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Ms Leanne Hughson
Chief Executive Officer
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Energy Safe Victoria
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Dear Leanne

RE: Rapid Earth Fault Current Limiters (REFCL) Operations Consultation Paper, January 2024

Thank you for your email dated 5 February 2024 requesting comments on the Consultation Paper on REFCL Operating Guidelines.

Jemena has reviewed the paper and provide the response below.

Jemena look forward to working collaboratively with ESV and other stakeholders on this journey. We are committed to playing our part in creating a safer and more resilient network for everyone. We appreciate the opportunity to provide our feedback on this important matter and remain open to further discussions.

If you require any further information or clarification please contact Alan Shu on 03 9173 8759.

Yours sincerely

Karl Edwards
General Manager Asset & Operations - Electricity
Jemena Electricity Networks

Rapid Earth Fault Current Limiters (REFCL) Operations Consultation Paper, January 2024

Jemena expresses our support for the vision outlined in the paper with respect to REFCL operations. We share ESV's commitment to safety and innovation.

Embracing a unified approach to REFCL operations across all DB's and broadening their usage across the network is a significant step towards achieving this goal. Our vision is to transform Jemena's network into a mix of prescribed and non-prescribed REFCL (i.e. base level REFCL) installations. This will not only enhance the safety of our network but also the resilience of the network.

Jemena's strategy involves the installation of a base level REFCL at new sites and at existing sites that are undergoing major redevelopment works. This is a clear demonstration of our commitment to this vision. Jemena is currently installing a base level REFCL at Footscray West (FW) ZSS. Jemena has an existing installation at Sydenham (SHM) ZSS. Furthermore, Jemena plans to install a REFCL at Sunbury (SBY) and Coburg North (CN) ZSS in the next EDPR period. These projects are part of our long-term strategy to ensure a safer network for everyone.

Although we support ESV's vison outlined in this paper, we believe that a gradual transition is essential. For example, we endorse the suggestion to restrict the use of bypass mode for sustained earth faults during periods of low bushfire risk. However, for this transition to occur, significant investment will be required to implement new advanced earth fault detection systems on the HV network. Similarly, to ensure the effective operation of the Fault Location Isolation Supply Restoration (FLISR) system, a substantial number of remotely controllable devices must be installed, a process which Jemena is currently undertaking. Furthermore, as REFCL technology is still relatively new, more time is required to gather and analyse operational data. This will enable businesses to make informed decisions necessary to align with ESV's vision.

We believe that this journey will take time and that immediate adoption is not practical. Therefore, we advocate for a phased approach that allows DBs to gradually adopt this technology without being deterred from this path. We believe that this approach will ensure a smooth transition and allow for the necessary improvements to be made along the way.

We also emphasise the necessity of setting different expectations for non-prescribed REFCLs compared to those prescribed. Installation of non-prescribed REFCLs in ever changing landscapes, particularly in increasingly urbanised areas, presents unique challenges. Urban networks, characterised by larger customer numbers and extensive underground cable networks, inherently leads to a larger network sizes. Additionally, our non-prescribed REFCL installations exclusively utilise passive Arc Suppression Coils (ASC), lacking an active compensation device like the Residual Current Compensation (RCC). Consequently, the performance of these systems differs significantly from that of prescribed REFCLs. As such, this approach ensures that REFCL operations are tailored to the specific conditions of each installation, thereby optimising their effectiveness in mitigating risks. By recognising and addressing these distinctions, we can better adapt REFCL technology to diverse environments and enhance overall network and public safety.

In conclusion, we look forward to working collaboratively with ESV and other stakeholders on this journey. We are committed to playing our part in creating a safer and more resilient network for everyone. We appreciate the opportunity to provide our feedback on this important matter and remain open to further discussions.

Responses to the Questions:

1. Do you agree that the issues outlined here are the key issues to inform how the distribution businesses should be expected to operate REFCLs?

   Public safety benefits: *Jemena agree that the primary objective for businesses to install REFCLs was to reduce the likelihood of powerlines starting bushfires. In addition, we also acknowledge that REFCLs also deliver other safety benefits in the form of reduction in electrocution and arc flash.*

   Ensuring the efficacy of REFCLs: *Jemena agree that REFCLs need to be tested and maintained regularly to ensure they operate effectively and reliably. The Annual Validation Testing process for prescribed REFCL installations will assist with identifying weaknesses or defects in the system.*

   Impacts on reliability of electricity supply: *Jemena agrees that REFCLs can have both positive and negative impacts on supply reliability. REFCLs can avoid unnecessary outages by maintaining supply during transient faults, but they can also cause more customers to lose supply for longer periods during sustained faults. The operating settings of REFCLs can also affect the frequency and duration of outages (i.e. operating REFCL on a High Sensitive settings can result in nuisance operations).*

2. Do you consider any of the issues to be irrelevant to the operation of REFCLs?

   Issues captured under this section are considered to be relevant to the operation of REFCL's.

