TransGrid

# Summary: Maintaining compliance with performance standards applicable to Broken Hill substation secondary systems

## RIT-T – Project Assessment Draft Report

Region: South Western NSW

Date of issue: 16 March 2021

# Disclaimer

This suite of documents comprises TransGrid's application of the Regulatory Investment Test for Transmission (RIT-T) which has been prepared and made available solely for information purposes. It is made available on the understanding that TransGrid and/or its employees, agents and consultants are not engaged in rendering professional advice. Nothing in these documents is a recommendation in respect of any possible investment.

The information in these documents reflect the forecasts, proposals and opinions adopted by TransGrid at the time of publication, other than where otherwise specifically stated. Those forecasts, proposals and opinions may change at any time without warning. Anyone considering information provided in these documents, at any date, should independently seek the latest forecasts, proposals and opinions.

These documents include information obtained from the Australian Energy Market Operator (AEMO) and other sources. That information has been adopted in good faith without further enquiry or verification. The information in these documents should be read in the context of the Electricity Statement of Opportunities, the Integrated System Plan published by AEMO and other relevant regulatory consultation documents. It does not purport to contain all of the information that AEMO, a prospective investor, Registered Participant or potential participant in the National Electricity Market (NEM), or any other person may require for making decisions. In preparing these documents it is not possible, nor is it intended, for TransGrid to have regard to the investment objectives, financial situation and particular needs of each person or organisation which reads or uses this document. In all cases, anyone proposing to rely on or use the information in this document should:

1. Independently verify and check the currency, accuracy, completeness, reliability and suitability of that information
2. Independently verify and check the currency, accuracy, completeness, reliability and suitability of reports relied on by TransGrid in preparing these documents
3. Obtain independent and specific advice from appropriate experts or other sources.

Accordingly, TransGrid makes no representations or warranty as to the currency, accuracy, reliability, completeness or suitability for particular purposes of the information in this suite of documents.

Persons reading or utilising this suite of RIT-T-related documents acknowledge and accept that TransGrid and/or its employees, agents and consultants have no liability for any direct, indirect, special, incidental or consequential damage (including liability to any person by reason of negligence or negligent misstatement) for any damage resulting from, arising out of or in connection with, reliance upon statements, opinions, information or matter (expressed or implied) arising out of, contained in or derived from, or for any omissions from the information in this document, except insofar as liability under any New South Wales and Commonwealth statute cannot be excluded.

## Privacy notice

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.

Under the National Electricity Law, there are circumstances where TransGrid may be compelled to provide information to the Australian Energy Regulator (AER). TransGrid will advise you should this occur.

TransGrid's Privacy Policy sets out the approach to managing your personal information. In particular, it explains how you may seek to access or correct the personal information held about you, how to make a complaint about a breach of our obligations under the Privacy Act, and how TransGrid will deal with complaints. You can access the Privacy Policy here (https://www.transgrid.com.au/Pages/Privacy.aspx).

# Summary

TransGrid is applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining reliable secondary systems at Broken Hill substation. Publication of this Project Assessment Draft Report (PADR) represents the second step in the RIT-T process.

Broken Hill substation is a customer connection point supplying the Essential Energy networks in the area. Silverton Wind Farm also connects at Broken Hill substation, as well as Broken Hill Solar Plant. It forms part of the wider South Western NSW network which supports renewable energy zone development and will continue to play a central role in supporting the flow of energy to the Far West region of NSW.[1]

TransGrid has identified that the secondary systems at Broken Hill substation have reached a condition that reflects the end of serviceable life. As it is superseded by new technology at the manufacturer level and the existing technology becomes obsolete, spare parts become scarce and the ability of any primary asset connected to the substation to reliably operate will be at risk.

## Identified need: meet the service level required under the National Electricity Rules for protection schemes

Secondary systems are used to control, monitor, protect and secure communication to facilitate safe and reliable network operation.[2] They are necessary to operate the transmission network and prevent damage to primary assets when adverse events occur.

