

Powercor



Regulatory Investment Test for Distribution

REFCL Program - Tranche three Non-network options

Notice of Determination under
clause 5.17.4(c) of the National
Electricity Rules

Table of contents

SUMMARY..... 3

1 BACKGROUND 5

1.1 Electricity Safety (Bushfire Mitigation) Regulations 20135

1.2 REFCL technology and timeframes6

1.3 Victorian Electricity Distribution Code8

2 IDENTIFIED NEED 9

3 CONSIDERATION OF NON-NETWORK OPTIONS 11

4 DETERMINATION 13

Summary

Powercor Australia Ltd (**Powercor**) has made a determination under clause 5.17.4(c) of the National Electricity Rules (**Rules**) that there will not be a non-network option that is a potential credible option, or that forms a significant part of a credible option, for the Regulatory Investment Test for Distribution (**RIT-D**) project relating to tranche three of our Rapid Earth Fault Current Limiter (**REFCL**) deployment program.

Powercor therefore publishes a Notice under clause 5.17.4(d) of the Rules to notify interested parties of this determination. This Notice sets out the reasons for making the determination, including any methodologies and assumptions used in making the determination.

In summary, Powercor's reasons for this conclusion are:

- On 1 May 2016, amendments to the Electricity Safety (Bushfire Mitigation) Regulations 2013 (**Regulations**) were implemented in Victoria to reduce the likelihood of fires being initiated by electricity distribution network assets.
- In relation to Powercor's distribution area, the Regulations require each polyphase electric line originating from 22 specified zone substations to comply with performance standards specified in the Regulations, by 1 May 2023. The network-specific nature of this performance standard is such that it cannot be met by a non-network option, such as an embedded generator or a demand-side response.
- The installation of REFCLs is the only technically feasible solution currently available that is capable of satisfying the performance requirements specified in the Regulations. A REFCL is a network protection device, normally installed at a zone substation, that can reduce the risk of a fallen powerline causing a fire-start. It is capable of detecting when a powerline falls to the ground and almost instantaneously reduces the voltage on the fallen line.

It should be noted that the above conclusions are not dependent on any assumptions or methodologies.

This Notice relates to tranche three of the REFCL program, as shown in the figure below. It should be noted that the Regulations provide scope to re-prioritise zone substation works across the different tranches, and therefore the current scope of tranche three may be subject to change. Any such changes, however, do not affect this notice or Powercor's reasons for its determination.

Figure 1 Powercor’s REFCL tranches

Tranche one	Tranche two	Tranche three
<ul style="list-style-type: none">• Gisborne (GSB)• Woodend (WND)• Camperdown (CDN)• Colac (CLC)• Castlemaine (CMN)• Maryborough (MRO)• Winchelsea (WIN)• Eaglehawk (EHK)	<ul style="list-style-type: none">• Bendigo TS (BETS)• Charlton (CTN)• Bendigo (BGO)• Ballarat South (BAS)• Ballarat North (BAN)• Geelong (GL)	<ul style="list-style-type: none">• Corio (CRO)• Koroit (KRT)• Stawell (STL)• Waurin Ponds (WPD)• Hamilton (HTN)• Ararat (ART)• Merbein (MBN)• Terang (TRG)

Source: Powercor, Bushfire Mitigation Plan, Revision 4.1b, 29 March 2017, p. 20

1 Background

This section sets out relevant background to the REFCL deployment program, including:

- the Electricity Safety (Bushfire Mitigation) Regulations 2013
- REFCL technology
- recent changes to the Victorian Electricity Distribution Code.

1.1 Electricity Safety (Bushfire Mitigation) Regulations 2013

The 2009 Victorian Bushfire Royal Commission made several recommendations regarding fires initiated from electricity distribution network assets. Recommendation 27 called for new technology that greatly reduces bushfire risk, to be applied to all overhead conductors (Single Wire Earth Return (**SWER**) and 22 kV powerlines) in high bushfire risk areas. The Royal Commission also suggested that an expert taskforce be established to advise on the best means of achieving the intent of this recommendation.

