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Summary: Maintaining Reliable Supply to the North West Slopes Area

RIT-T – Project Assessment Draft Report

Region: Northern New South Wales

Date of issue: 18 February 2022

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Summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining reliable supply to the North West Slopes area of northern 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 April 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 North West Slopes area going forward. This is mainly due to a number of substantial industrial loads that are anticipated to connect, as well as underlying general load growth in Narrabri and Gunnedah.

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.[3] 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.[4]

We have undertaken planning studies that show that the current North West Slopes network will not be capable of supplying the forecast 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. Moreover, in addition to the voltage constraints identified, our planning studies show that the increased demand will also lead to thermal constraints, particularly during times of low renewable generation dispatch in the region.

Demand forecasts for the area have changed since the PSCR, due both an update from Essential Energy in terms of load in its network as well as a specific spot load forecast no longer being expected to proceed. We are therefore no longer considering the 'high' forecast from the PSCR and have made minor revisions to the central and low demand forecasts. However, 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 constraints associated with the load growth are unresolved, it could result in the interruption of a significant amount of electricity supply under both normal and contingency conditions due to voltage and thermal limitations in the area.

This RIT-T therefore assesses options to ensure the above NER requirements continue to be met in the North West Slopes area 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.

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1 Transgrid, *2021 Transmission Annual Planning Report*, p. 45, 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 These levels are specified in Clause S5.1a.4.

4 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 April 2021. We did not receive any submissions directly to the PSCR but we did receive two responses to the EOI.

The non-network proponents who responded to the EOI requested confidentiality and so we have not reproduced any of their response material in the PADR, nor have we published the responses on our website.

In light of the removal of the high demand forecast and minor revisions to the other demand forecasts since the PSCR, during November 2021 we re-engaged with the two parties to confirm their continuing interest and to 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 discussions with proponents. Both parties that submitted to the EOI subsequently updated their proposals.

The credible options have been refined since the PSCR

The network options considered in the PADR remain the same as those set out in the PSCR.

Each of the credible network options includes the installation of a third 60 MVA 132/66 kV transformer at Narrabri, as the firm supply capacity of the existing transformers at this location is forecast to be exceeded under both demand forecasts used in this PADR leading to the reliability standard determined by IPART not being met for Narrabri in the short-term.

Aside from the new 132/66 kV transformer at Narrabri, the credible network options differ in the near-term by where, how and when new capacity is added to the North West Slopes region. In particular, there are three broad types of credible option assessed that centre on:

- uprating the existing line 969 from Tamworth to Gunnedah (Option 1A and Option 1B);
- installing new single or double circuit transmission lines between Tamworth and Gunnedah (Option 2A, Option 2B, Option 2C and Option 2D); and
- rebuilding the existing line 969 from Tamworth to Gunnedah to be a double circuit line (Option 3A, Option 3B and Option 3C).

Most credible options include the provision of dynamic reactive support at Narrabri provided by an SVC or grid-scale battery. Two options (Option 2C and Option 3C) involve a new transmission line between Gunnedah and Narrabri as an alternative to dynamic reactive support and the upgrade to the 9UH line running between Boggabri North and Narrabri.