Provision of redundant protection schemes to ensure the transmission system is adequately protected is a Network Performance Requirement under Schedule 5.1 of the National Electricity Rules (NER), therefore the condition issues affecting the secondary systems at Broken Hill substation must be addressed.

The Network Performance Requirements, set out in Schedule 5.1 of the NER, place an obligation on Transmission Network Service Providers (TNSPs) to provide redundant protection schemes to ensure the transmission system is adequately protected. Schedule 5.1.9(c) of the NER requires a TNSP to provide sufficient primary and back-up protection systems, including any communications facilities and breaker fail protection systems, to ensure that a fault of any type anywhere on its transmission system is automatically disconnected.

Additionally, TNSPs are required to disconnect the unprotected primary systems where secondary systems fault lasts for more than eight hours (for planned maintenance) or 24 hours (for unplanned outages). TNSPs must also ensure that all protection systems for lines at a voltage above 66 kV are well-maintained so as to be available at all times other than for short periods (less than eight hours), while the maintenance of protection systems is being carried out.[3] In the event of an unplanned outage, AEMO's Power System Security Guidelines require that the primary network assets must be taken out of service within 24 hours.[4]

Furthermore, as per clause 4.11.1 of the NER, remote monitoring and control systems are required to be maintained in accordance with the standards and protocols determined and advised by AEMO.

A failure of the secondary systems would involve replacement of the failed component or taking the affected primary assets, such as lines and transformers, out of service.

---

1 There is over 5GW of potential wind and solar generation connections in South Western NSW and the Barrier Ranges. TransGrid. "*Transmission Annual Planning Report 2020*." Sydney: TransGrid, 2020. 57. Accessed 3 March, 2021. https://www.transgrid.com.au/what-we-do/Business-Planning/transmission-annual-planning/Documents/2020%20Transmission%20Annual%20Planning%20Report.pdf

2 As per Schedule 5.1 of the NER.

3 As per S5.1.2.1(d) of the NER.

4 Australian Energy Market Operator. *"Power System Security Guidelines, 20 September 2019."* Melbourne: Australian Energy Market Operator, 2019. 39. Accessed 15 May 2020. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715---Power-System-Security-Guidelines.pdf

Though replacement of failed secondary systems component is a possible interim measure, the approach is not sustainable as the stock of spare components will deplete due to the technology no longer being manufactured or supported. Once all spares are used, replacement will cease to be a viable option to meet performance standards stipulated in clause 4.6.1 of the NER.

If the failure to provide functional secondary systems due to technology obsolescence is not addressed by a technically and commercially feasible credible option in sufficient time (by 2022/23), the likelihood of not recovering from secondary systems faults and not maintaining compliance with NER performance requirements will increase.

The proposed investment will enable TransGrid to continue to meet the standards for secondary systems availability set out in the NER, and to avoid the impacts of taking primary assets out of service. Consequently, it is considered a reliability corrective action under the RIT-T.

A reliability corrective action differs from a 'market benefits'-driven RIT-T in that the preferred option is permitted to have negative net economic benefits on account of it being required to meet an externally imposed obligation on the network business.

## No submissions received in response to Project Specification Consultation Report

TransGrid published a Project Specification Consultation Report (PSCR) on 17 December 2019 which presented four credible options that would meet the Identified Need from a technical, commercial, and project delivery perspective[5].The options included: complete replacement with Secondary Systems Buildings (SSBs) (Option 1); complete in-situ replacement (Option 2); strategic asset replacement (Option 3); and a complete upgrade and renewal with 22 kV switchroom and 220 kV Secondary Systems Building (SSBs) (Option 4).

TransGrid invited written submissions on the materials contained within the PSCR; particularly on the credible options presented and from potential proponents of non-network options that could meet the technical requirements set out in the PSCR.

On publication of the PSCR, TransGrid opened a 12-week consultation period, during which time no submissions were received.

