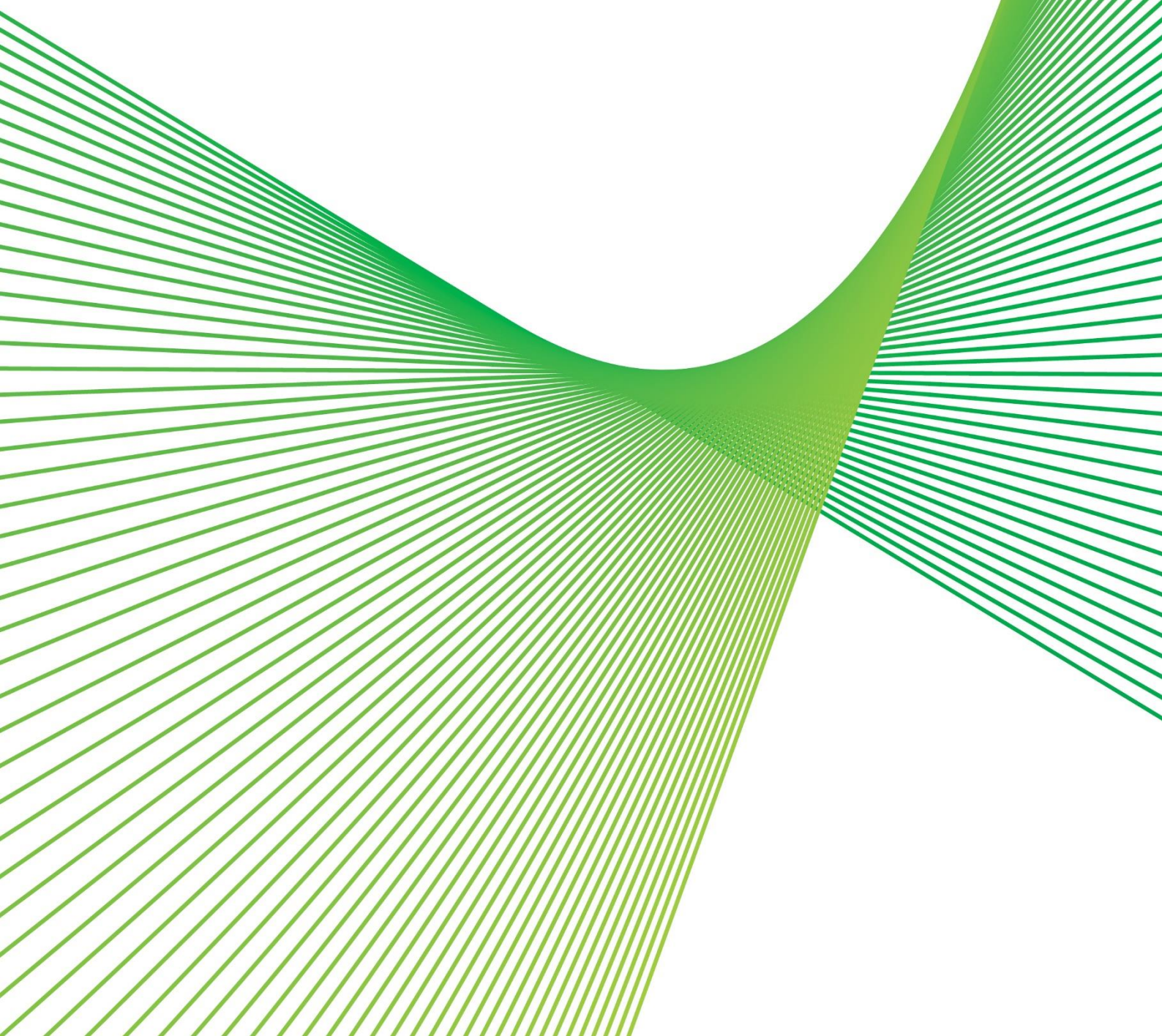


Summary: Managing the risk of capacitor bank failure

RIT-T Project Specification Consultation Report

Issue date: 8 August 2023



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Summary

Capacitor banks are essential for ensuring that system voltage levels are maintained within +/-10% of nominal volts, as required under the NER.¹

The likelihood of capacitor can and reactor failure is expected to increase as the units continue to deteriorate. If left unaddressed, this will result in unserved energy for consumers, costs associated with replacements (with long lead times) as well as higher risks relating to safety and environmental issues.

