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# Maintaining Reliable Supply in the Deniliquin, Coleambally and Finley area

RIT-T Project Specification Consultation Report

Region: South West NSW

Date of issue: 2 June 2022

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# Executive summary

Transgrid is applying the Regulatory Investment Test for Transmission (RIT-T) to options for maintaining reliable supply in the Deniliquin, Coleambally and Finley area in south west New South Wales (NSW). Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

The Australian Energy Market Operator (AEMO) forecasts that minimum demand in NSW will rapidly decline over the next 10 years due to ongoing growth in distributed solar (PV) generation.[1] In south west NSW, growth in small to large scale embedded generation connecting to the Essential Energy network is forecast to continue, driving declining minimum demand in this region.

The south west NSW region is supplied by four 132 kV transmission lines which form a link between Wagga Wagga and Darlington Point, via Deniliquin, Coleambally, and Finley. Our power system studies show that the declining minimum demand in these areas mean that the electricity transmission system in these areas is at risk of exceeding allowable voltage levels during times of low demand and in particular when nearby solar farms are unable to provide reactive power support.

In addition to the excessive voltage issues identified by Transgrid, AEMO have declared an immediate Network Support and Control Ancillary Services (NSCAS) gap of 2 MVAr absorbing reactive power in the Coleambally region for overnight when nearby solar farms are not available.[2]

We are required to manage the risk of system voltages exceeding their allowable limits as set out in the National Electricity Rules (NER)[3] and procure services to meet the NSCAS gap declared by AEMO.

This RIT-T therefore examines various network and non-network options to address the excess voltage levels to ensure compliance with the requirements of the NER and provide the greatest net benefit to the market.

## Identified need: maintaining reliable supply to the Deniliquin, Coleambally and Finley area

The identified need for this RIT-T is to maintain reliable supply in the Deniliquin, Coleambally and Finley areas by managing the risk of excess voltage levels due to declining minimum demand. There is an increasing likelihood of unserved energy and non-compliance with the NER without any proactive investment to address the need.

We are required to maintain compliance with Schedule 5.1.4 of the NER and meet the NSCAS gap declared by AEMO as a result of the declining minimum demand. Consequently, we consider this 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.

1 AEMO, 2021 Electricity Statement of Opportunities, August 2021.
2 AEMO, 2021 System Security Reports, December 2021.
3 Schedule 5.1.4 of the NER requires us to plan and design equipment for voltage control to maintain voltage levels within 10 per cent of normal voltage. We expect a non-compliance with this requirement will occur without remedial action.

## Two credible network options have been identified

We have identified two credible network options that meet the identified need from a technical, commercial, and project delivery perspective.[4] These options are summarised in Table E-1 below.

Table E-1: Summary of the credible options

| Option | Description | Capital costs ($M 2021-22, +/- 25%) | Operating costs ($ per year 2021-22) | Remarks |
|---|---|---|---|---|
| Option 1 | Install two 10 MVAr 132 kV reactors at Deniliquin | 9.2 | 40,000 | Provides the same benefits as Option 2, but at a higher cost |
| Option 2 | Install two 11 MVAr 66 kV reactors at Deniliquin | 8.1 | 40,000 | Most economical and preferred option |

## 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 who 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.

However, we note that the cost of the 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 of non-network options to satisfy, or contribute to satisfying, the identified need for this RIT-T.

## Option 2 delivers highest net economic benefits and will meet relevant regulatory obligations

Implementing Option 2 by 2024/25 will meet the relevant regulatory obligations set out in the NER and meet the NSCAS gap declared by AEMO, maintaining reliable supply to the Deniliquin, Coleambally and Finley area in the long term.

Option 2 delivers the highest net economic benefits in all scenarios, meeting the identified need and avoiding expected unserved energy in the long term at a lower cost than Option 1. This makes Option 2 the preferred option.

## Draft Conclusion

The optimal commercially and technically feasible option presented in this PSCR – Option 2 (Install two 11 MVAr 66 kV reactors at Deniliquin) – is the preferred option to meet the identified need and maintain reliable supply to the Deniliquin, Coleambally and Finley area.

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

Moving forward with this option is the most prudent and economically efficient solution to ensure the NER requirements and NSCAS gap is met in the long term, while avoiding expected unserved energy.

The estimated capital expenditure associated with this option is $8.1 million +/- 25 per cent. Routine operating and maintenance costs relating to planned activities are approximately $40,000 per year.

This preferred option, Option 2, is not found to have positive net benefits under the weighted scenario, however, since this RIT-T is a reliability corrective action, the top-ranked option is permitted to have a negative market benefit.

We also conducted sensitivity analysis on the net economic benefit to investigate the robustness of the conclusion to key assumptions. Our analysis concluded that Option 2 remains the preferred option under all sensitives studied.

The works will be undertaken between 2022/23 and 2024/25, with final commissioning of the solution expected in 2024/25.