## Developments since publication of the PSCR

Since publication of the PSCR, TransGrid identified a need to re-scope one of the credible options (Option 4- Complete upgrade and renewal with 22 kV switchroom and 220 kV Secondary Systems Building), and identified one additional credible option (Option 5- Complete in-situ secondary systems and 22 kV AIS replacement). Consequently, as a result of this material change, TransGrid re-ran the NPV analysis including Options 1, 2 and 3[6], Option 4 (re-scoped) and the new Option 5.

In the NPV analysis, TransGrid used updated costs where applicable, as well as the latest inflation and discount rates.

The program of work to address the secondary systems at Broken Hill including complete replacement with 22 kV switchroom and 220 kV in-situ secondary systems (Option 4) is the option that was found to be the preferred option, both on the basis of net economic benefits, and being technically feasible.

Option 4 is the preferred option presented in this PADR. The other options put forward for consideration in the PSCR and the new Option 5 were estimated to have lower net economic benefits than the preferred option.

[5] As per clause 5.15.2(a) of the NER.

[6] Including $11.29m of reinvestment costs in 2025 to allow comparable assessment of the base case, Option 1, 2 and 3 with the revised Option 4 and new Option 5.

## Credible options considered

In this PADR, TransGrid has put forward for consideration credible options that would meet the identified need from a technical, commercial, and project delivery perspective.[7]

These are summarised in the following table.

**Table 1 Summary of the credible options**

| Option | Description | Capital cost ($m 2020/21) | Operating costs ($ per year) | Remarks |
|---|---|---|---|---|
| Option 1 | Complete replacement with Secondary Systems Building | 13.8 (+/- 25%) by 2022/23 (additional $11.29 million by 2024/25*) | ~ 6,000 | Technically and commercially feasible but less efficient and provides less benefit for consumers as it does not provide a reduction in reliability risk costs due to the 22 kV switchgear being replaced 'like-for-like' and in-situ. |
| Option 2 | Complete in-situ replacement | 8.07 (+/- 25%) by 2022/23 (additional $11.29 million by 2024/25*) | ~ 6,000 | Technically and commercially feasible but less efficient. |
| Option 3 | Strategic asset replacement | 6.22 (+/- 25%) by 2022/23 and ~ 1.57 in 2029/30 (additional $11.29 million by 2024/25*) | ~ 6,000 | Technically and commercially feasible but does not address technological obsolescence beyond 2023 and is therefore not practicable. |
| Option 4 | Complete replacement with 22 kV switchroom and 220 kV in-situ secondary systems | 18.34 (+/- 25%) by 2022/23 | ~ 6,000 | Preferred option, provides efficiencies in combining primary works with secondary works and provides the most benefit to consumers. |

[7] As per clause 5.15.2(a) of the NER.

| Option | Description | Capital cost ($m 2020/21) | Operating costs ($ per year) | Remarks |
|---|---|---|---|---|
| Option 5 | Complete in-situ secondary systems and 22 kV AIS replacement | 17.5 (+/- 25%) by 2022/23 | ~ 6,000 | Provides efficiencies in combining primary works with secondary works but does not address unique site conditions. |

* Renewal of some of the primary plant at Broken Hill substation is scheduled by 2024/25. This additional $11.29 million in capital expenditure is included in the base case, Option 1, 2 and 3, for NPV analysis purposes to enable 'like-for-like' comparison with Options 4 and 5.

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

TransGrid does 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.

## Implementing Option 4 will meet relevant regulatory obligations

Implementation of Option 4 will enable TransGrid to meet regulatory obligations set out in Schedule 5.1 and clauses 4.11.1, 4.6.1(b)[8] of the NER to provide redundant secondary systems and ensure that the transmission system is adequately protected. Consequently, it will also ensure the performance standards applicable to Broken Hill substation secondary systems are met.

## Option 4 delivers highest net economic benefits

In all scenarios, highest net economic benefits result from implementing Option 4. Option 4 is the most efficient option to ensure reliability of the secondary systems at Broken Hill substation and mitigate its risks of prolonged failure. Sensitivity testing finds that Option 4 delivers the most net economic benefits under all sensitivities undertaken by TransGrid.

