AusNet Electricity Services Ltd Pty

Delivering Tranche Three of the Rapid Earth Fault Current Limiter (REFCL) Program

Reliability Corrective Action

Regulatory Investment Test for Distribution
Stage 1: Notice of Determination

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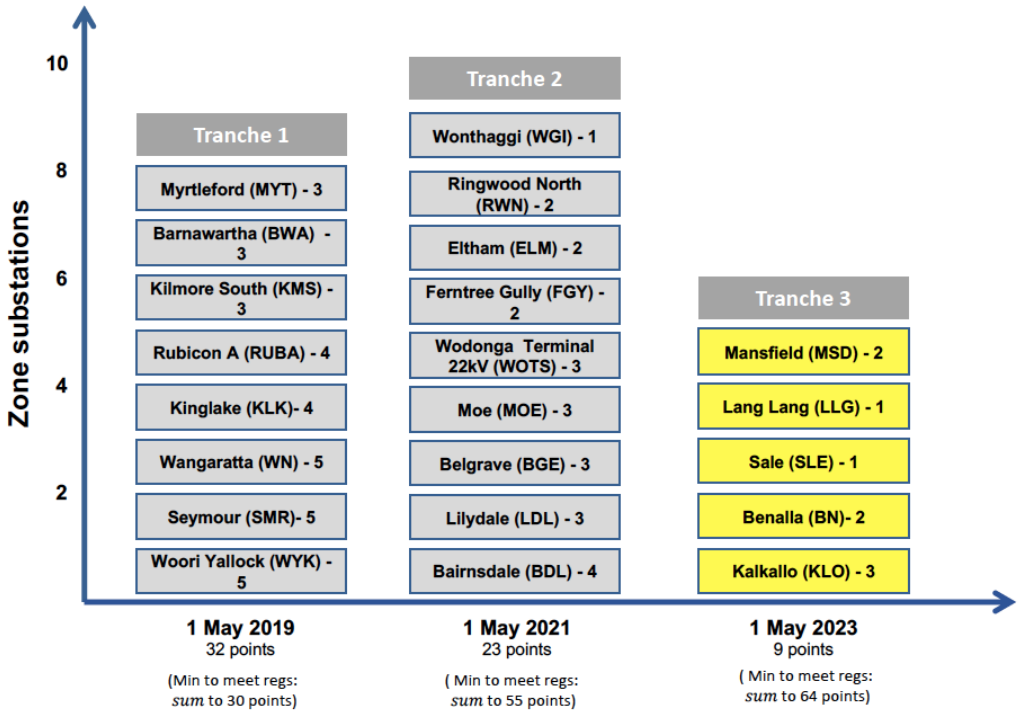
Contents

1 Introduction and overview

The installation of Rapid Earth Fault Current Limiters (REFCL) technology is delivering bushfire mitigation benefits to Victoria and our customers. The REFCL program was established in response to regulatory obligations[1] designed to reduce the likelihood of fires being initiated by electricity distribution network assets. The program is a world first in using REFCL technology to mitigate bushfire risk.

As presented in Figure 1 below, AusNet Services' REFCL program is being deployed in three tranches based on a points system that, by assigning more points to higher risk areas, aims to prioritise zone substations where fire mitigation measures would provide the greatest benefit.

Figure 1 – REFCL location, points and implementation timing[2]



AusNet Services' Tranche three of the REFCL program is the final tranche to meet our compliance obligations in relation to specified zone substations by 1 May 2023. This Tranche is subject to the regulatory investment test for distribution (RIT-D), an economic cost-benefit test used to assess and rank potential investments capable of meeting an identified need.[3] The purpose of the RIT-D is to identify credible options to maximise the present value of net economic benefit to all those who produce, consume and transport electricity in the National Electricity Market.

Under clause 5.17.4(c) of the National Electricity Rules (NER), AusNet Services has determined there are no credible non-network options, or a non-network component that form a significant part of a potential credible option, to meet AusNet Services' REFCL Tranche three obligations. This document is the notification of that determination made under clause 5.17.4(d) of the NER, which means AusNet Services will not publish a non-network options report as part of this RIT-D. The next stage of the RIT-D process will be the publication of the Draft Project Assessment Report (DPAR), which AusNet Services intends to publish by 15 March 2021.

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1 Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016 (Amended Bushfire Mitigation Regulations).

2 This figure is reproduced from the Tranche three Contingent Project Application submitted to the AER. The actual compliance dates and composition of the tranches have been varied from those shown to enable technical and cultural heritage issues to be addressed. These changes are not relevant to this notice.