3. Do you have any information or data about the positive or adverse impacts of REFCLs on supply reliability?

   Jemena's initial deployments of REFCL systems have shown promise in neutralising transient earth faults on the network. Unlike traditional NER systems which typically require momentary supply interruptions to isolate transient earth faults, REFCL systems have demonstrated the ability to ride through most of these earth faults without supply disruption. This is promising when utilising the bypass mode as the REFCL is only bypassed when the sustained earth fault occurs, which is now considerably minimised.

4. Are there other issues that we should consider in relation to the operation of REFCLs?

   Jemena believes that the size of the network of non-prescribed REFCL implementation is a key consideration. Since these implementations are not mandated to operate at the specified capacity, the network size is generally much larger (>300A) compared to a prescribed REFCL site (<150A). This increased network size can affect the performance of the REFCL.

Furthermore, non-prescribed installations typically do not undergo Primary Earth Fault Testing (PEFT) to assess the REFCL performance and sensitivity level, resulting in a lack of readily available information.

It is imperative to consider these constraints when assessing non-prescribed REFCL installation sites.

5. Do you agree with the benefits and risks of the options for operating frequency of REFCLs? Do you consider there to be any benefits and risks that have not been captured in the examples?

   Jemena agrees that the options for operating frequency of REFCLs have different benefits and risks as outlined in Section 4.1. Jemena is of the opinion that the option of having REFCLs in-service continuously throughout the year, except in limited circumstances, is the most appropriate to maximise the public safety benefits of REFCLs and to ensure their efficacy.

   Although the primary objective is to maintain the REFCL operational for the majority of the year, it is imperative to vary its operating modes to effectively manage both bushfire prevention and network reliability.

   We do not believe there are any other benefits or risks that have not been captured in this section.

6. Do you agree that REFCLs should be in-service continuously throughout the year?

   Jemena will strive to maintain continuous operation of the REFCL throughout the year. Nonetheless, there may be instances where the REFCL requires maintenance, planned outages on the network, or experiences unplanned outages, necessitating the REFCL to be taken out of service. Efforts will be made to minimise the frequency and the duration of REFCL outages.

7. Should different expectations about operating frequency apply to REFCLs that have been installed to meet prescribed requirements under the Act and associated regulations compared with those that have been installed for other reasons?

   Jemena supports the same expectations about operating frequency for all REFCLs regardless of whether they were installed to meet prescribed requirements and those that have been installed for other reasons.

8. Are there any other considerations we should have regard to about the operating frequency of REFCLs?

   Jemena's goal is to limit the use of bypass mode for sustained earth faults on days that bushfire risk levels are low. However, as we embark on this journey, Jemena needs to gain more operational experience with the REFCL system at Coolaroo (COO) ZSS, as it is the only mandated system on the JEN network which was only placed into operation recently. Moreover, several advanced solutions need to

be developed and successfully implemented, such as enabling FLISR on the REFCL network, installation of additional RCGS and the implementation advancing fault detection on the ACRs.

The COO network operates as an island when the REFCL is in service, meaning adjacent ZSS feeders are not REFCL rated. This limits switching opportunities for a FLISR system. To maximise these opportunities, it is currently necessary for the NER to be reinstated for sustained faults until advanced solutions are developed.

Furthermore, Jemena needs to conduct research and development on advanced ACR settings to enable earth fault detection from field devices such as ACRs when the REFCL is in service. Jemena is currently in the process of replacing ACR's on the COO network. Upon completion of this replacement process, additional research, development and testing will be necessary to incorporate an earth fault detection scheme on the ACRs for REFCL network. Subsequently, once these solutions have been developed, tested, and demonstrated to be reliable, the reliance on bypass mode will be minimised, only resorting to its use when absolutely essential.

Additionally, during Live Line Sequence Works, it is essential to note that the REFCL system is designed to isolate the faulted feeder instead of bypassing it. Jemena is collaborating with relevant stakeholders to develop due diligence procedures required to facilitate Live Line Work with the REFCL operational at COO ZSS.

