitive earth fault (SEF) protection installed on feeders and may have multiple protection or auto-reclosing devices along the feeder.

Meshed transmission networks: Typically, 33kV and above networks where feeders are run in parallel and meshed configurations. These types of networks may have auto-reclosing, but typically cannot be set up with SEF protection or multiple protection and auto-reclosing devices along a feeder.

2 Principles for risk assessment on TOBAN days

When applying a Risk based approach, the principles for Risk Assessment should be:

2.1 All risks should be managed under an endorsed company risk management process

The risk assessment approach shall comply with the principles of ISO 31000:2018 Risk Management – Guides and AS 5577: 2013 Electricity network safety management systems.

2.2 Expert advice should be considered to inform network operators in their risk assessment and decision-making

Examples of relevant experts include state fire authorities and fire researchers or institutions e.g. university fire-related faculties, CSIRO, and Natural Hazards Research Australia (NHRA). This includes the body of powerline research conducted by the Powerline Bush fire Safety Taskforce (PBST) set up following the Victorian 2009 'Black Saturday' fires.

2.3 All risks need to be considered and appropriately weighted to avoid disproportionate responses or consequences

The potential health and safety impacts to customers caused by loss of supply, as well as potential health impacts caused by fires, should be considered. A balance may need to be struck or impacts aligned to community expectations, local emergency services requirements and network asset protection. Community expectations also require considerations of critical infrastructure e.g. hospitals, communication services, water pumping stations etc.

2.4 New or innovative bushfire prevention or mitigation techniques should be assessed as part of regular reviews

Opportunities or limitations of new and existing network technologies, equipment, and resources should be considered including their availability and capability.

2.5 Relevant legislative requirements

The energy regulators' expectations or requirements must be considered. This includes environmental, safety and economic regulators.

Organisations making network operation or configuration decisions guided by risk assessments that include these principles should aim to achieve optimal outcomes for network safety and configuration on TOBAN days for all stakeholders.

3 Fire start risks and mitigation factors

3.1 Risks

Network operators should undertake their own risk analysis to determine which feeders are considered high risk during TOBAN days, and whether changes to network configuration should be used. In determining which feeders are high risk and whether reclosing devices should be disabled, or protection device settings modified on TOBAN days, the following may be considered:

- pre bush fire season inspections and defect rectification programs
- feeder performance – i.e. do the feeders in question have particularly poor reliability performance and so high likelihood that faults will not be transient?
- historical data of bush fire initiation from electrical network assets
- other bush fire risk preventative measures and mitigation strategies
- portion of feeder length within bush fire prone land, the bush fire prone area (BPA) rating, and potential consequences
- Capability of protective devices.

3.2 Mitigation factors

When assessing the risk and potential of fire starts, the following factors should also be considered with respect to the network and where appropriate, the identified mitigation can be used as controls to manage the associated risk:

3.2.1 Construction type

The selection of construction designs and materials is important in reducing the probability of fire ignition from powerlines. For example, the level of insulation provided, or conductor clearance provides safety margins.

3.2.2 Protection capability

Protection systems can be complex, with natural limitations for what they can achieve under all possible scenarios given the exposure of powerlines to the elements, particularly overhead powerline systems. Protection system capability is increasingly improving with advances in electronics and relay technology. The PBST research into fault characteristics causing ignitions is useful in the design of protection equipment and in setting its operation thresholds.

3.2.3 Supply loss impact

Research is being undertaken by the powerline industry in Australia to better understand the safety impacts of loss of supply to customers. Energy Networks Australia (ENA) commissioned

work in this area in 2022, which is being assisted by CSIRO. The learnings will help inform the decision-making process.

3.2.4 Powerline fire start performance and risk exposure

Network operators can learn much from the insights that network fire start data may provide. Effective capture, reporting and analysis of this type of data is crucial in properly understanding the risks and causal factors. Network operators should be encouraged to share data and learnings whenever possible. This is also likely to call out differences between how the type of networks be managed.