## Option 4 delivers the most benefit to consumers

In this PADR TransGrid has considered five credible options which have been assessed relative to the base case. Of the credible options considered, Option 4 delivers the most benefit to consumers. This includes renewal of some 22 kV switchgear which, although not part of the need being addressed by this RIT-T, has been discussed in some sections of this PADR.

Renewal of some of the primary plant at Broken Hill substation is scheduled by 2024/25. The renewal of the 22 kV switchgear is not subject to the RIT-T, however there are efficiencies in completing the works required to meet the identified need for this RIT-T at the same time.

[8] As per clause 4.6.1(b) of the NER, AEMO must ensure that there are processes in place that will allow the determination of fault levels for normal operation of the power system and in anticipation of all credible contingency events and protected events that AEMO considers may affect the configuration of the power system, so that AEMO can identify any busbar which could potentially be exposed to a fault level which exceeds the fault current ratings of the circuit breakers associated with that busbar.

Under the base case, Option 1, Option 2 and Option 3, the primary plant scheduled for renewal in 2025 is replaced 'like-for-like'. This is due to the nature of those options; specifically, under those options the location of primary plant remains the same. However, under Option 4 the primary plant is installed within a new 22 kV switchroom as part of a new demountable building in a different location within the switchyard and includes all associated secondary systems within the building. Installing the primary plant in this location delivers more benefit to consumers than all other options where it remains in the current location. Locating the primary plant in the new location enables TransGrid to reduce reliability risk costs as the asset is physically less exposed to factors causing instances of involuntary load shedding. The estimated reduction in reliability risk costs under Option 4 is approximately $430,000 per year. Option 5 has the primary plant replaced in-situ. Option 4 has a higher net economic benefit than Option 5, making it the preferred option.

## Draft assessment – the preferred option

The implementation of Option 4, complete replacement with 22 kV switchroom and 220 kV in-situ secondary systems at the Broken Hill substation by using modular Secondary Systems Building (SSBs), new metal-clad 22 kV switchgear, and installing new cable throughout, is the most efficient technically and commercially feasible option at this draft stage of the RIT-T process. Option 4 addresses the identified need and identified primary plant renewals under asset renewal programs, offers the most benefit to consumers and can be implemented in sufficient time to meet the identified need by 2022/23. It is therefore the preferred option presented in this PADR.

The estimated capital cost of this option is approximately $18.34 million. Routine operating and maintenance costs are approximately $6,000 per year.

The works will be undertaken between 2020/21 and 2022/23. Planning (including commencement of the RIT-T) commenced in 2019/20 and is due to conclude in 2020/21. The detailed design will commence in 2021/22 with procurement and delivery of the identified assets planned to occur during 2021/22. All works will be completed by 2022/23.

Necessary outages of relevant existing assets will be planned appropriately in order to complete the works with minimal impact on the network.

## Submissions and next steps

The purpose of this PADR is to:

- set out the reasons TransGrid proposes that action be taken;
- present the options that address the identified need;
- outline the technical characteristics that non-network options will need to provide;
- allow interested parties to make submissions and provide input to the RIT-T assessment; and
- provide TransGrid's draft assessment on the preferred option to address the identified need.

TransGrid welcomes written submissions on materials contained in this PADR. Submissions are due on 30 April 2021.

Submissions should be emailed to TransGrid's Regulation team via RIT-TConsultations@transgrid.com.au.[9] In the subject field, please reference 'Broken Hill secondary systems PADR.'

