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Summary: Maintaining Reliable Supply to the Bathurst, Orange and Parkes areas

RIT-T – Project Assessment Draft Report

Region: Central West New South Wales

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Summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining reliable supply to the Orange and Parkes areas of central west New South Wales (NSW). Publication of this Project Assessment Draft Report (PADR) represents the second step in the RIT-T process and follows the Project Specification Consultation Report (PSCR) and accompanying non-network expression of interest (EOI) released in March 2021.

The 'identified need' driving investment

As set out in our most recent Transmission Annual Planning Report (TAPR),[1] and our revenue proposal for the 2023-2028 period,[2] the latest forecasts indicate that electricity demand is expected to increase substantially in the Orange and Parkes areas going forward. This is mainly due to expected demand growth associated with the expansion of some existing large mine loads in the area, the planned connection of new mine/industrial loads and general load growth around Parkes, including from the NSW government's Parkes Special Activation Precinct (SAP).[3]

Schedule 5.1.4 of the National Electricity Rules (NER) requires us to plan and design equipment for voltage control to maintain voltage levels within 10 per cent of normal voltage.[4] The NER also requires the power system to be operated in a satisfactory operating state, which requires voltages to be maintained within these levels, both in normal operation and following any credible contingency event.[5]

We have undertaken planning studies that show that the current central west network will not be capable of supplying the combined increases in load in the area without breaching the NER requirements and that voltage-limited constraints will have to be applied in the 132 kV supply network if action is not taken, leading to substantial levels of unserved energy to end customers.

While demand forecasts have reduced since the PSCR, due both to a fall in Essential Energy's general load forecasts as well as a decrease in several specific spot load forecasts, our updated planning studies still show that the current network will not be capable of supplying the expected combined increases in load in the area without breaching the NER requirements going forward. If the longer-term voltage constraints associated with the load growth in Orange and Parkes areas are unresolved, it could result in the interruption of a significant amount of electricity supply to customers under both normal and contingency conditions.

This RIT-T therefore assesses options to ensure the above NER requirements continue to be met in central west NSW in light of the forecast demand increases. We consider this a 'reliability corrective action' under the RIT-T as the proposed investment is for the purpose of meeting externally-imposed regulatory obligations and service standards, i.e., Schedule 5.1.4 of the NER.

1 Transgrid, *2021 Transmission Annual Planning Report*, p. 47, available at: https://www.transgrid.com.au/media/j2llfv1u/transmission-annual-planning-report-2021.pdf
2 Transgrid, *Revenue Proposal 2023–2028*, 31 January 2022, pp. 44-45.
3 https://www.nsw.gov.au/snowy-hydro-legacy-fund/special-activation-precincts/parkes-special-activation-precinct
4 These levels are specified in Clause S5.1a.4.
5 These requirements are set out in Clauses 4.2.6, 4.2.4 and 4.2.2(b) of the NER. The requirement for secure operation of the power system in Clause 4.2.4 requires the power system to be in a satisfactory operating state following any credible contingency event, that is, to maintain voltage within 10 per cent of normal voltage following the first credible contingency event.

The PADR analysis has benefited from stakeholder consultation

The PSCR and accompanying non-network EOI were released in March 2021. We subsequently received submissions from three parties to the PSCR and five parties to the EOI.

One of the submissions received directly in response the PSCR was from a non-network proponent. All three parties have requested confidentiality and so we have not reproduced any of their submission material in the PADR, nor have we published the submissions on our website. Similarly, the non-network proponents who responded to the EOI also requested confidentiality and so we have not reproduced any of their submission material in the PADR or on our website.

In light of the revision to the demand forecasts since the PSCR, during October 2021 we re-engaged with all parties who submitted a non-network solution to confirm their continuing interest and ensure appropriately sized, and costed, solutions were assessed in the PADR. This involved relaying the reduced requirements for non-network solutions under the revised demand forecasts and holding a number of meetings with proponents. Four out of the five parties that submitted to the EOI updated their proposals, while one withdrew their offer.