3.2.5 Vegetation management

The management of vegetation is important in mitigating the risk of fire ignition from powerlines. Refer to ISSC3 - Guide for the Management of Vegetation in the Vicinity of Electricity Assets for guidance on the minimum requirement for the establishment and maintenance of vegetation clearances from electricity supply infrastructure (including powerlines) to achieve and maintain currently accepted levels of safety, risk and reliability performance of electricity supply networks.

4 Configuration changes on TOBAN days – Radial Distribution and Transmission networks

4.1 Automatic Reclosing on radial networks

Reclosing devices are generally installed either as standalone equipment or incorporated within circuit breakers and are designed to automatically restore supply following a trip. This pattern of reclosing may be repeated several times. If the cause of the original fault persists, then the device will cease automatically attempting to restore supply and generally staff will be dispatched to patrol the affected feeder.

4.2 Risks mitigated by disabling reclosing devices

In the circumstances where the cause of the fault is not transient (i.e. the cause persists and the reclosing device recloses), additional energy will be released at the fault site when compared to the non-reclosing alternative. The additional energy released into a fault, given particular circumstances, could increase the risk of initiating a bush fire. Disabling reclosing devices could in certain circumstances reduce the risk of initiating a fire.

4.3 Risks increased or introduced by disabling reclosing devices

Disabling automatic reclosing devices can, in certain circumstances, introduce additional risks, particularly to the community supplied by the portion of the network being reviewed.

The following risks should be considered when determining whether reclosing devices will be disabled on TOBAN days. These risks are in 2 broad categories:

4.3.1 Increased likelihood of initiating a fire

Some reclosing devices have been set to open after a longer period than that used when the reclosing function is enabled. This is particularly the case for older types of reclosers with limited flexibility in settings, or where the recloser has been set to operate faster on initial reclose than a downstream fuse, but slower if the fault proves to be persistent.

In these cases the amount of energy delivered into the fault will be higher if the reclosing device is disabled (and the fault is transient in nature) than if the recloser is left enabled.

4.3.2 Reduced network reliability

If the cause of the circuit breaker or recloser tripping is a transient fault, then supply to an area will be unnecessarily interrupted for a sustained period. This in turn may introduce a number of risks to the community including

- the loss of supply to:

- critical water supply pumping stations, which may impact general health as well as firefighting strategies
- community facilities such as petrol stations and communications facilities, which may impact emergency services response strategies
- critical community facilities and customers such as hospitals, nursing homes, customers using life-support systems, traffic light systems, etc
- rail facilities, which may increase the risk of trains being stranded in an area under threat by a fire

- General health impacts that result from loss of supply to inhabited spaces, such as heat-related illness.

4.4 Controls for reclosing devices

It's recommended that auto-reclose be disabled on TOBAN days on rural overhead bare conductor radial 11kV, 22kV, 12.7kV SWER and 33kV where:

- feeders are deemed to be high risk. The definition of high risk is to be determined by the DNSP.
- the time period and duration of the disabling of auto-reclose on TOBAN days is determined by the Network Operator considering specific local risk factors (such as FBI, wind changes etc).
- the Network Operator has facilities available to practicably disable auto-reclosing, such as remote SCADA without having to send staff to site and manually engage settings.
- the risk of loss of supply does not outweigh the bush fire risk.

Where the Network Operator can implement alternate controls that would provide similar risk reduction to disabling auto-reclose, they could be considered in lieu of disabling auto-reclose.

4.5 Protection settings on radial networks

4.5.1 Risks mitigated by lowering protection device settings in radial distribution networks

Lowering protection device settings (including operating times and/or element pickup will reduce energy released into a fault. This could in certain circumstances reduce the risk of initiating a fire.