The purpose of this PSCR is to examine and consult on options to address the deterioration in the conditions of the identified capacitor banks to ensure the safe and secure operation of our network. Given the high population of capacitor banks that fall within this category, the selected capacitor banks for replacement were chosen on the basis that they include sibling units (capacitor cans, reactors or both), are the oldest units in the network and cover a range of voltages and capabilities. The capacitor bank replacement program would apply to the following capacitor banks: Kempsey No 1, Narrabri No 3 and Coffs Harbour No 1 and Narrabri No 2.

Identified need: Ensure the safe and reliable operation of our transmission network by managing the risk of capacitor bank 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 capacitor banks that are approaching, or have passed, the end of their technical life.

In this RIT-T, we have considered four capacitor banks for replacement across our network: Kempsey No 1 Capacitor, Narrabri No 2 Capacitor, Narrabri No 3 Capacitor and Coffs Harbour No 1 Capacitor. In assessing the ongoing viability of the capacitor banks, we have considered several factors:

- existing holdings of spares and the ability to source more spares.
- the general condition of the equipment; and
- age of the asset.

The identified capacitor banks have been in service longer than their expected technical lives, which is 30 years and have limited spare reactors and/or spare cans, which are also expected to deplete quickly. The ability to source additional spares in a reasonable time period may be challenging due to reduced manufacturer support. Ultimately, the selected capacitor banks for replacement were chosen on the basis that they include sibling units (capacitor cans, reactors or both), and cover a range of voltages and capabilities. This will enable us to strategically use these parts to assist with maintenance of other capacitor banks across the network, and to extend the serviceable lives of those assets.

If left unreplaced, the likelihood that the identified capacitor banks will fail is expected to increase significantly as the capacitor banks continue to deteriorate (refer to section 2.3.1). If the capacitor banks are not available during times of high load, load shedding will be required to take place for customers in NSW to ensure that system voltage levels remain within $\pm 10\%$ as required by the NER. The impact of each capacitor bank failure on lost load varies depending on where the capacitor bank is located on the network and whether viable spare parts are available. Asset failure may also increase the risk of safety and environment issues, and the potential costs of emergency repair and replacements. Given the limited

¹ Clause S5.1a.4: <https://energy-rules.aemc.gov.au/ner/452/229026>

availability of spares, the duration of such outages will also be expected to increase over time. On the basis of this assessment, we consider that replacing the identified capacitor banks would be expected to result in economic benefits for consumers by reducing the risk of load shedding.

We have classified this RIT-T as a 'reliability' driven RIT-T as the economic assessment is being progressed specifically to meet a mandated reliability standard and the net benefits are expected to be generated for end-customers. This replacement will help limit the number of in-service failures that occur (along with the associated interruptions to customer load, as well as safety and environmental consequences).

Credible options considered

As indicated above, we have selected four capacitor banks for replacement on the basis that they include sibling units (capacitor cans, reactors or both), are the oldest units in the network and cover a range of voltages and capabilities. The four identified capacitor banks have already exceeded their expected technical lives and the likelihood of failure of the capacitor can and reactor components increases as the capacitor bank units continue to age. The list of capacitor banks which we have selected for replacement across the network are Kempsey No 1 Capacitor, Narrabri No 2 Capacitor, Narrabri No 3 Capacitor, and Coffs Harbour No 1 Capacitor.

On this basis, we consider that there is one credible network option that can meet the identified need. This option is summarised in Table E-1. We do not consider non-network options to be technically feasible to provide the functionality of the equipment required for addressing the identified need in this RIT-T.