3 The earlier tranches of the REFCL program were subject to transitional provisions under clause 11.99.6 of the National Electricity Rules that excluded these tranches from the application of the RIT-D.

2 Identified need

AusNet Services' distribution network operates in a geographical location exposed to extreme bushfire risk, warranting significant investment to reduce the risk of electricity assets contributing to this risk.

The Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016 came into effect on 1 May 2016, amending the Electricity Safety (Bushfire Mitigation) Regulations 2013 (the Regulations). Among other obligations, the effect of the amendment requires AusNet Services to install REFCL technology at twenty-two specified zone substations and meet specific REFCL performance requirements (the Required Capacity) designed to reduce the fire start potential of electricity distribution assets.

Tranche three is the final tranche of AusNet Services' REFCL program, which is targeted to achieve 'Required Capacity' at all remaining zone substations by 1 May 2023.

The NER defines a reliability corrective action as an investment by a Distribution Network Service Provider in respect of its network for the purpose of meeting the service standards linked to the technical requirements of NER schedule 5.1 or in applicable regulatory instruments. In relation to Tranche three of the REFCL program, AusNet Services classifies the identified need as 'reliability corrective action' as the Regulations require network investment in order to comply with the Required Capacity at the remaining REFCL zone substations, and the 22 kV networks they supply.

For a reliability corrective action, the preferred option may result in a negative net economic benefit, as outlined in clause 5.17.1(b) of the NER. As explained in further detail in the next section, however, the Victorian Government's Regulatory Impact Statement includes a detailed cost-benefit analysis indicating the estimated costs of deploying REFCLs outweighs the reliability and bushfire risk reduction benefits.

2.1 Regulatory regime changes and compliance obligations

AusNet Services' REFCL program is necessary to comply with bushfire safety obligations. The regulatory framework has become increasingly prescriptive over time, with strict penalties for non-compliance. This section outlines the background to the development of these obligations and the key regulatory instruments.

2.1.1 Victorian Bushfire Royal Commission

The 2009 Victorian Bushfire Royal Commission (VBRC) made several recommendations with respect to fires originating from electricity networks. Recommendation 27 called for new technology that delivered greatly reduced bushfire risk, being applied to all overhead conductors, including Single Wire Earth Return (SWER) and 22 kV powerlines, in high bushfire risk areas. The VBRC also suggested an expert taskforce be established to advise on the best means of achieving the intent of this recommendation. The Powerline Bushfire Safety Taskforce (PBST) was established for this purpose.

2.1.2 Powerline Bushfire Safety Taskforce

The PBST made its report to the Victorian Government in September 2011 and recommended the risk of powerlines starting bushfires could be reduced by:

- installing fault suppression equipment, known as REFCLs, on selected 22 kV powerlines to reduce the risk of polyphase powerlines starting fires by automatically reducing the electric current in some types of powerline faults;
- installing remotely controlled Automatic Circuit Reclosers (ACRs) on SWER lines to reduce the risk of SWER lines starting fires by enabling the devices to be set remotely so that they turn off those powerlines quickly when faults occur; and
- putting powerlines underground or insulating conductors in the areas of highest bushfire risk.

The PBST also indicated the need for further research and development, noting REFCLs had not previously been used for bushfire risk reduction. In December 2011, the Government accepted the PBST's recommendations and established the Powerline Bushfire Safety Program to determine the optimal method for deploying REFCLs for bushfire prevention. This included further investigation of the optimal performance standards, which included trials of REFCL technology at both Frankston South and Kilmore South zone substations.

2.1.3 REFCL – Regulatory impact statement

A Regulatory Impact Statement (RIS)[4] was prepared, by consulting firm ACIL Allen, on behalf of the Victorian Department of Economic Development, Jobs, Transport and Resources, on the Government's proposal to mandate new fault suppression standards. The RIS assessment incorporated a detailed cost-benefit analysis indicating that the estimated costs of deploying REFCLs would be more than outweighed by the reliability and bushfire risk reduction benefits. The RIS recommended the installation of REFCLs at forty-five zone substations across Victoria, twenty-two of which form part of AusNet Services' distribution network.

2.1.4 Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016

Following the completion of the RIS process, the Government made the Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016, which amend the Electrical Safety (Bushfire Mitigation) Regulations 2013. The effect of the amended Regulations was to place three obligations on AusNet Services:

- to install REFCLs (or equivalent technology) at specified zone substations;
- each electric line, within the Electric Line Construction Area, with a nominal voltage of between 1 kV and 22 kV that is constructed, or is wholly or substantially replaced, is to be a covered or underground electric line; and
- to install an ACR on each SWER line.