9. Do you agree with the benefits and risks of the options for operating settings of REFCLs? Do you consider there to be any benefits and risks that have not been captured in the examples?

Jemena agrees that the options for operating settings of REFCLs have different benefits and risks depending on the fire danger level and the supply reliability impact.

With regards to management of voltage at the fault site to a desired level, this is not easily achieved since the RCC Compensation is carried out at the ZSS using the bus voltage.

Furthermore, on a number of non-prescribed REFCL installation, this is not at all practical as these installations solely employ passive Arc Suppression Coils (ASC) and lack an active compensation device such as RCC.

10. Do you agree that operating settings are the appropriate way to balance public safety benefits alongside considerations of supply reliability?

We agree that operating settings are the appropriate way to balance public safety benefits alongside considerations of supply reliability on prescribed REFCL installations.

However, for non-prescribed REFCL installations, employing various sensitivity settings is not always feasible. This is attributed to the considerable size of the network (>300A) and the presence of substantial capacitive imbalance, resulting in a higher standing neutral

voltage. Consequently, there is limited opportunity for implementing multiple sensitivity settings.

11. Are the AFDRS levels appropriate for guiding the operating settings of REFCLs? Do you agree with the way we have applied the AFDRS levels in our preliminary views?

    We agree that the AFDRS levels are appropriate for guiding the operating settings of a prescribed REFCLs on Declared TFB day.

    Throughout a Declared Fire Period, it is crucial to maintain a degree of flexibility concerning operational sensitivity to strike a balance between effective protection against most bushfire and network reliability.

    Consequently, if the AFDRS level falls below 'High', it may be sufficient to operate at reduced sensitivity settings, given the comparatively lower risk of fire ignition.

    Also, within the JEN network, there exists only a single sensitivity setting group for non-prescribed REFCLs (due to the aforementioned constraint). Consequently, the proposed AFDRS levels are not applicable to non-prescribed REFCL installations.

12. Should different expectations about operating settings apply to REFCLs that have been installed to meet prescribed requirements under the Act and associated regulations compared with those that have been installed for other reasons?

    Yes. For non-prescribed REFCL installations, the expectations need to be different as the application is somewhat different from prescribed installation sites. Given that the network size on a non-prescribed installation is significantly larger and involves greater capacitive imbalance, only one sensitivity setting is realistically achievable. Hence, the expectation needs to take this into consideration for non-prescribed installations. This approach ensures that the operation of REFCLs is optimized according to the specific conditions of each installation, thereby maximising their effectiveness in mitigating risks.

13. Are there any other considerations we should have regard to about the operating settings of REFCLs?

    No.

14. Do you have any comments in relation to testing and maintenance of REFCLs?

    Regarding testing procedures, it is important to highlight that annual validation testing is not conducted at non-prescribed REFCL installation sites, as they are not mandated to operate at required capacity. Additionally, primary earth fault testing is not performed at these installations, leaving the sensitivity of the REFCL system generally unknown.

15. Do you have any comments on the broader installation and use of REFCLs?

We agree with the proposition that DBs should consider the implementation of non-prescribed REFCLs on additional segments of their network.

Jemena has initiated plans to expand the deployment of non-prescribed REFCLs across numerous ZSS in the foreseeable future where they are financially viable. As part of this commitment, Jemena is currently deploying this technology at the Footscray West (FW) ZSS. We believe that this strategic move will help enhance the safety and reliability of our network, thereby delivering a safe and superior service to our customers.

16. Do you have any comments on record keeping and reporting by the distribution businesses?

While we acknowledge the necessity of reporting for prescribed REFCL installations, Jemena holds the view that such reporting requirements should not be extended to non-prescribed REFCLs. Implementing additional requirements for non-prescribed REFCLs would impose a significant burden as the DB's look to expand the deployment of non-prescribed REFCLs.

Feedback on the Paper:

1. **Table 2** provides a summary of the REFCL operating settings for the distribution business.

Jemena[20]	**Bushfire Mitigation Enabled** If an earth fault does not self-clear after an adjustable time delay (to be determined), the relevant protection will trip the circuit breaker of the affected feeder.	This mode will be enabled on Total Fire Ban days when immediate isolation of the faulty feeder is required. Hence, on such days, a greater number of customers may experience supply interruption because conventional earth fault protection

It is important to note that the specified settings mentioned for Jemena are applicable to non-prescribed REFCL ZSS, such as Sydenham (SHM). However, it is necessary to include the REFCL operating settings for prescribed REFCL ZSS (COO) in this table.