All works will be completed in accordance with the relevant standards by 2024/25 with minimal modification to the wider transmission assets. Necessary outages of in service equipment 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 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 we consider its investment in relation to the preferred option to be exempt from that part of the process under NER clause 5.16.4(z1). Production of a PADR is not required due to:

- the estimated capital cost of the proposed preferred option being less than $46 million[5];
- the PSCR states:
  - the proposed preferred option (including reasons for the proposed preferred option)
  - the RIT-T is exempt from producing a PADR
  - the proposed preferred option and any other credible option will not have material market benefits[6] except for voluntary load curtailment and involuntary load shedding
- the RIT-T proponent considers that there were no PSCR submissions identifying additional credible options that could deliver a material market benefit; and
- the PACR must address any issues raised in relation to the proposed preferred option during the PSCR consultation.

[5] Varied from $43m to $46m based on the AER Final Determination: Cost threshold review November 2021.
[6] As per clause 5.16.1(c)(6)

## Submissions and next steps

The purpose of this PSCR is to set out the reasons we propose 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 31 August 2022.

Submissions should be emailed to Transgrid's Regulation team via regulatory.consultation@transgrid.com.au.[7] In the subject field, please reference 'Maintaining Reliability in the Deniliquin, Coleambally and Finley area.'

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.

Should we consider that no additional credible options were identified during the consultation period, we intend to produce 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. Subject to additional credible options being identified, Transgrid anticipates publication of a PACR in October 2022.

[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.

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# 1. Introduction

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options which manage excessive voltage levels to maintain reliable supply around Deniliquin, Coleambally and Finley in south west New South Wales (NSW). Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

Our power system studies show that declining minimum demand as a result of growth in distributed solar generation in the Deniliquin, Coleambally and Finley areas mean that there is a need to manage the risk of system voltages exceeding their allowable limit. Currently the excessive voltages are managed through operational measures which reduce supply reliability to Deniliquin, Coleambally and Finley.

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. We expect non-compliance with this requirement will occur without remedial action.

This RIT-T therefore examines various network and non-network options to address the excess voltage to ensure compliance with the requirements of the NER and provide the greatest net benefit to the market.

Further, in AEMO's 2021 System Security Report,[8] an immediate NSCAS gap of 2 MVAr absorbing reactive power has been declared in the Coleambally region for times where nearby solar farms are not available to provide reactive power support.

## 1.1. Purpose of this report

The purpose of this PSCR[9] is to:

- set out the reasons why Transgrid proposes that action be taken (the 'identified need')
- present the options that Transgrid currently considers to address the identified need
- outline the technical characteristics that non-network options would need to provide
- summarise how we have assessed the options for addressing the identified need
- present the cost benefit assessment of all options for meeting the identified need
- identify the preferred option under the RIT-T assessment, and
- allow interested parties to make submissions and provide input to the RIT-T assessment.

## 1.2. Exemption from producing a Project Assessment Draft Report

This RIT-T is being progressed under the provisions in the NER[10] that allow the assessment to proceed from the initial PSCR to the final RIT-T Project Assessment Conclusions Report (PACR). This investment is eligible for this faster RIT-T process because:

- the estimated capital cost of the preferred option is less than $46 million[11];
- we have identified in this PSCR our proposed preferred option, together with the reasons for the preferred option; and

[8] AEMO, 2021 System Security Reports, December 2021.
[9] See Appendix A for the National Electricity Rules requirements.
[10] Clause 5.16.4(z1)
[11] Varied from $43m to $46m based on the AER Final Determination: Cost threshold review, November 2021.

- the proposed preferred option and any other credible options in respect of the identified need do not have any material market benefits (with the exception of market benefits arising from changes in voluntary 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 Project Assessment Draft Report (PADR) that updates the NPV assessment presented in this PSCR.

If no additional credible options with material market benefits are identified during the consultation period, then the next step in this RIT-T process will be the publication of a PACR that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period.

### 1.3. Submissions and next steps

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 31 August 2022.

