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Summary: Managing the risk of circuit breaker failure

RIT-T Project Specification Consultation Report

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Summary

Circuit breakers are essential for the control and protection of the high voltage network. We have identified 122 circuit breakers on our network that will have reached or be approaching the end of their technical life by 2027/28. The probability of failure for these assets is high and is expected to increase as the assets age. If left unaddressed, this will result in greater unserved energy for consumers, greater safety and environment risk, and greater financial costs associated with emergency repair and replacements.

The purpose of this PSCR is to examine and consult on options to address the deteriorating condition of the identified circuit breakers to ensure the safe and secure operation of our network. We consider it prudent and cost effective to manage this risk through an asset replacement program during the 2023/24 and 2027/28 regulatory period.

Identified need: Ensure the safe and reliable operation of our transmission network by managing the risk of circuit breaker failure

The identified need for this project is to ensure the safe and reliable operation of our transmission network by addressing the risk of failure of certain circuit breakers that are approaching the end of their technical life.

The end-of-life assets have been identified through the application of our Network Asset Health Framework to the circuit breaker population to determine each assets effective age and identify assets with increased risk of failure. The evaluated health index inputs for circuit breakers considers aging factors including natural age, operation count and high wear switching applications; as well as performance factors including defects rate and cost, condition monitoring results and sub population type issues.

The failure of a circuit breaker to operate during a network fault will result in an uncleared fault that must be cleared with a larger outage (via a circuit breaker failure back up protection operation), leading to greater unserved energy. The impact of each circuit breaker failure on lost load varies according to where it is located in the network. Asset failure may also increase the risk of safety and environment issues associated with catastrophic asset failure, and the potential costs of emergency repair and replacements.

We have identified 122 circuit breakers that will have reached or be approaching the end of their technical life by 2027/28. These are all live head circuit breakers (LHCBs) and therefore have separate current transformers installed within the switch bay.

The associated current transformers for 55 of the 122 identified circuit breakers are also approaching the end of their technical life. It is therefore feasible to replace the two units with a single Dead Tank Circuit Breaker (DTCB) which incorporates both the circuit breaker and current transformers.

Installing a DTCB removes the need for a separate current transformer and therefore provides additional benefits through avoiding the risk of in-service current transformer failure which can result in interruptions to customer load, safety and environmental consequences and emergency repair and replacement costs.

We have classified this RIT-T as a ‘market benefits’ driven RIT-T as the economic assessment is not being progressed specifically to meet a mandated reliability standard but by the net benefits that are expected to be generated for end-customers. Given the quantity of circuit breakers that have been identified for replacement, we consider it prudent and cost effective to manage this risk through a single asset

replacement program. This replacement will help limit the amount of in-service failures that occur (along with the associated interruptions to customer load, and safety and environmental consequences).

Credible options considered

We consider that there are two credible network options that can meet the identified need.

- For 55 of the 122 identified circuit breakers, the associated current transformers will have reached or be approaching the end of their technical life by 2027/28. For these circuit breakers, we consider that there are two technically and commercially feasible options, which are to replace the existing LHCB with a new LHCB, or to replace the existing LHCB and associated current transformer with a DTCB.[1]

- For 67 of the 122 identified circuit breakers, either replacement with a DTCB is not technically feasible, there are no associated current transformers, or the current transformers have substantial remaining life. For these circuit breakers, we consider that replacing the existing LHCB with a new LHCB is the only technically and commercially feasible option.

On this basis, we consider that there are two credible network options that can meet the identified need. These options are summarised in Table E-1.

Table E-1: Summary of the credible options

Category	Number of existing CBs in this category	Option 1	Option 2
LHCBs that are reaching the end of their technical life, and for which (i) the associated current transformers are also reaching end of life, and (ii) replacement with a DTCB is technically feasible	55	Replace the existing LHCB with a new LHCB	Replace the existing LHCB and CT with a DTCB
LHCBs that are reaching the end of their technical life, and for which, (i) a DTCB is not technically feasible, (ii) there are no associated current transformers, or (iii) the current transformers have a substantial remaining life	67	Replace the existing LHCB with a new LHCB	Replace the existing LHCB with a new LHCB
Estimated capex ($2021-22)		32.27	41.50
Expected commission date		2028	2028

Non-network options are not expected to be able to assist in this RIT-T

We do not consider non-network options to be commercially and technically feasible to assist with meeting the identified need for this RIT-T. Non-network options are not able to meet NER obligations to provide redundant secondary systems and ensure that the transmission system is adequately protected.

[1] Installing a DTCB removes the need for a separate current transformer and therefore provides additional benefits through avoiding the risk of in-service current transformer failure which can result in interruptions to customer load, safety and environmental consequences and emergency repair and replacement costs.

Draft Conclusion

This PSCR finds that implementation of Option 2 is the preferred option at this draft stage of the RIT-T process. Under Option 2:

- 55 of the 122 identified circuit breakers will be replaced with a DTCB. For these circuit breakers, the associated current transformers are approaching the end of their technical life.
- 67 of the 122 identified circuit breakers will be replaced with a LHCB. For these circuit breakers, either replacement with a DTCB is not technically feasible, there is no associated current transformers, or the current transformers have substantial remaining life.

The capital cost of this option is approximately $41.50 million (in $2021/22). The work will be undertaken over a five-year period with all works expected to be completed by 2027/28. Routine operating and maintenance costs are estimated at approximately $0.16 million per annum (in $2021/22).[2] All works will be completed in accordance with the relevant standards and components shall be replaced to have minimal modification to the wider transmission network. Necessary outages of relevant assets in service will be planned appropriately to complete the works with minimal network impact.

Exemption from preparing a Project Assessment Draft Report

Subject to the identification of additional credible options during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as we consider that the conditions in clause 5.16.4(z1) of the NER exempting RIT-T proponents from providing a PADR have been met.

Specifically, production of a PADR is not required because:

- the estimated capital cost of the preferred option is less than $46 million;[3]
- we have identified in this PSCR our preferred option and the reasons for that option, and noted that we will be exempt from publishing the PADR for our preferred option; and
- we consider that the preferred option and any other credible options do not have a material market benefit (other than benefits associated with changes in voluntary load curtailment and involuntary load shedding).

If an additional credible option that could deliver a material market benefit is identified during the consultation period, then we will produce a PADR that includes an assessment of the net economic benefit of each additional credible option.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T will be the publication of a Project Assessment Conclusions Report (PACR) that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period.[4]

[2] Average operating costs over the period 2028/29 to 2049/50.
[3] Varied from $43m to $46m based on the AER Final Determination: Cost threshold review, November 2021.
[4] In accordance with NER clause 5.16.4(z2).

Submissions and next steps

We welcome written submissions on materials contained in this PSCR.

Submissions are due on 15 August 2023[5]and should be emailed to our Regulation team via regulatory.consultation@Transgrid.com.au.[6] In the subject field, please reference 'Circuit breaker renewal program PSCR.' At the conclusion of the consultation process, all submissions received will be published on our website. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

Should we consider that no additional credible options were identified during the consultation period, we intend to produce a PACR that addresses all submissions received including any issues in relation to the proposed preferred option raised during the consultation period. Subject to additional credible options being identified, we anticipate publication of a PACR by September 2023.

[5] Consultation period is for 12 weeks, additional days have been added to cover public holidays

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