The credible options have been refined since the PSCR

The credible options considered in the PADR assessment have been refined since the PSCR, to reflect:

- submissions to the PSCR and EOI, resulting in four new options being included that utilise non-network technologies (including Battery Energy Storage Systems (BESS)) put forward by third-party proponents; and
- revised demand forecasts since the PSCR, which has led to the network elements being resized and rescoped.[6]

Key changes to the network elements since the PSCR, including from the lower demand forecasts, are:

- the size of components assisting with the short-term reactive support at Parkes and Panorama has fallen, which has in turn reduced their cost;
- a new 132 kV line from Wellington to Parkes has been included in some options to provide support around Parkes on account of the revised cost estimates finding it to be lower cost than the originally intended line (i.e., a new 132 kV line from Orange to Parkes) – these lines are also now required later in the assessment period;
- the option in the PSCR involving a new 330 kV line between Orange and Parkes has not been progressed in this PADR as the additional cost of this option is not expected to be offset by material additional benefits and so it is no longer considered commercially feasible (even under the high demand forecast); and
- many of the longer-term components of the options are no longer required (and so have been removed, reducing the cost of the options compared to the PSCR).

The options involving non-network solutions in the short-term have each been coupled with the eventual build of a new 132 kV line between Wellington and Parkes (which is the longer-term component of what is considered the preferred solely network option at this stage of the RIT-T (i.e., Option 3).

[6] The lower demand forecasts also resulted in the originally proposed non-network solutions being reviewed and refined, as outlined in section 3 of this PADR.

The credible network options assessed in this PADR differ in the near-term by where, how and when new capacity is added to the central west network going forward. Specifically, the network options differ by:

- how reactive support is provided in the short-term (including through traditional transmission network elements as well as through installing dynamic reactive power devices);
- how much reactive support is provided in the short-term; and
- whether a new transmission line is ultimately built over the longer-term.

Table E-1 below summarises each of the credible options assessed in the PADR.

Table E-1: Summary of the credible options

Option	Description	Estimated capex ($2020/21)
New 330/132 kV substation at Orange ahead of a new Wellington to Parkes 132 kV line (if required)		
1A/1B[7]	• Orange 330/132 kV substation (2 transformers, a 132kV line to Orange North)	• $164 million
	• Wellington to Parkes 132 kV line	• $123 million[8]
Reactive support at Parkes and a new 330/132 kV substation at Orange ahead of additional reactive support at Parkes (if required)		
1C	• Initial synchronous condenser at Parkes 132 kV (40 MVA)	• $30 million
	• Orange 330/132 kV substation (2 transformers, a 132kV line to Orange North)	• $164 million
	• Second synchronous condenser at Parkes 132 kV (30 MVA)	• $26 million
	• Two further synchronous condensers at Parkes 132 kV (2 x 30 MVA)	• $51 million
Reactive support at Panorama and Parkes ahead of a new 132 kV line from Wellington to Parkes (if required)		
3	• Panorama 132 kV SVC (25 MVA) + synchronous condenser at Parkes 132 kV (3*30 MVA)	• $107 million
	• Wellington to Parkes 132 kV line	• $121 million
Reactive support at Panorama and Parkes ahead of a new 330/132 kV substation at Orange and additional reactive support at Parkes (if required)		
4	• Panorama 132 kV SVC (25 MVA) + synchronous condenser at Parkes 132 kV (3*30 MVA)	• $107 million
	• New Orange 330/132 kV substation (2 transformers, a 132kV line to Orange North)	• $164 million
	• Synchronous condenser at Parkes 132 kV (40 MVA)	• $28 million
BESS at Parkes and Panorama (plus reactive support at Parkes) ahead of a new 132 kV line from Wellington to Parkes (if required)		

[7] In the PSCR this option distinguished between Option 1A and 1B because of the then anticipated future stages of developments. These later stages are no longer considered necessary and so these two options have been collapsed into one option. The option naming has been retained for consistency.