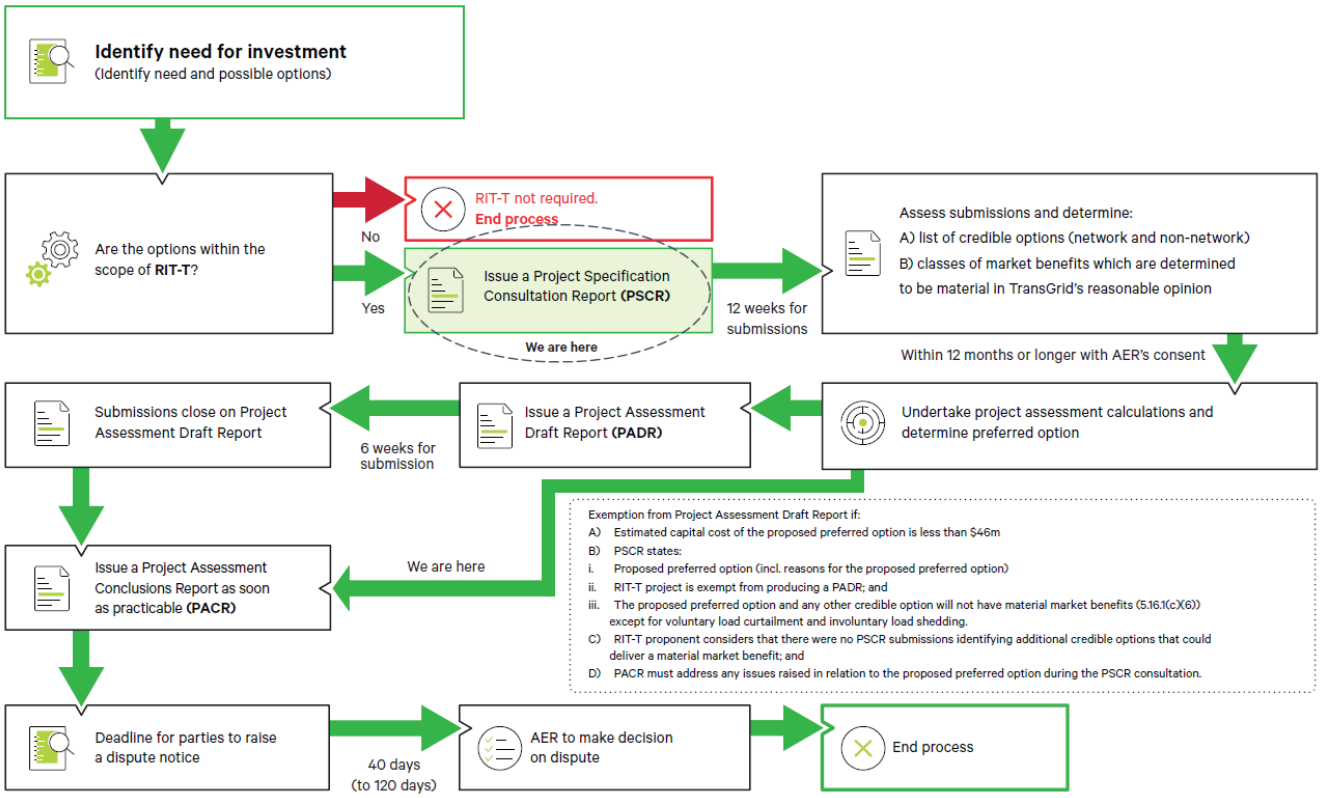
Submissions should be emailed to Transgrid's Regulation team via regulatory.consultation@transgrid.com.au.[12] In the subject field, please reference 'Maintaining Reliability in the Deniliquin, Coleambally and Finley area.'

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.

Should we consider that no additional credible options were identified during the consultation period, we intend to produce 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. Subject to additional credible options being identified, Transgrid anticipates publication of a PACR in October 2022.

[12] 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 1-1 This PSCR is the first stage of the RIT-T process