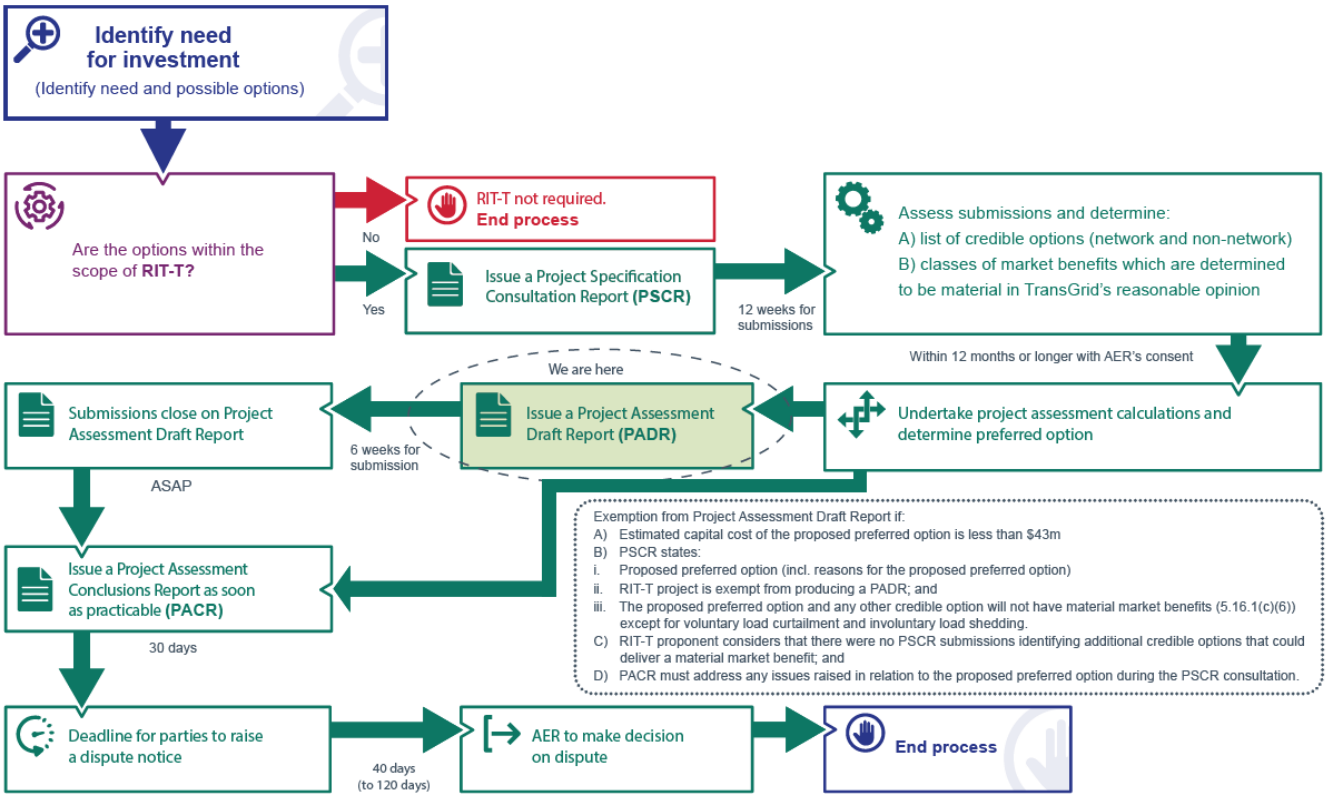
At the conclusion of the consultation process, all submissions received will be published on TransGrid's website. If you do not wish for your submission to be made public, please clearly specify this at the time of lodgement.

[9] 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.

The next step in this RIT-T, following consideration of submissions received via the six-week consultation period and any further analysis required, will be publication of a Project Assessment Conclusion Report (PACR). TransGrid anticipates publication of a PACR by October 2021.

To read the full Project Assessment Draft Report visit the Regulatory Investments Test page on TransGrid's website.

**Figure 1 This PADR is the second stage of the RIT-T process**[10]




[10] Australian Energy Market Commission. "*Replacement expenditure planning arrangements, Rule determination*". Sydney: AEMC, 18 July 2017.65. Accessed 14 May 2020. https://www.aemc.gov.au/sites/default/files/content/89fbf559-2275-4672-b6ef-c2574eb7ce05/Final-rule-determination.pdf