



TransGrid

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

RIT-T – Project Specification Consultation Report

Region: South Western NSW

Date of issue: 17 December 2019

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 Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

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 As it is superseded by new technology at the manufacturer level and the existing technology becomes obsolete, spare parts become scarce and the ability of any primary asset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.

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 Aligned with the approach of the Integrated System Plan developed by AEMO, TransGrid has identified large-scale renewable energy zones to meet the objectives of energy security and reliability, affordability and reduced emissions.

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.

The Network Performance Requirements, set out in Schedule 5.1 of the NER, place an obligation on 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.

Though replacement of failed secondary systems component is a possible interim measure, the approach is not sustainable as spare components will deplete due to the technology no longer being manufactured or

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 2019." Sydney: TransGrid, 2019. 45. Accessed 18 November, 2019. <https://www.transgrid.com.au/what-we-do/Business-Planning/transmission-annual-planning/Documents/2019%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, 23 April 2019." Melbourne: Australian Energy Market Operator, 2019. Accessed 15 May 2019. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715---Power-System-Security-Guidelines.pdf

supported. Once all spares are used, replacement will cease to be a viable option to meet performance standards applicable to Broken Hill substation secondary systems.

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).

Continued deterioration of the secondary systems at Broken Hill substation will accelerate the depletion of spares which will lead to a situation where TransGrid is unable to operate the secondary systems in accordance with clause 4.6.1 of the NER. 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.

Credible options considered

In this PSCR, TransGrid has put forward for consideration credible options that would meet the identified need from a technical, commercial, and project delivery perspective.⁵

These are summarised in the following table.

Table 1 Summary of the credible options

| Option | Description | Capital cost | Operating cost and maintenance | Remarks |
|----------|---|--|--------------------------------|--|
| Option 1 | Complete replacement with Secondary Systems Building (SSBs) | \$11.44 million by 2022/23 <i>(additional \$1.99 million by 2022/23*)</i> | \$6,358 per year | 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 22kV switchgear being replaced 'like-for-like' and in-situ. |
| Option 2 | Complete in-situ replacement | \$6.25 million by 2022/23 <i>(additional \$1.99 million by 2022/23*)</i> | \$6,358 per year | Technically and commercially feasible but less efficient. |
| Option 3 | Strategic asset replacement | \$4.03 million by 2022/23 and | \$6,358 per year | Technically and commercially feasible but does |

⁵ As per clause 5.15.2(a) of the NER.

| Option | Description | Capital cost | Operating cost and maintenance | Remarks |
|----------|--|---|--------------------------------|---|
| | | \$1.57 million spread between 2023/23 and 2037/38 <i>(additional \$1.99 million by 2022/23*)</i> | | not address technological obsolescence beyond 2023 and is therefore not practicable. |
| Option 4 | Complete upgrade and renewal with 22kV Switch Room and 220kV Secondary Systems Building (SSBs) | \$13.03 million by 2022/23 | \$6,358 per year | Preferred option, provides efficiencies in combining primary works with secondary works and provides the most benefit to consumers. |

* Renewal of some of the primary plant at Broken Hill substation is scheduled by 2022/23. This additional \$1.99 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.

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.

Options assessed under three different scenarios

TransGrid has considered three alternative scenarios – a low net economic benefits scenario, a central scenario, and a high net economic benefits scenario – all involve a number of assumptions that results in the lower bound, the expected, and the upper bound estimates for present value of net economic benefits respectively.

Table 2 Summary of the scenarios

| Variable/Scenario | Central | Low benefit scenario | High benefit scenario |
|------------------------------|----------------|----------------------|-----------------------|
| Scenario weighting | 50% | 25% | 25% |
| Network capital costs | Base estimate | Base estimate + 25% | Base estimate - 25% |
| Discount rate | 5.90% | 8.95% | 2.85% |
| Environment and safety costs | Base estimates | Base estimate - 25% | Base estimate + 25% |
| USE costs | Base estimates | Base estimates | Base estimates |

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)⁶ 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. The gross benefits are mostly composed of reduction in reliability risks. 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.

Option 4 delivers the most benefit to consumers

In this PSCR TransGrid has considered four 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 22kV switchgear which, although not part of the need being addressed by this RIT-T, has been discussed in some sections of this PSCR.

Renewal of some of the primary plant at Broken Hill substation is scheduled by 2022/23. The renewal of the 22kV 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.

Under the base case, Option 1, Option 2 and Option 3, the primary plant scheduled for renewal in 2023 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 the modular Secondary Systems Buildings (SSBs) in a different location within the switchyard. 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 \$400,000 per year.

Draft conclusion

The implementation of Option 4, complete upgrade and renewal of secondary systems at the Broken Hill substation by using modular Secondary Systems Building (SSBs), new metal-clad 22kV 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 PSCR.

The estimated capital cost of this option is approximately \$13 million (weighted present value of \$9 million). Routine and operating maintenance costs are approximately \$6,358 per year – the same as the base case.