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)
Uprating the existing line 969 from Tamworth to Gunnedah		
1A	• Install a third 60 MVA 132/66 kV transformer at Narrabri	• $8 million
	• Upgrade the existing 969 line between Tamworth 330/132 kV and Gunnedah 132/66 kV substations to a rating of 160 MVA	• $51 million
	• Install a 132 kV +50 MVAr (capacitive) -20 MVAr (inductive) SVC at Gunnedah substation	• $18 million
	• Upgrade the 9UH line between Narrabri and Boggabri North to a rating of 100 MVA	• $38 million
	• Upgrade the existing 968 line between Tamworth 330 and Narrabri substations to a rating of at least 160 MVA	• $149 million
	• Install a 132 kV +60 MVAr -20 MVAr SVC at Narrabri	• $20 million
1B	• Install a third 60 MVA 132/66 kV transformer at Narrabri	• $8 million
	• Upgrade the existing 969 line between Tamworth 330/132 kV and Gunnedah 132/66 kV substations to a rating of 160 MVA	• $51 million
	• Install a 132 kV +50 MVAr (capacitive) -20 MVAr (inductive) SVC at Gunnedah substation	• $18 million
	• Upgrade the 9UH line between Narrabri and Boggabri North to a rating of 100 MVA	• $38 million
	• Build a new 132 kV line between Tamworth 330/132 kV and Narrabri 132/66 kV substations	• $160 million
New single or double circuit transmission lines between Tamworth and Gunnedah		
2A	• Install a third 60 MVA 132/66 kV transformer at Narrabri	• $8 million
	• Build a new single circuit 160 MVA 132 kV line between Tamworth 330 and Gunnedah.	• $74 million
	• Upgrade the existing 969 line to a rating of 135 MVA	• $51 million
	• Upgrade the 9UH line to a rating of 100 MVA	• $38 million
	• Install a 132 kV +50 MVAr -20 MVAr SVC at Narrabri	• $20 million
2B	• Install a third 60 MVA 132/66 kV transformer at Narrabri	• $8 million
	• Build a new double circuit 132 kV line between Tamworth 330 and Gunnedah, each circuit rated at 160 MVA. Decommission the existing 969 transmission line	• $89 million
	• Upgrade the 9UH line to a rating of 100 MVA	• $38 million

Option	Description	Estimated capex ($2020/21)
	• Installation of a 132 kV +50 MVAr -20 MVAr SVC at Narrabri	• $19 million
2C	• Install a third 60 MVA 132/66 kV transformer at Narrabri	• $8 million
	• Build a new single circuit 160 MVA 132 kV line between Tamworth 330 and Gunnedah	• $74 million
	• Upgrade the existing 969 line to a rating of 135 MVA	• $51 million
	• Build a new single circuit 132 kV line between Narrabri and Gunnedah	• $106 million
2D	• Install a third 60 MVA 132/66 kV transformer at Narrabri	• $8 million
	• Build a new single circuit 330 kV line between Tamworth 330 and Gunnedah operated at 132 kV, rated at least 160 MVA	• $159 million
	• Upgrade the existing 969 line to a rating of 135 MVA	• $51 million
	• Upgrade the 9UH line to a rating of 100 MVA	• $38 million
	• Install a 132 kV +50 MVAr -20 MVAr SVC at Narrabri	• $20 million
Rebuilding the existing line 969 from Tamworth to Gunnedah to be a double circuit line		
3A	• Install a third 60 MVA 132/66 kV transformer at Narrabri 132/66 kV substation	• $8 million
	• Rebuild the existing 969 line between Tamworth 330 and Gunnedah substations as a double circuit	• $94 million
	• Upgrade the 9UH line between Narrabri and Boggabri North to a rating of 100 MVA	• $38 million
	• Install a 132 kV +60 MVAr (capacitive) -20 MVAr (inductive) SVC at Narrabri substation	• $20 million
3B	• Install a third 60 MVA 132/66 kV transformer at Narrabri 132/66 kV substation	• $8 million
	• Rebuild the existing 969 line between Tamworth 330 and Gunnedah substations as a double circuit	• $94 million
	• Upgrade the 9UH line between Narrabri and Boggabri North to a rating of 100 MVA	• $38 million
	• Install a 50 MW (50 MWh) BESS at Narrabri 132 kV	• $88 million
3C	• Install a third 60 MVA 132/66 kV transformer at Narrabri 132/66 kV substation	• $8 million
	• Rebuild the existing 969 line between Tamworth 330 and Gunnedah substations as a double circuit	• $94 million
	• Build a new single circuit 132 kV line between Narrabri and Gunnedah	• $106 million
Combination of non-network solutions with the top-ranked network option (Option 3A)		
5A	• Install a third 60 MVA 132/66 kV transformer at Narrabri 132/66 kV substation	• $8 million
	• Install a BESS at Gunnedah or Narrabri 132 kV as a network support service	• Confidential
	• Rebuild the existing 969 line between Tamworth 330 and Gunnedah substations as a double circuit	• $94 million