Specifically, the amended Regulations required that each polyphase electric line originating from the specified zone substations must have the following capability, defined as 'Required Capacity', in the event of a phase to ground fault:

a) reduce the voltage on the faulted conductor in relation to the station earth when measured at the corresponding zone substation for high impedance faults to 250 volts within 2 seconds; and

b) 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) 1,900 volts within 85 milliseconds; and
   (ii) 750 volts within 500 milliseconds; and
   (iii) 250 volts within 2 seconds; and

c) during diagnostic tests for high impedance faults, limit —
   (i) fault current to 0.5 amps or less; and
   (ii) the thermal energy on the electric line to a maximum I^2t value of 0.1.[5]

The practical effect of the amendment is to impose an obligation on AusNet Services to install REFCLs at each of the specified twenty-two zone substations.

The Regulations use a scoring system to establish milestones for completing the required works. Each zone substation is attributed a point score from 1 to 5, with the highest value attributed to those zone substations where fire mitigation measures would provide the greatest benefit.

AusNet Services is required to complete the works necessary in order to accumulate:

- 30 points by 1 May 2019.

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4 ACIL Allen Consulting, Regulatory Impact Statement –Bushfire Mitigation Regulations Amendment, 17 November 2015. Available at http://www.acilallen.com.au/cms_files/ACILAllen_BushfireMitigationRIS_2015.pdf

5 Other performance requirements are also specified in the definition of 'Required Capacity' in the Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016.

- 55 points by 1 May 2021.
- 64 points by 1 May 2023.

In total, the Regulations require AusNet Services to install REFCL devices at twenty-two zone substations by 1 May 2023.

2.1.5 Electricity Safety Amendment (Bushfire Mitigation Civil Penalties Scheme) Act 2017

The Victorian Government subsequently introduced the Electricity Safety Amendment (Bushfire Mitigation Civil Penalties Scheme) Act 2017 (Amendment Act). This Amendment Act amended the Electricity Safety Act 1998 (Vic) (ESA) to provide for significant financial penalties if AusNet Services fails to achieve the number of points prescribed by the Regulations by the applicable deadlines.

The penalties legislation prescribes a penalty of $2 million per point that AusNet Services falls short. Since each zone substation is assigned a number of points (up to 5) depending on the degree of bushfire risk, penalties of up to $10 million per zone substation can apply if AusNet Services fails to achieve the Required Capacity by the prescribed dates. Additionally, a daily penalty of $5,500 per point can be applied for each day AusNet Services remains non-compliant.

In addition to the significant financial penalties that AusNet Services could incur if it fails to meet its obligations, this Amendment Act:

- requires AusNet Services to prepare annual compliance reporting; and
- empowers Energy Safe Victoria (ESV) to request audits and information.

2.1.6 Victorian Electricity Distribution Code

Section 4.2.2 of the Electricity Distribution Code (EDC) specifies the maximum variations from standard nominal voltage for different voltage levels and durations. It is a condition of our Electricity Distribution Licence that AusNet Services complies with all applicable provisions of the EDC.

On 14 August 2018, the Essential Services Commission (ESC) published a final decision on changes to the EDC, which allows AusNet Services to operate REFCL protected networks at elevated voltages and places an obligation on high voltage customers to ensure their installation can safely handle these elevated voltages.

2.2 REFCL technology and required works

A REFCL is a protection device designed to reduce the risk of fire starts caused by powerlines. It is installed on the neutral of the supplying transformer, where the supplying transformer is typically located at the zone substation.

A REFCL operates when a single phase-to-earth fault occurs. Its operation causes the phase-to-ground voltage of the faulted phase to be reduced to near earth potential (zero volts), thereby working to eliminate the flow of fault current in that phase. To achieve this outcome, the REFCL is tuned to the capacitance of the electrical network and a current injected into the transformer neutral that cancels the residual active fault current. This compensation results in a near zero phase-to-ground voltage on the faulted phase, and a very low fault current.

The near zero voltage in the faulted phase is achieved through a voltage shift that could result in up to a 90% voltage rise (from 12.7 kV up to 24.2 kV) in the two healthy phases. While the REFCL is compensating for a fault, the healthy phases remain energised and customers remain on supply. However, there remains a risk the energised phases may be in an unsafe condition depending on the nature of the network fault, so maximum compensating periods apply.

As explained in our Contingent Project Applications for the REFCL program, significant work is required at each zone substation to accommodate the installation of the REFCL equipment. For example, the speed and sensitivity at which the REFCLs operate means traditional protection schemes distributed along a feeder will not operate as they normally would, to detect and isolate a faulted section of the network. In addition, the operation of the network with REFCLs in service imposes higher electrical stresses on the network.