The subsequent Powerline Bushfire Safety Taskforce (**Taskforce**) made its report to Government in September 2011. The Taskforce's report indicated that the optimal means of reducing bushfire risk from SWER and 22 kV powerlines was a mixture of powerline replacement, automatic circuit reclosers (**ACRs**) on SWER lines and the selective installation of REFCLs. The Taskforce also identified the need for further research and development, particularly as REFCLs had not been used for bushfire suppression previously.

In December 2011, the Government accepted the Taskforce's recommendations, and established the Powerline Bushfire Safety Program (**PBSP**) to determine the optimal method for deploying REFCLs for bushfire prevention. Following the completion of this research program, the Government introduced new regulations which amended the Electricity Safety (Bushfire Mitigation) Regulations 2013 (the **Regulations**) with effect from 1 May 2016.

The Regulations require that each polyphase electric line originating from a list of specified zone substations must have the following capability in the event of a phase to ground fault²:

To reduce the voltage on the faulted conductor in relation to the station earth when measured at the corresponding zone substation for low impedance faults to —

(i) 1900 volts within 85 milliseconds; and

(ii) 750 volts within 500 milliseconds; and

(iii) 250 volts within 2 seconds.

² Other performance requirements are also specified in the definition of 'required capacity' in the Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016.

The Regulations further specify the timeframes by which the selected zone substations must meet the above performance requirements. That is, schedule two of the Regulations assigns a number of ‘points’ to each of the selected zone substations. We are then required to ensure the following:

- at 1 May 2019, the points set out in schedule two to the Regulations in relation to each zone substation upgraded, when totalled, are not less than 30
- at 1 May 2021, the points set out in schedule two in relation to each zone substation upgraded, when totalled, are not less than 55
- on and from 1 May 2023, in our supply network, each polyphase electric line originating from every zone substation specified in schedule two has the required capacity.

The Victorian Government also introduced significant financial penalties if service performance in accordance with the timetable is not met. The Bushfire Mitigation Civil Penalties Scheme includes financial penalties of up to \$2 million per point for any difference between the total number of required substation points prescribed in the Regulations and that actually achieved. The scheme also includes a daily penalty up to \$5,500 per point for each day that a contravention with the Regulations continues.

1.2 REFCL technology and timeframes

The Regulations prescribe a performance standard that Powercor’s network must satisfy, rather than specifying a particular technological solution. However, the outcome-based performance standard was based on the REFCL trials conducted by the PBSP, as explained below³:

PBSP conducted a series of world-first trials of Rapid Earth Fault Current Limiter (REFCL) technology for use on electricity networks to reduce fire risks on bare-wire overhead powerlines.

[...]

Through this research, the Victorian Government and electricity distribution businesses identified and confirmed new fault detection and suppression standards required to significantly lower the risks that 22 kV powerlines will start bushfires in worst bushfire risk conditions. These standards are now in force from the 1 May 2016 commencement of the Electricity Safety (Bushfire Mitigation) Amendment Regulations.

The Victorian Government also highlighted the superior performance of the REFCL technology in its factsheet ‘REFCL – Introducing best knowledge and technology’:

³ Department of Environment, Land Water and Planning, Investing in new technology, research and development, February 2018.

In a series of world-first trials, the Victorian Government together with the electricity distribution businesses and research experts demonstrated that REFCLs can suppress arc-induced bushfire ignitions from wire-to-earth faults on 22 kV powerlines.

The technology was successfully tested under worst-case bushfire conditions, confirming critical fault detection and suppression standards, which are necessary to stop downed powerlines from starting bushfires, and further determining the optimal safety settings of these devices to reduce the risk of powerlines-started fires.

The test program demonstrated that REFCLs provide over 10-times better protection than the current best network protection technology.

These standards were mandated for 22 kV powerlines proceeding from 45 zone substations by the Government's 1 May 2016 amendments to the Electricity Safety (Bushfire Mitigation) Regulations.

Evidently, the Victorian Government's expectation is that REFCLs will be installed to meet the performance standard specified in the Regulations. While Powercor remains open to using alternative technologies to meet the performance standard, no such technologies are available today. In addition, given the tight timeframes for meeting the standard and the financial penalties for failing to do so, the installation of REFCLs is the only feasible network solution.