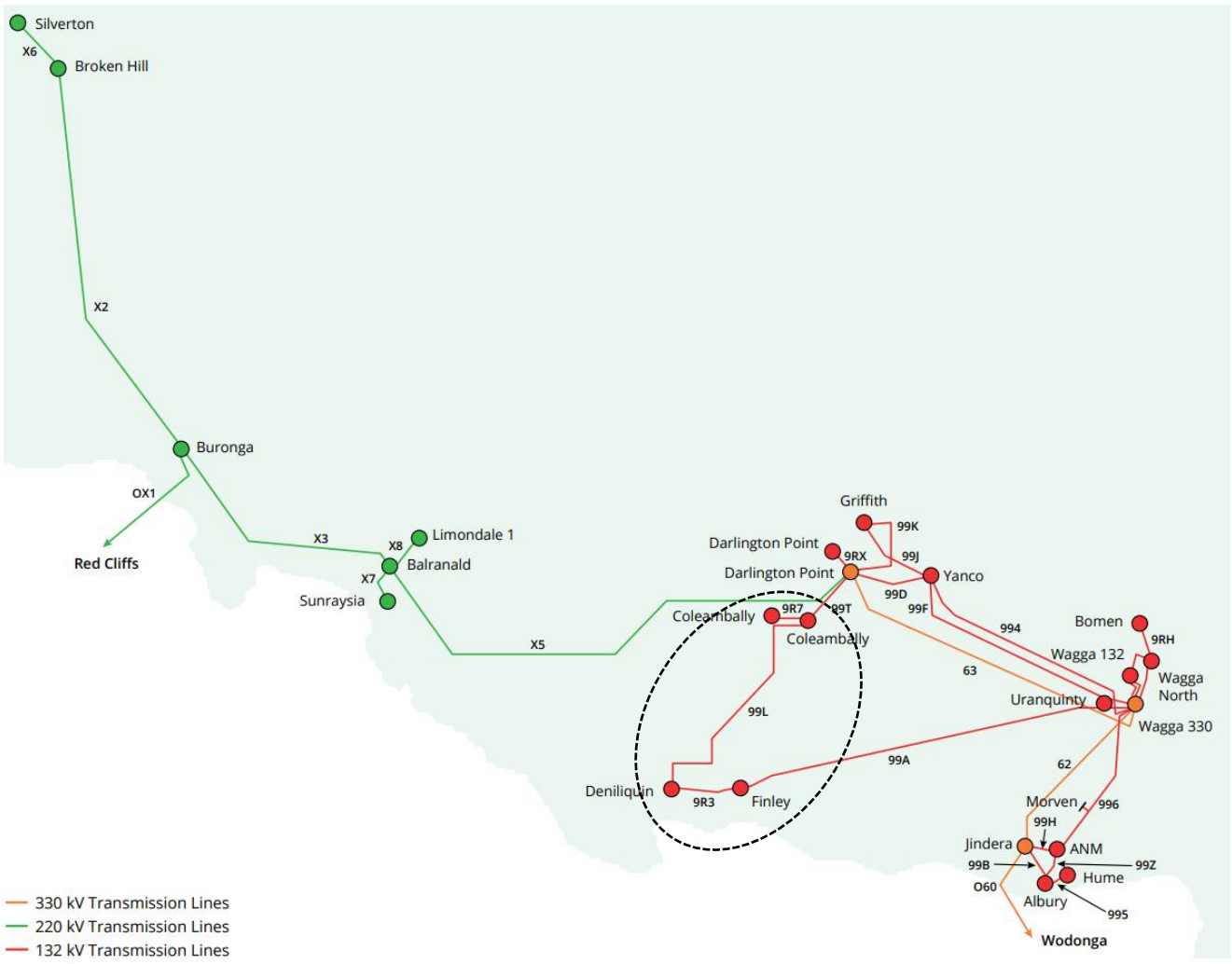


# 2. The identified need

## 2.1. Background to the identified need

The current south west NSW electricity transmission network is shown in in Figure 2-1 below. The Deniliquin and Coleambally areas are supplied by four 132 kV transmission lines which form a link between Wagga Wagga and Darlington Point, via Finley, Deniliquin and Coleambally. These are circled in Figure 2-1.

Figure 2-1: South west NSW transmission network




The latest demand forecasts show that the minimum demand in NSW will be steadily declining over the next 20 years due to gradual and continued growth in distributed solar generation capacity.[13] In south west NSW the expected growth in embedded generation is contributing the falling minimum demand in the Deniliquin and Coleambally areas into the future.

[13] AEMO, Electricity Statement of Opportunities (ESOO) 2021, August 2021

This declining minimum demand is leading to excessive voltage levels, particularly at night when solar farms are unavailable and demand is low.

## 2.2. Description of the identified need

Schedule 5.1.4 of the NER requires us to plan and design equipment for voltage control to maintain voltage levels within 10 per cent of normal voltage.[14] 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.[15]

Our power system studies show that the declining minimum demand in south western NSW, specifically in the Deniliquin, Coleambally and Finley areas means that there is an immediate need to manage the risk of excessive voltage levels leading to non-compliance with the NER under a single credible contingency. In April 2020, there were several events where excessive voltage levels occurred in this area during times of low demand. During these events, operational measures were implemented to manage the voltage levels by splitting the 132kV subsystem. However, these operational measures will reduce the reliability of supply in the area by placing load at risk in the event of a contingency.

In addition to the issues identified by Transgrid due to the declining minimum demand and increasing uptake of solar and embedded generation, AEMO have also declared a NSCAS gap in the Coleambally region of 2 MVAr absorbing reactive power for overnight when the nearby solar farms are not available.[16] As such, Transgrid is required to either procure services or implement a solution to address the NSCAS gap.

We have therefore commenced this RIT-T to assess options to ensure the above NER requirements continue to be met in the longer term in south west NSW in light of the declining minimum demand.

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.

## 2.3. Assumptions underpinning the identified need

This RIT-T has been initiated in response to declining minimum demand in the Deniliquin and Coleambally areas, as well as to address the NSCAS gap declared by AEMO in the Coleambally region. The demand forecasts underpinning the identified need for this RIT-T reflect the expected continued growth in embedded and distributed generation which will continue to reduce minimum demand in the region.

We have undertaken planning studies with a number of operating scenarios (day and night times) to assess the impact of the decreasing minimum demand. These studies shows that the voltage at the following busbars will exceed acceptable levels for the loss of the one of the 132 kV lines 99T (Darlington Point to Coleambally), 99A (Deniliquin to Finley) or 99L (Coleambally to Deniliquin):

- Coleambally 132 kV;

[14] These levels are specified in Clause S5.1a.4.

[15] 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.