The work will be undertaken over the three-year period, with all works expected to be completed by 2022/23.

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

⁶ 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.

Submissions and next steps

The purpose of this PSCR 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, and allow interested parties to make submissions and provide input to the RIT-T assessment.

TransGrid welcomes written submissions on materials contained in this PSCR. Submissions are particularly sought on the credible options presented and from potential proponents of non-network options that could meet the technical requirements set out in this PSCR. Submissions are due on 16 March 2020.

Submissions should be emailed to TransGrid's Regulation team via RIT-TConsultations@transgrid.com.au.⁷ In the subject field, please reference 'PSCR Broken Hill secondary systems project.'

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

Subject to additional credible options being identified during the consultation period, publication of a Project Assessment Draft Report (PADR) is not required for this RIT-T as TransGrid considers its investment in relation to the preferred option to be exempt from that part of the process as per NER clause 5.16.4(z1). Production of a PADR is not required due to:

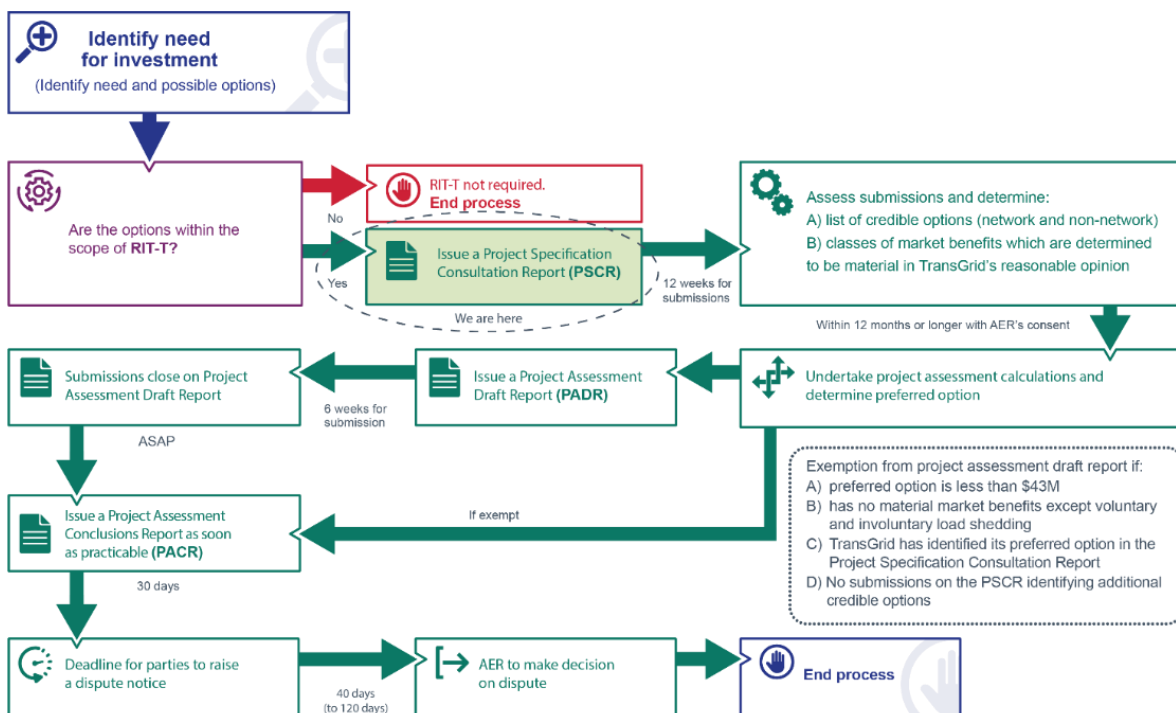
- > preferred option being less than \$43 million
- > no market benefits except voluntary and involuntary load shedding
- > preferred option has been identified in the PSCR
- > no submissions on the PSCR identifying additional credible options.

Therefore, the next step in this RIT-T, following consideration of submissions received during the 12-week consultation period and any further analysis required, will be publication of a Project Assessment Conclusions Report (PACR). TransGrid anticipates publication of a PACR by April 2020.

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if TransGrid considers that an additional credible option that could deliver a material market benefit is identified during the consultation period. Accordingly, if TransGrid considers that any additional credible options are identified, TransGrid will produce a PADR which includes a net present value (NPV) assessment of the net economic benefits of each additional credible option.

⁷ 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.

Figure 1 This PSCR is the first stage of the RIT-T process⁸



To read the full Project Specification Consultation Report visit the [Regulatory Investments Test page](#) on TransGrid's website.

⁸ Australian Energy Market Commission. "Replacement expenditure planning arrangements, Rule determination". Sydney: AEMC, 18 July 2017.65. Accessed 19 November 2019. <https://www.aemc.gov.au/sites/default/files/content/89bf559-2275-4672-b6ef-c2574eb7ce05/Final-rule-determination.pdf>