Option	Description	Estimated capex ($2020/21)
	• Upgrade the 9UH line between Narrabri and Boggabri North to a rating of 100 MVA	• $38 million
5B	• Install a third 60 MVA 132/66 kV transformer at Narrabri 132/66 kV substation	• $8 million
	• Install a BESS at Gunnedah 132 kV as a network support service	• Confidential
	• Rebuild the existing 969 line between Tamworth 330 and Gunnedah substations as a double circuit	• $94 million
	• Upgrade the 9UH line between Narrabri and Boggabri North to a rating of 100 MVA	• $38 million

While there have been no material changes to the network options since the PSCR, the non-network options have been refined to reflect:

- responses to the EOI, resulting in two new options being included that utilise Battery Energy Storage Systems (BESS) as put forward by proponents; and
- revised demand forecasts since the PSCR, which has led to the non-network components being resized and slightly rescoped.

The two non-network options, Option 5A and Option 5B, use BESS to provide a network support service. Option 5A and Option 5B vary by the size, number and location of the BESS.

The non-network solutions are not considered to be long-term standalone solutions and, instead, defer or avoid the rebuilding of line 969 as a double-circuit line and upgrading the 9UH line between Narrabri and Boggabri North, as part of the preferred network option at this stage of the RIT-T (Option 3A). The details of these options have not been presented in this PADR to preserve the requested confidentiality by proponents.

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 North West Slopes 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.[5]

Two of the credible options assessed involve the use of BESS, both of which have been proposed by third party proponents in response to the PSCR and accompanying EOI. These BESS components (which have been combined with network investment components to meet the overall identified need) are expected to be able to assist with providing reactive support in the short-term and also to 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 that

[5] 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.

all options provide. The wider wholesale market benefits associated with the BESS components of these options 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.

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	Central demand forecast
New renewable generation in the area	All in-service and committed generators	All in-service, committed and advanced generators	All in-service and committed generators
Wholesale market benefits estimated	Estimated based on 'progressive change' 2022 ISP scenario	30 per cent lower than central scenario estimate	30 per cent higher than central scenario estimate
VCR	$46.93/kWh	$32.85/kWh	$61.01/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 preferred over the solely network options

The results of the PADR assessment find that the options involving non-network solutions in the short-term (i.e., Option 5A and 5B) are preferred over those based solely on network components. The options

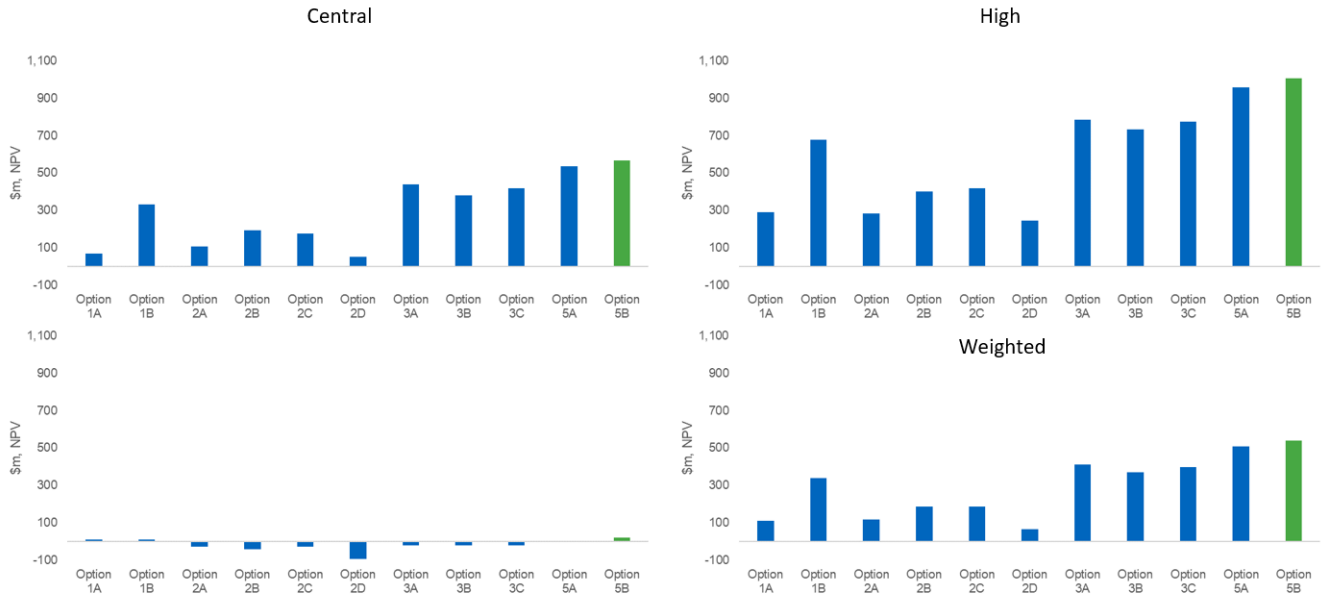
involving non-network solutions in the short-term are found to deliver estimated net benefits of approximately $507 million to $540 million overall on a weighted basis across the scenarios, relative to the base case 'do nothing' option, which compares to $410 million for the top-ranked solely network option (Option 3A).