4.5.2 Risks Increased by lowering protection device settings in radial distribution networks

Lowering protection device settings (including operating times and/or element pickup) will introduce additional risks, particularly to the portion of network being reviewed. The following

risks should be considered when determining if protection element settings should be modified on TOBAN days:

- Loss of supply to the community as a result of mal-operation of the protection system, i.e. the protection system operating when it should not have, resulting in unacceptable nuisance tripping.
- increased loss of supply to the community as a result of mal-grading between protection devices, i.e. more network than required is de-energised by the protection systems to clear a fault, resulting in a larger portion of the community than necessary without supply.

4.6 Controls for protection settings on radial networks

It's recommended that protection settings are lowered on TOBAN days on rural overhead bare conductor 11kV, 22kV, 12.7kV SWER and 33kV feeders with the same criteria defined for auto-reclosing.

The lowering of protection settings may include, but is not limited to:

- overcurrent and/or earth fault element operating time and/or pickup
- SEF element operating time and/or pickup
- other non-traditional protection schemes (e.g. wires down protection)

5 Configuration changes on TOBAN days – Meshed Transmission networks

Typical meshed transmission networks have a failure rate which is an order of magnitude lower than radial distribution networks. This is generally a consequence of the higher operating voltages of transmission networks and the resulting taller and stronger structures, a predominance of steel or concrete support structures, larger conductor spacing and increased clearances to both ground and vegetation. Transmission networks also have dedicated easements, allowing for better access, increased monitoring of the structures and vegetation, resulting in specific structure and conductor maintenance and vegetation management programs.

Meshed transmission protection systems settings are generally high speed settings that are designed specifically for network stability and network security. Changing settings on transmission lines has the potential to compromise the whole network resulting in a wider impact than distribution and, particularly in rural areas, could result in more widespread loss of electricity supplies to multiple cities and townships, than would otherwise have been experienced.

5.1 Automatic Reclosing on meshed transmission networks

Automatic reclosing on meshed transmission networks is normally enabled by default. This is a direct result of the operating requirement to manage the network securely under the National Electricity Rules. Where automatic reclosing is enabled, it is limited to one reclose attempt, after which, if a fault is still present the protection scheme instantaneously trips the line and prevents any further operation. This mechanism allows for a transient fault (e.g. Lightning, fire, smoke, windblown debris, flora and fauna) to be cleared from the transmission line and the line return to normal operation, within statutory requirements.

5.1.1 Controls

On meshed transmission networks, it is recommended not to disable auto-reclosing on TOBAN days.

5.2 Protection settings on meshed transmission networks

Protection schemes employed on meshed transmission networks are, in most circumstances, faster than those on radial distribution and transmission networks and in many cases instantaneous. There is generally no room to accelerate these protection schemes without severely compromising grading between adjacent feeders.

Mal-grading of protection schemes on meshed distribution networks can result in large widespread outages (e.g. loss of supply to an entire Zone Substation), while changing settings on transmission networks can result in state-wide power supply loss.

5.2.1 Controls

On meshed transmission networks, it is recommended not to accelerate or mal-grade protection schemes on TOBAN days.

References

AS 5577: 2013 Electricity network safety management systems, Standards Australia.

Ausgrid - *Bush fire Risk Management Plan*, Clause 4.1.3 'Operation' (March 2017)

Coroners Court of NSW, Findings from the report: *General Inquiry into the fire at Reedy Swamp Tarraganda Bega/Tathra* (December 2021)

Essential Energy - *Bush fire Risk Management Plan CEOP8022*, Clause 7.1 'Special procedures and precautions' (September 2020)

ISSC recommendation to the NSW Minister for Energy and Environment – Response to Currandooley fire (March 2021)

ISSC3 – Guide for the Management of Vegetation in the Vicinity of Electricity Assets, Industry Safety Steering Committee, NSW (November 2016)

ISO 31000: 2018 Risk Management – Guides, International Organization for Standardization, Switzerland.

NSW Bush fire Inquiry *Final Report of the NSW Bush fire Inquiry* (July 2020)

PBST research into fault characteristics causing ignitions. Powerline Bush fire Safety Taskforce.

Transgrid *Bush fire Risk Management Report* (October 2017)