Table E-1: Summary of the credible options

Option	Description	Estimated capex (\$2021-22)	Expected commission date
Option 1		10.22	2028
Kempsey No 1 Capacitor	Renew the Capacitor Bank Bay	2.80	2027
Narrabri No 2 Capacitor	Replace Capacitor Bank Cans only ²	1.64	2028
Narrabri No 3 Capacitor	Renew the Capacitor Bank Bay	2.99	2027
Coffs Harbour No 1 Capacitor	Renew the Capacitor Bank Bay	2.79	2027

Non-network options may also be able to form credible options for this RIT-T

We consider that non-network options may be able to assist with meeting the identified need, specifically non-network technologies that are able to provide reactive support. At this stage we consider that possible solutions include, but are not limited to:

- battery energy storage systems (BESS), and
- generators in the region who are able to provide reactive power support.

² There are no air core reactors in this bay, and consequently do not need to be replaced. The associated protection and control will be replaced under the secondary systems renewal programs.

However, we note that the cost of the non-network options may act to effectively bound the cost available for any non-network options to be considered commercially feasible.

We encourage parties to make written submissions regarding the potential for non-network options to satisfy, or contribute to satisfying, the identified need for this RIT-T.

The options have been assessed against three reasonable scenarios

The credible options have been assessed under three scenarios as part of this PSCR assessment, which differ in terms of the key drivers of the estimated net market benefits (ie, the estimated risk costs avoided).

Given that wholesale market benefits are not relevant for this RIT-T, the three scenarios assume the most likely scenario from the 2022 ISP (ie, the ‘Step Change’ scenario). The scenarios differ by the assumed level of risk costs, given that these are key parameters that may affect the ranking of the credible options. Risk cost assumptions do not form part of AEMO’s ISP assumptions and have been based on Transgrid’s analysis.

Table E-2 Summary of scenarios

Variable / Scenario	Central	Low risk cost scenario	High risk cost scenario risk
Scenario weighting	1/3	1/3	1/3
Discount rate	5.50%	5.50%	5.50%
VCR (\$2021-22)	\$46.86/kWh	\$46.86/kWh	\$46.86/kWh
Network capital costs	Base estimate	Base estimate	Base estimate
Operating and maintenance costs	Base estimate	Base estimate	Base estimate
Environmental, safety and financial risk benefit	Base estimate	Base estimate – 25%	Base estimate +25%
Avoided unserved energy	Base estimate	Base estimate – 25%	Base estimate +25%

The sensitivity analysis has investigated how the NPV results are affected by changes to other variables, including the discount rate and capital costs.

Draft Conclusion

This PSCR finds that implementation of Option 1 is the preferred option at this draft stage of the RIT-T process. Under Option 1, the four capacitor banks identified will be renewed entirely or undergo a replacement of the capacitor can component. These capacitor banks currently exceed their technical life of 30 years and would be exceeding the technical life by at least 15 years in 2027/28. Under this option, Kempsey No 1 Capacitor, Narrabri No 3 Capacitor, and Coffs Harbour No 1 Capacitor would undertake a renewal of the capacitor bank bays i.e., replacement of all components within the capacitor bank, whereas Narrabri No 2 Capacitor would have only its capacitor bank cans and associated steelworks replaced.

The capital cost of this option is approximately \$10.22 million (in \$2021-22). The work will be undertaken over a four-year period with all works expected to be completed by 2027/28. Routine operating and maintenance costs are estimated at approximately \$4,000 per annum (in \$2021-22). 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 in order to complete the works with minimal impact on the network.

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 million³;
- 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 specified in clause 5.15A.2(b)(4) (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

Submissions and next steps

We welcome written submissions on materials contained in this PSCR.

Submissions are due on 3 November 2023 and should be emailed to our Regulation team via regulatory.consultation@transgrid.com.au.⁵ In the subject field, please reference 'Managing risk of capacitor bank failure 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 in December 2023.

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).

⁵ Transgrid is bound by the Privacy Act 1988 (Cth). In making submissions in response to this consultation process, Transgrid will collect and hold your personal information such as your name, email address, employer and phone number for the purpose of receiving and following up on your submissions. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement. See Privacy Notice within the Disclaimer for more details.