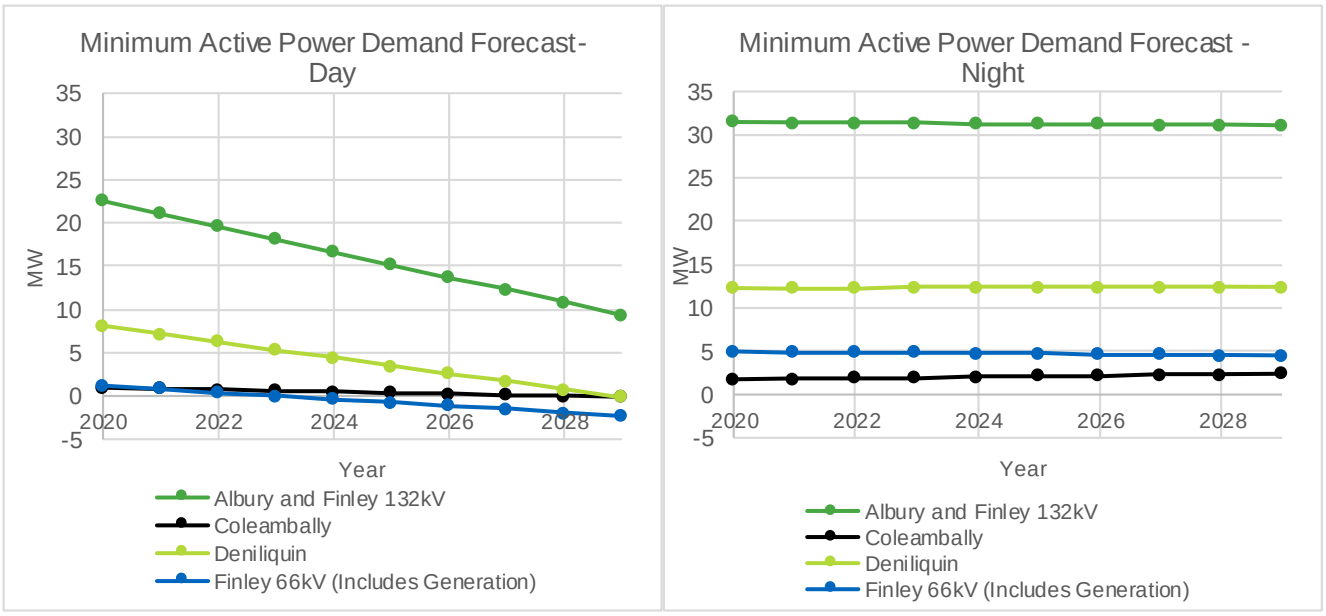
[16] AEMO, 2021 System Security Reports, December 2021

- Deniliquin 132 kV; and
- Finley 132 kV

Amongst these credible contingencies, the loss of Line 99T is considered as the critical contingency as it leads to the worst case results with highest over voltages at the Coleambally 132kV, Deniliquin 132kV, and Finley 132kV busbars are found to exceed 1.10 pu. Further, the corresponding voltage step change is exceeds 10%. This is expected to occur during both day time and night time periods when the demand is low and reactive power support is unavailable from the Finley Solar Farm.[17]

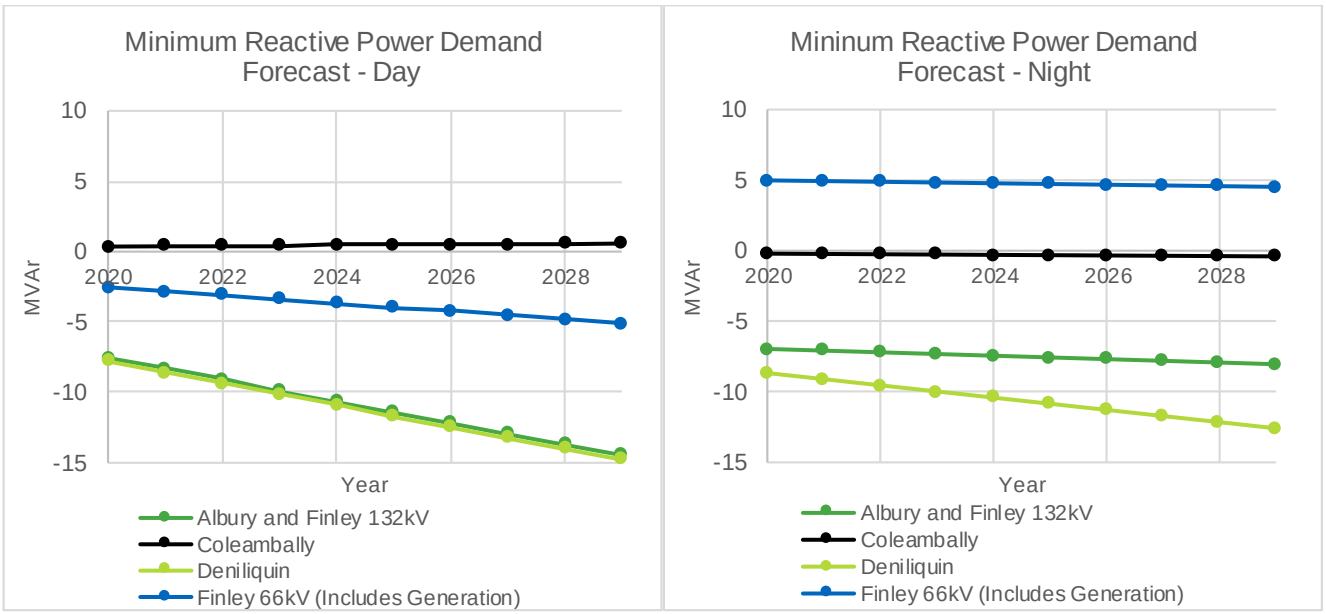
Figure 2-2 and Figure 2-3 below illustrates the POE50 minimum active (MW) and reactive (MVAr) power demand forecast at the Coleambally, Deniliquin and Finley 132 kV substations respectively.[18] The demand forecasts show that the day time minimum demand is declining at Deniliquin and Finley at a rapid rate compared to the night time minimum demand forecasts. This results in more pronounced over voltages for the day time scenarios followed by the critical contingency (trip of Line 99T) when reactive support is not available from the nearby solar farm. Additionally, the capacitive (injecting) reactive power forecast at Deniliquin and Finley contributes to the excessive voltages at these locations.