[8] Please note that the estimated cost of the Wellington to Parkes line is slightly higher for Option 1A/1B than it is for Option 3, Option 5, Option 7A, Option 7B, Option 7C and Option 7D since, for Option 1A/B, the new Wellington-Parkes line connection is the first work undertaken at Parkes and so it includes the scope to add 132 kV bus section circuit breakers (which is included in the earlier stages of Option 3, Option 5, Option 7A, Option 7B, Option 7C and Option 7D).

Option	Description	Estimated capex ($2020/21)
5	• 2 x 30 MVAr synchronous condensers at Parkes + 15 MW (30 MWh) BESS at Parkes + 20 MW (40 MWh) BESS at Panorama	• $156 million
	• Wellington to Parkes 132 kV line	• $121 million
BESS at Parkes and Panorama (plus reactive support at Parkes) ahead of a new 330/132 kV substation at Orange and additional reactive support at Parkes (if required)		
6	• 2 x 30 MVAr synchronous condensers at Parkes + 15 MW (30 MWh) BESS at Parkes + 20 MW (40 MWh) BESS at Panorama	• $156 million
	• Orange 330/132 kV substation (2 transformers, a 132kV line to Orange North)	• $164 million
	• Synchronous condenser at Parkes 132 kV (40 MVA)	• $28 million
Combination of non-network solutions with the top-ranked network option (Option 3)		
7A	• Solar PV and BESS at Parkes • BESS at Panorama • Wellington to Parkes 132 kV line	• Confidential for the non-network components • $121 million for the line
7B	• Solar PV and BESS at Parkes • BESS at Panorama • Wellington to Parkes 132 kV line	• Confidential for the non-network components • $121 million for the line
7C	• BESS at Parkes • BESS at Panorama • Wellington to Parkes 132 kV line	• Confidential for the non-network components • $121 million for the line
7D	• BESS at Parkes • BESS at Panorama • 2 x 42.5 MVA synchronous condensers at Parkes • Wellington to Parkes 132 kV line	• Confidential for the non-network components (including the synchronous condensers) • $121 million for the line

Benefits from the options considered in this PADR

The key source of benefit expected for all credible options assessed in this PADR is avoided unserved energy to end consumers relative to the RIT-T 'base case', i.e., where action is not taken. Specifically, the current central west network is not capable of supplying the combined increases in load in the area and that voltage-limited constraints will have to be applied in the 132 kV supply network if action is not taken, leading to substantial levels of unserved energy to end customers. While the expected avoided unserved energy is substantial and will increase over time, we have capped it in the analysis so as to remove

avoided unserved energy that is common to all options (since, including it, does not assist with identifying the preferred option overall), which is in line with the approach adopted in other RIT-Ts.[9]

Six of the credible options assessed in this PADR involve the use of BESS, including four from third party proponents of these solutions provided in response to the PSCR and EOI. The BESS are expected to be able to assist with providing reactive support in the short-term and to also use a portion of their capacity to dispatch to the wholesale market, replacing more costly generation that would otherwise be called on to operate, and thus provide wider wholesale market benefits in addition to the avoided unserved energy provided by all options. The additional wholesale market benefits associated with the BESS option component have been estimated using market modelling as part of this PADR.

Uncertainty has been captured by way of three scenarios

Uncertainty is captured under the RIT-T framework through the use of scenarios. The credible options have been assessed under three scenarios as part of this PADR assessment, which differ in terms of the key drivers of the estimated net market benefits.

The three scenarios are characterised as follows:

- a 'low net economic benefits' scenario, involving a number of assumptions that gives a 'lower bound', conservative estimate of the present value of net economic benefits;
- a 'central' scenario based on a central set of variable estimates and reflects the most likely scenario; and
- a 'high net economic benefits' scenario that reflects a set of assumptions selected to investigate an 'upper bound' of net economic benefits.

The table below summarises the specific key variables that influence the net benefits of the options under each of the scenarios considered.

[9] Section 6.1 outlines in more detail how the unserved energy that does not contribute to identifying the preferred option has been removed from the analysis.