Option 5B is the top-ranked option overall, with net benefits that are approximately 6 per cent greater than the second ranked option (Option 5A) and 32 per cent greater than the top-ranked solely network option (Option 3A).

Option 3A has the second lowest expected total cost of the solely network options in present value terms under the weighted results. However, it can be constructed more quickly and so can avoid a substantial amount of unserved energy one to two years earlier than the lowest cost network option (Option 2B).[6] Option 3A is therefore considered the preferred 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 three scenarios, Option 5B is always the top-ranked option by a material margin (between 5 and 92 per cent). Option 5A is the second-ranked option in all scenarios besides the low scenario, where Option 1A and Option 1B are marginally ahead of Option 5A. Option 5A and Option 5B have greater net benefits than the solely network options on a weighted basis due to these options being able to be commissioned approximately one to three years before the network options, which allows them to avoid substantial additional unserved energy in these earlier years.

Figure E.1: Summary of the estimated net benefits



Almost all of the estimated gross benefits are derived from avoided unserved energy, which make up approximately 89 per cent of the total gross benefits of Option 5B on a weighted basis. However, the estimated wider wholesale market benefits are found to not be material to the overall outcome and, if

[6] The present value of all capex and opex of Option 3A under this scenario is $101 million, which compares to $87 million for Option 2B.

removed from the assessment, would not change the ranking of the options under the central scenario, high scenario or on a weighted basis.[7]

Option 5B is considered the preferred option and the option that satisfies the RIT-T at this stage of the process. However, we note that this conclusion is highly dependent on the assumed timing of Option 5B compared to Option 3A (and Option 5A), as discussed further below.

Assumed option timing is a key driver of the preferred option (and will be further investigated 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. Options that can be commissioned sooner allow for substantial amount of unserved energy to be avoided in earlier years.

Sensitivity analysis undertaken as part of this PADR shows that the results are relatively sensitive to the assumed commissioning dates for the options, e.g., if Option 3A was to be delivered a year earlier, and Option 5B remained on the same timing, then Option 3A would have almost the same benefit as Option 5B.

While the timing sensitivities undertaken in this PADR are focused in particular on the rankings between the network and non-network options (rather than between the non-network options), we note that the assumed timings are also likely to be a key driver of the rankings between the non-network options.

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.[8] In the subject field, please reference 'PADR Summary: Maintaining Reliable Supply to the North West Slopes Area 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.

[7] If wholesale market benefits are removed from the low scenario, Option 5B and 5A would go from being ranked 1st and 4th, respectively, to being ranked 6th and 10th, respectively.

[8] 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.