Figure 2-2: Coleambally, Deniliquin and Finley BSP POE50 minimum demand forecasts (Active Power Day/Night)




[17] Day time scenarios with an outage of Finley Solar Farm is the worst case result.
[18] Positive MVAr means Inductive (absorbing) reactive power whereas negative MVAr means Capacitive (injective) reactive power.

Figure 2-3 Coleambally, Deniliquin and Finley BSP POE50 minimum demand forecasts (Reactive Power Day/Night)




The analysis in this PSCR uses the central (POE 50) demand forecast provided by Essential Energy. Essential Energy do not produce a low (POE 90) or high (POE10) forecasts for minimum demand. However, as outlined in section 5.1, each of the credible options avoids exactly the same level of unserved energy and so the underlying demand forecasts are not considered material to the outcome of this RIT-T.

Figure 2-4 shows the voltage at the Coleambally, Deniliquin and Finley 132 kV bulk supply points (BSP) in the event of a contingency event on the 99T line using the central minimum demand forecast during the day time. Figure 2-5 shows these same voltages at night time. The figures show that the voltages are presently exceeding or will soon exceed 1.10 pu under a single credible contingency event. The highest over voltages are expected to occur during the day (when reactive power support is not available from the nearby solar farms).

Figure 2-4: Day time post-contingent voltage at Coleambally, Deniliquin and Finley

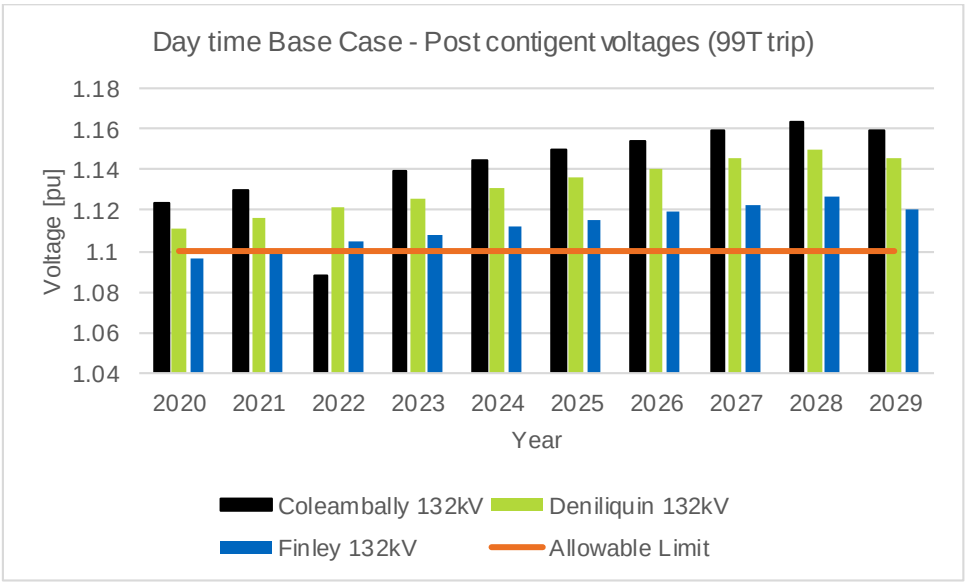
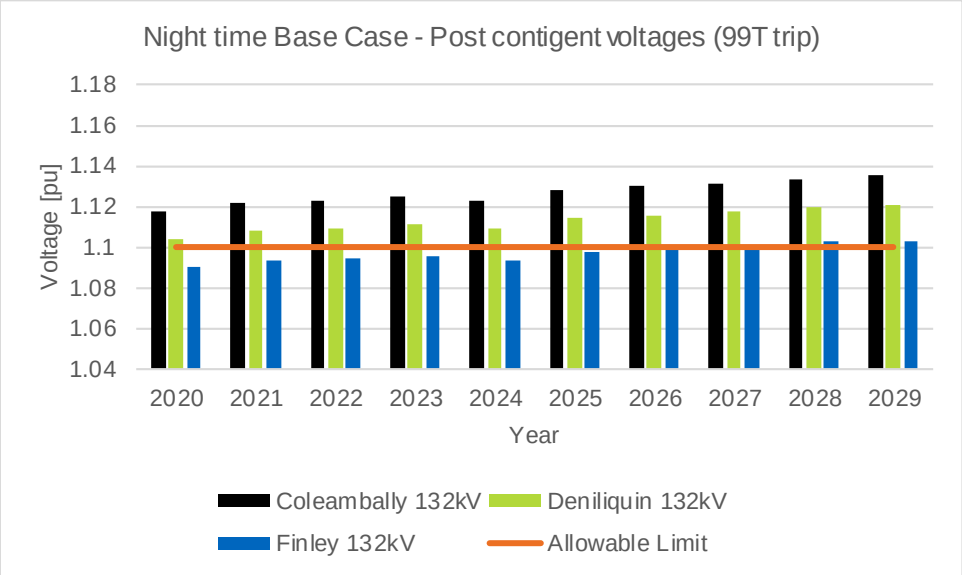