Table E-2: Summary of the three scenarios modelled

Variable	Central	Low net economic benefits	High net economic benefits
Network capital costs	Base estimate	Base estimate + 25%	Base estimate - 25%
Demand	Central demand forecast	Low demand forecast	High demand forecast
New renewable generation in the area	In-service, commissioning and committed generators.	In-service, commissioning, committed and advanced generators.	In-service, commissioning and committed generators.
Wholesale market benefits estimated	Estimated based on the 'progressive' 2022 ISP scenario	30 per cent lower than central scenario estimate	30 per cent higher than central scenario estimate
VCR	$53.48/kWh	$37.44/kWh	$69.53/kWh
Discount rate	5.50%	7.50%	2.23%

We consider that the central scenario is most likely since it is based primarily on a set of expected assumptions. We have therefore assigned this scenario a weighting of 50 per cent, with the other two scenarios being weighted equally with 25 per cent each.

The options involving non-network solutions in the short-term are strongly preferred over the solely network options

The results of the PADR assessment find that the options involving non-network solutions in the short-term coupled with the preferred network option in the long term (i.e., Option 7A, Option 7B, Option 7C and Option 7D) are strongly preferred over the solely network options. The options involving non-network solutions in the short-term are found to deliver estimated net benefits of approximately $3.8 billion to $3.9 billion overall relative to the base case 'do nothing' option on a weighted basis, which compares to $1.5 billion for the top-ranked solely network option (Option 3).

While Option 7D is the top-ranked option overall on a weighted basis, the options involving non-network solutions are found to have net benefits all within 2.5 per cent of each other and so are not considered materially different.

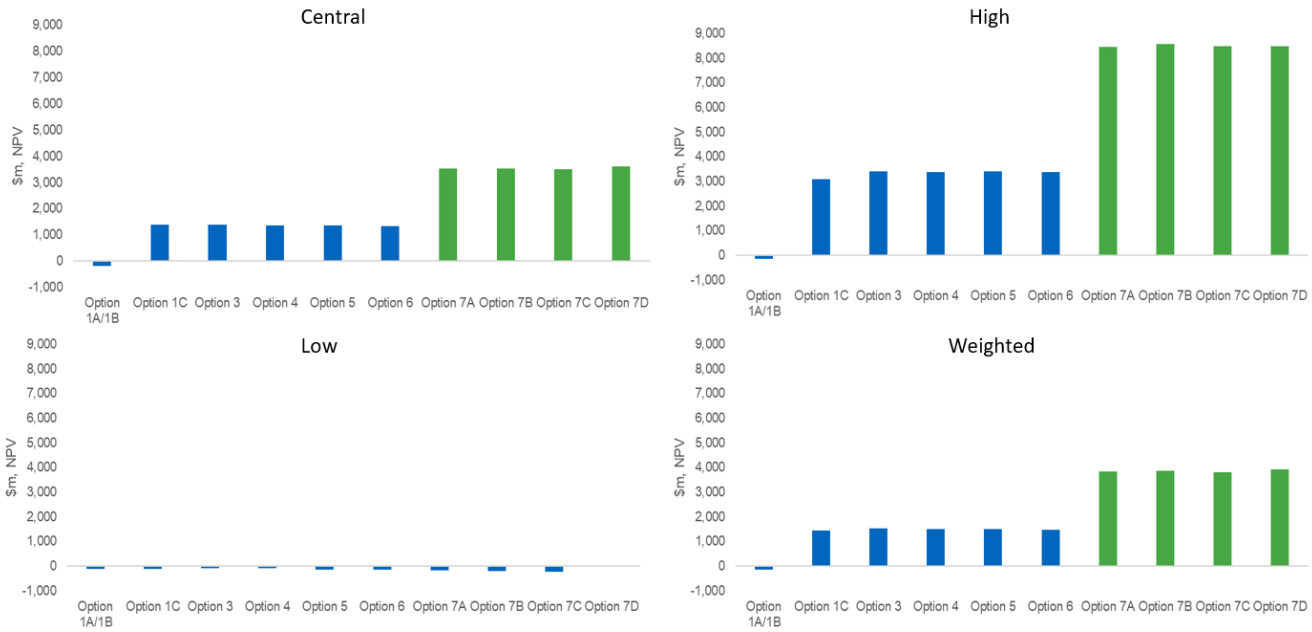
Options 7A-7D are all combined with the network component of Option 3 over the longer-term, to provide a complete solution. While Option 3 is found to have net benefits that are approximately 1 per cent greater than the next best network option (Option 4) on a weighted basis, it is found to have the lowest expected capital cost of all the solely network options (5 per cent lower than Option 1C and 12 per cent lower than Option 4 (the two next lowest cost network options)), which is why it is considered the preferred solely network option at this stage of the RIT-T and is the network option the non-network options have been coupled with.