Powercor's REFCL program has been structured into three separate tranches in order to achieve the milestones set out in the Regulations. These tranches are shown in Figure 2 below.

Figure 2 Powercor's REFCL tranches

Tranche one	Tranche two	Tranche three
<ul style="list-style-type: none">• Gisborne (GSB)• Woodend (WND)• Camperdown (CDN)• Colac (CLC)• Castlemaine (CMN)• Maryborough (MRO)• Winchelsea (WIN)• Eaglehawk (EHK)	<ul style="list-style-type: none">• Bendigo TS (BETS)• Charlton (CTN)• Bendigo (BGO)• Ballarat South (BAS)• Ballarat North (BAN)• Geelong (GL)	<ul style="list-style-type: none">• Corio (CRO)• Koroit (KRT)• Stawell (STL)• Waurin Ponds (WPD)• Hamilton (HTN)• Ararat (ART)• Merbein (MBN)• Terang (TRG)

Source: Powercor, Bushfire Mitigation Plan, Revision 4.1b, 29 March 2017, p. 20

This Notice relates to tranche three of the REFCL program. It should be noted that the regulations provide scope to re-prioritise zone substation works between tranches two and three. Any such changes, however, do not affect this notice or Powercor's reasons for its determination.

1.3 Victorian Electricity Distribution Code

To reduce bushfire risk, REFCLs are designed to trigger when an abnormal condition occurs, such as when a power line fails and comes into contact with the ground (known as an 'earth fault'). When triggered, the REFCL very rapidly reduces the amount of abnormal current flowing through the downed line, significantly reducing the potential for an electrical spark igniting a fire.

As a consequence of the REFCL triggering, the phase-to-earth voltage on the remaining two un-faulted polyphase lines simultaneously 'spike' from their normal operating range by up to 90 per cent. During the time of the voltage spike, the REFCL will test whether the original fault is legitimate. If the REFCL confirms the fault, the REFCL will disconnect power to the affected circuit to reduce the potential for a bushfire. This process takes approximately one minute.

In light of the voltage spikes caused by REFCL operation, the Essential Services Commission of Victoria (**ESCV**) has recently completed a review of the Victorian Electricity Distribution Code to ensure that it supports the introduction of REFCL technology. In August 2018, the ESCV published its final decision, which amended the voltage standards in the Code.

An important aspect of the ESCV's decision is to clarify the respective responsibilities of distributors and affected high voltage (**HV**) customers in complying with the amended Victorian Electricity Distribution Code. The ESCV made the following observations regarding the implications of the new voltage standards for HV customers⁴:

Because high voltage customers privately own and manage their electrical assets directly connected to the network, it is likely that affected high voltage customers will need to review and where necessary, upgrade their assets, to safeguard against the increased voltages when REFCLs operated – several high voltage customers confirmed this would be the case. This could include the hardening of high voltage customer equipment to strengthen against the voltage spikes during REFCL operation, installing isolation transformers that are designed to withstand voltage spikes or electing to become a low voltage customer.

Powercor notes that the affected HV customers will need to decide how best to meet their Distribution Code obligations.

⁴ Essential Services Commission, *Electricity Distribution Code – Review of voltage standards for bushfire mitigation* Final Decision, 14 August 2018, page 11.

2 Identified need

As explained in section 1, the need for the REFCL program arises from the requirement that Powercor must comply with the performance standards and timeframes specified in the Regulations. It is also important to emphasise that the implementation of the REFCL program must also ensure that the safety and reliability of Powercor's distribution network is not compromised.

As the Regulations are mandatory, the 'identified need' is classified in the RIT-D as a 'reliability corrective action.' This classification recognises that the preferred option may have a negative net economic benefit, as the investment need is driven by a compliance obligation.

A negative economic benefit does not imply that customers will be worse off when the identified need is addressed. On the contrary, the Regulations were introduced following a detailed cost benefit analysis in the Victorian Government's Regulatory Impact Statement⁵. This analysis showed that the reduction in fire risk warranted the introduction of the Regulations and the associated compliance costs.