Figure 2-5: Night time post-contingent voltage at Coleambally, Deniliquin and Finley




The above assessment highlights the need is required to be addressed as soon as possible in order to ensure compliance with the NER as well as address the NSCAS gap declared by AEMO. In the interim, we have implemented operational measures to manage the voltage levels, however this reduces the reliability of supply to the region.

# 3. Options that meet the identified need

We consider credible options in this RIT-T assessment as those that would meet the identified need from a technical, commercial, and project delivery perspective.[19] This will include any credible options that are put forward by proponents in response to this PSCR.

The credible network options for this RIT-T all focus on reactors at Deniliquin substation. The options differ in terms of the busbars that any new reactor connect into and the rating of any new reactor.

Table 3-1 summarises each of the credible options we currently consider can meet the identified need. While the expected timing for all options is shown as later in 2024/25, we are endeavouring to have the preferred option in-place as soon as practical given the immediate need for voltage management in the area.

Table 3-1: Summary of the credible options

| Option | Description | Estimated capex ($2021-22) | Expected timing |
|---|---|---|---|
| 1 | Install two 10 MVAr 132 kV reactors at Deniliquin | $9.2 million | 2024/25 |
| 2 | Install two 11 MVAr 66 kV reactors at Deniliquin | $8.1 million | 2024/25 |

In addition, we consider that non-network solutions may be able to form credible options for this RIT-T. Section 4 provides details on the technical information that proponents of non-network options need to provide in order to enable their option to be considered in this RIT-T.

None of the credible options listed above are expected to have a material inter-regional impact.

## 3.1. Base case

Consistent with the RIT-T requirements, the assessment undertaken in this PSCR compares the costs and benefits of each option to a base case 'do nothing' option. The base case is the (hypothetical) projected case if no action is taken, ie:[20]

> "The base case is where the RIT-T proponent does not implement a credible option to meet the identified need, but rather continues its 'BAU activities'. 'BAU activities' are ongoing, economically prudent activities that occur in absence of a credible option being implemented"

Under the base case, where the excessive voltage levels due to declining minimum demand are unresolved, there is expected to a reduction in supply reliability to the Coleambally and Deniliquin areas. This is expected to result in unserved energy of 14 MWh per year, increasing to 15 MWh per year from 2042. The NSCAS gap declared by AEMO would also not be met.

While this is not a situation we plan to encounter, and this RIT-T has been initiated specifically to avoid it, the assessment is required to use this base case as a common point of reference when estimating the net benefits of each credible option.

[19] As per clause 5.15.2(a) of the NER.
[20] AER, *Regulatory Investment Test for Transmission Application Guidelines,* August 2020, p. 21.

## 3.2. Option 1 – Install two 10 MVAr 132kV reactors at Deniliquin

Option 1 involves installing two 10 MVAr 132kV reactors at the existing Deniliquin 132/66kV substation. The rating of the reactive power is estimated based on the expected over voltages for the day time scenario forecast with outage of the nearby solar farm, hence the reactive power requirement is larger than the NSCAS gap declared by AEMO (i.e 2 MVAr).

Two reactors are proposed to ensure that the switching voltage step size is within acceptable limits (<3%). This involves extending the existing switchyard (within the existing property boundary) to accommodate installation of the reactors and their associated switchbays.

The estimated capital cost of Option 1 is approximately $9.2 million as set out in Table 3-2.

Table 3-2 Option 1 Capital Cost ($M, real 2021-22)

| Capital cost | FY2021-22 | FY2022-23 | FY2023-24 | FY2024-25 |
|---|---|---|---|---|
| Option 1 | 0.5 | 0.8 | 7.5 | 0.4 |

Routine operating and maintenance cost are estimated at approximately $40,000/annum.