Figure E-1 shows that while the level of net benefits differs across the central and high scenarios, the options involving non-network solutions in the short-term (i.e., Option 7A, Option 7B, Option 7C and Option 7D) are always strongly preferred over the solely network options. This is due to these options being

assumed to be able to be commissioned approximately two to four years before the network options, which allows them to avoid substantial additional unserved energy in those early years.

While all options have marginally negative net benefits under the low economic benefits scenario, we note that Option 7D is the top-ranked option and that the preferred option is permitted to have negative net benefits under the RIT-T for a reliability corrective action.[10]

Figure E-1: Summary of the estimated net benefits



All charts in the figure above have been presented using the same scale in order to illustrate the headline differences between the scenarios.

Almost all of the estimated gross benefits are derived from avoided unserved energy, which make up between 93 and 99 per cent of the total gross benefits on a weighted basis for the four non-network options. While the estimated wider wholesale market benefits are not found to be material to the conclusion that the options involving non-network solutions are preferred over the solely network options, they are found to be material to which of the non-network options is top-ranked overall. We will therefore be working with proponents to refine the assessment of these wider benefits as part of the PACR.

At this stage of the RIT-T, the preferred options are therefore the options involving non-network solutions in the short-term, coupled with the eventual build of a new 132 kV line between Wellington and Parkes.

[10] Moreover, as noted above, the avoided unserved energy benefits are capped in the PADR analysis to remove unserved energy that does not contribute to identifying the preferred option and, if the full avoided unserved energy benefit was modelled, Option 7D would have positive net benefits under this scenario (but that all other options, including Option 3 and the other non-network options, would still have negative net benefits).

Assumed option timing is a key driver of the preferred option (and will be refined ahead of the PACR)

A key determinant of the overall preferred option is the assumed build times, and ultimate commissioning dates, of each of the credible options, since options that can be commissioned sooner allow for substantial amount of unserved energy to be avoided.

Sensitivity analysis undertaken as part of this PADR shows that the conclusion that options involving non-network solutions in the short-term are strongly preferred over the solely network options is relatively robust to alternate assumed option timings. Specifically, it shows that:

- there would need to be a two year delay to the commissioning of the BESS under Option 7D combined with a two year bringing forward of Option 3 in order for Option 3 to be preferred (and, even under these assumptions, Option 3's net benefits would only be approximately 10 per cent greater than Option 7D's); and
- Option 3 would need to be brought forward two years (and Option 7D assumed to either have no change to its timing, or be delayed by one year), or Option 3 would need to be brought forward by one year and Option 7D is delayed by two years, to result in Option 3 being within 5 per cent of Option 7D.

We will therefore be focussing, internally and with third party proponents of non-network solutions, to firm up the assumed commissioning dates (and costs) for all options between now and the PACR, and to ensure that the assumed option timing is realistic in all cases. We expect that factors such as the assumed timing of land acquisition and planning approvals will be key to firm up and note that the current proposals from third parties display some diversity across these assumptions. It is expected that the assumed option timings in the PACR will reflect what option proponents are willing to commit to.

Next steps

We welcome written submissions on this PADR. Submissions are due on 7 April 2022.

Submissions should be emailed to our Regulation team via Regulatory.Consultation@transgrid.com.au.[11] In the subject field, please reference 'PADR Summary: Maintaining Reliable Supply to the Bathurst, Orange and Parkes areas project.'

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.

The next formal stage of this RIT-T is the publication of a PACR. The PACR is expected to be published in June 2022.

To read the full Project Assessment Draft Report visit TransGrid's website.

[11] 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.