The Regulations were introduced in the knowledge that REFCL technology, being Swedish Neutral's Ground Fault Neutraliser (**GFN**), is capable of meeting the specified performance targets. In order to comply with the regulations and maintain the safety and reliability of the distribution network, the following categories of works are required:

- **Zone substation works.** The installation of a REFCL requires changes to the electrical operating characteristics of a zone substation. These zone substation works include the installation of the GFN(s), as well as associated primary and secondary plant.
- **Surge arrestors.** The failure of a surge arrestor to withstand over-voltages arising from the operation of a REFCL would induce a cross-country fault on the distribution system. This could result in multiple feeder outages, and potential fire starts. The scope of work therefore involves replacing surge arrestors that are not rated for REFCL operation.
- **Compatible Equipment.** Some widely utilised line equipment is incompatible with REFCLs and must be replaced. This equipment includes ACRs, Voltage Regulators and Capacitor Banks.
- **Balancing works.** Fire risk reduction relies on minimal capacitive imbalance on switchable sections of the network. Accordingly, the scope of work includes three and single phase admittance balancing units, fuse savers and re-phasing of long single phase lines, where required to maintain capacitive balance.
- **Design, project management and commissioning.** These activities are common across all of the specific workstreams described above, and are included in the scope of work.

⁵ ACIL ALLEN Consulting, Regulatory Impact Statement, Bushfire Mitigation Regulations Amendment, 2015.

As explained in section 1.3, the amended Victorian Electricity Distribution Code now clarifies that HV customers are responsible for ensuring that their facilities can accommodate the new voltage standards applicable to REFCL operation. The scope of work at HV customers' installations may include:

- hardening of the HV customer assets to withstand the higher voltages
- isolating the HV customer from the distribution network so that the increased voltages do not impact the customer's network
- transferring the HV customer connection from HV supply to LV supply
- abolishment of the connection.

While these HV customer works are integral to the successful implementation of the REFCL program, the works themselves relate to private installations and therefore fall outside the scope of Powercor's REFCL tranche three works.

3 Consideration of non-network options

The AER's RIT-D Guidelines require a RIT-D proponent to screen for non-network options before making a determination under clause 5.17.4(c) of the Rules. The Guidelines list the following examples of non-network options that should be considered:

- measures or programs targeted at reducing peak demand, including:
 - improvements to or additions of automatic control schemes such as direct load control
 - energy efficiency programs or a demand management awareness program for consumers
 - installing smart meters with measures to facilitate cost-reflective pricing
- increased local or distributed generation/supply options, including:
 - capacity for standby power from existing or new embedded generators
 - using energy storage systems, load transfer capacity and more.

For a non-network option to be regarded as 'credible' it must be both:

- capable of addressing the identified need, either by itself or in combination with other non-network or network options
- commercially and technically feasible.

In relation to the first point, we recognise that credible non-network options are not required to address the identified need in its entirety. Instead, a non-network option could form a significant part of a credible option to address the identified need where:

- adding a non-network option to a network option or a generation option could be used as an integrated solution, or
- the network option is not a feasible credible option, unless the RIT-D proponent combines it with a non-network option.

In relation to tranche three of the REFCL implementation program, our reasons for concluding that there are no feasible non-network solutions to the tranche three works are:

- On 1 May 2016, amendments to the Regulations were implemented in Victoria to reduce the likelihood of fires being initiated by electricity distribution network assets.
- In relation to Powercor's distribution area, the Regulations require each polyphase electric line originating from 22 specified zone substations to comply with performance standards specified in the Regulations, by 1 May 2023. The network-specific nature of this performance standard is such that it cannot be met by a non-network option, such as an embedded generator or a demand-side response.

- The installation of REFCLs is the only technically feasible solution currently available that is capable of satisfying the performance requirements specified in the Regulations.

It should be noted that the above conclusion and reasons are not dependent on any assumptions or methodologies.

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4 Determination

For the reasons set out in section 3, there are no credible non-network options to address the identified need, which is to comply with the Regulations. Therefore, in accordance with clause 5.17.4(d) of the Rules, Powercor will not be publishing a non-network options report in relation to the tranche three REFCL program.

Powercor will prepare and publish a draft project assessment report in relation to the tranche three REFCL program, in accordance with clause 5.17.4(i) of the Rules.

Any questions regarding this Notice or requests for further information should be directed to:

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