As a consequence, capital works extend beyond the immediate confines of the zone substation to ensure that the network continues to operate safely and reliably and AusNet Services maintains compliance with its obligations. Tranche three of the REFCL program therefore involves five capital expenditure workstreams, described below:

- **Zone substation works**

  Includes: REFCL installation and associated equipment within the zone substation. It also includes the replacement of assets that fail during network hardening tests of the relevant high voltage network.

  Reason: In addition to installing the REFCL, additional works are required because the REFCL technology is based on a different earthing philosophy. It is essential that the zone substation operates safety and reliability in the new environment.

- **Network Balancing**

  Includes: Initial desktop and field modelling work following by: low voltage (LV) capacitor bank installations, third phase installations and re-phasing long single phase lines.

  Reason: Long single phase (two-wire) spurs teed off three-phase lines can create significant capacitive imbalance. Fire risk reduction relies on minimal capacitive imbalance on switchable sections of the network.

- **Line and Cable Hardening**

  Includes: Surge Arrestor replacement and underground cable testing and/or replacements

  Reason: When an earth fault occurs, the REFCL response creates increased voltage stresses (compared to without REFCLs) on line equipment connected to un-faulted phases, which can lead to a second fault. In the absence of line hardening, the REFCL installation would increase fire risk and decrease network reliability. Increased voltage levels can also lead to cable failures.

- **Compatible Equipment**

  Includes: Automatic Circuit Reclosers, Voltage Regulators, sectionalisers and Capacitor Bank replacements.

  Reason: Some widely utilised line equipment cannot be used with REFCLs due to the reduced fault currents. This is separate to line hardening, which is solely concerned with the ability of line equipment to withstand over-voltage events.

- **Assisting HV customers to achieve Electricity Distribution Code (EDC) compliance**

  Includes: The costs of working with HV customers to ensure that the appropriate works are undertaken to achieve EDC compliance in readiness for the REFCL program.

  Reason: The timely completion of HV customers works is essential to the successful implementation of the REFCL program. It is therefore prudent and efficient for AusNet Services to provide support to HV customers to ensure that the lowest cost, effective options are adopted to achieve EDC compliance in a timely manner.

In addition to these capital works, the project will also entail expenditure for an incremental increase in AusNet Services' operating expenditure.

3 Screening for non-network options

In applying the RIT-D, the distributor is required to publish a non-network options report, to screen for potential non-network options, unless it reasonably determines that there are no credible non-network options. Where a distributor makes such a determination, it must publish a notice setting out the reasons for its determination, and any methodologies and assumptions applied in making that determination. In accordance with clause 5.17.4(c) of the NER, AusNet Services has determined that there are no credible non-network options in relation to the Tranche three REFCL installations and associated works.

Our reasoning for concluding that there are no feasible non-network solutions are:

- The installation of REFCLs is the only technically feasible solution currently available that is capable of satisfying the performance requirements specified in the Regulations.
- The proposed capital works on AusNet Services' distribution network (and associated operating expenditure) are required to ensure that REFCL operation does not compromise the safety and reliability of AusNet Services' distribution network.
- As the proposed capital works address the impact of REFCL operation on our distribution network and its service performance, non-network solutions cannot provide an effective substitute for the proposed capital works.

In accordance with the NER requirements, we note that these reasons are not dependent on any particular assumptions or methodologies.

4 Determination and next steps

For the reasons set out in Section 3, AusNet Services has determined that there will not be a non-network option that is a credible option, or a non-network component that forms a significant part of a potential credible option, for this RIT-D, which seeks to meet AusNet Services' REFCL Tranche three obligations. In accordance with clause 5.17.4(c) of the NER, AusNet Services will therefore not be publishing a non-network options report as part of this RIT-D.

Any questions on the matters of this determination notice should be submitted via email to ritdconsultations@ausnetservices.com.au.

The next stage of the RIT-D process is the publication of the DPAR, which is required to provide the information set out in clause 5.17.4(j) of the NER, including:

- A description of the identified need for investment.
- The assumptions used in identifying the need for investment, including the reasons why AusNet Services considers the subject of this RIT-D requires reliability corrective action.
- A description of each credible option assessed, and their costs, that AusNet Services considers could potentially address the identified need.
- The results of our net present value analysis and accompanying explanatory statements regarding the results.
- Identification of the proposed preferred option that meets the identified need and the RIT-D requirements.
- The contact details for a suitably qualified staff member to whom queries on the draft report may be directed.

AusNet Services intends to publish the DPAR by 15 March 2021.