We estimate that it will take 42 months from this RIT-T commencement to complete Option 1 with commissioning possible in 2024/25.

This option will manage the excess network voltages in the region at times of low demand and therefore meet the NER compliance requirements as well as resolve the NSCAS gap.

## 3.3. Option 2 – Install two 11 MVAr 66kV reactors as Deniliquin

Option 2 involves installing two 11 MVAr 66kV reactors at the existing Deniliquin 132/66kV substation. The rating of the reactive power is estimated based on the expected over voltages for the day time scenario forecast with outage of the nearby solar farm, hence the reactive power requirement is larger than the NSCAS gap declared by AEMO (i.e 2 MVAr).

Two reactors are proposed to ensure that the switching voltage step size is within acceptable limits (<3%). This involves extending the existing switchyard (within the existing property boundary) to accommodate installation of the reactors and their associated switchbays.

The estimated capital cost of Option 2 is approximately $8.1 million as set out in Table 3-3.

Table 3-3 Option 2 Capital Cost ($M, real 2021-22)

| Capital cost | FY2021-22 | FY2022-23 | FY2023-24 | FY2024-25 |
|---|---|---|---|---|
| Option 2 | 0.4 | 0.7 | 6.6 | 0.4 |

Routine operating and maintenance cost are estimated at approximately $40,000/annum.

We estimate that it will take 42 months from this RIT-T commencement to complete Option 2 with commissioning possible in 2024/25.

This option will manage the excess network voltages in the region at times of low demand and therefore meet the NER compliance requirements as well as resolve the NSCAS gap.

## 3.4. Options considered but not progressed

We have also considered whether other options could meet the identified need. Reasons these options were not progressed are summarised in Table 3-4.

Table 3-4: Options considered but not progressed

| Option | Reason(s) for not progressing |
|---|---|
| Install a 16 MVAr reactor at Coleambally 132kV bus | This option is not technically feasible as a reactor installed at Coleambally would not sufficiently improve the voltages at Deniliquin and Finley during a contingent trip of 99T. |
| Reinstate two decomissioned 3 MVAr 11kV reactors or install two new 4 MVAr 11kV reactors at Deniliquin substation | This option is not technically feasible as the decommissioned reactor ratings are not adequate to alleviate the excess voltage conditions. New reactors are limited by the rating of the transformer tertiary windings and not able to alleviate the excess voltage conditions. |
| Upgrade the proposed Dinawan 330kV Switching Station to a 330/132kV Substation and build a new 132kV connection from Dinawan to Coleambally | This option is expected to have a significantly higher capital cost due to the need to establish a 132kV busbar at Dinawan and construct a 132kV transmission line. This option is not considered commercially feasible. This option would also take significantly longer to implement, prolonging the existing voltage and NSCAS gap issues. |

## 3.5. No material inter-network impact is expected

Transgrid has considered whether the credible options listed above is expected to have material inter-regional impact[21]. A 'material inter-network impact' is defined in the NER as:

> "*A material impact on another Transmission Network Service Provider's network, which impact may include (without limitation): (a) the imposition of power transfer constraints within another Transmission Network Service Provider's network; or (b) an adverse impact on the quality of supply in another Transmission Network Service Provider's network.*"

AEMO's suggested screening test to indicate that a transmission augmentation has no material inter-network impact is that it satisfies the following[22]:

- a decrease in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3 per cent of the maximum transfer capability and 50 MW
- an increase in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3 per cent of the maximum transfer capability and 50 MW
- an increase in fault level by less than 10 MVA at any substation in another TNSP's network; and

[21] As per clause 5.16.4(b)(6)(ii) of the NER.

[22] Inter-Regional Planning Committee. "*Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations*." Melbourne: Australian Energy Market Operator, 2004. Appendix 2 and 3. Accessed 23 June 2021. https://aemo.com.au/-/media/files/electricity/nem/network_connections/transmission-and-distribution/170-0035-pdf.pdf

- the investment does not involve either a series capacitor or modification in the vicinity of an existing series capacitor.

We consider that each credible option satisfies these conditions as it does not modify any aspect of transmission assets and will only have localised effects around the south west region of NSW. By reference to AEMO's screening criteria, there is no material inter-network impacts associated with any of the credible options considered.

# 4. Technical characteristics for non-network options

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 absorbing 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.

However, we note that the cost of the network options may act to effectively bound the cost available for any non-network options to be considered commercially feasible. We are interested in hearing from proponents on their individual solutions and costs.

This section describes the technical characteristics that a non-network option would need to deliver to address the identified need consistent with the NER.

The following table outlines the size, location, and nature of the required non-network option have been determined based on the power system studies carried out by Transgrid for a period of 10 years. Further, the size of the reactive power requirement have been estimated for the worst case scenario which is the day time minimum demand forecast for the critical contingency (loss of Line 99T) when Finely solar farm is out of service.

Table 5 - Reactive power requirement for the non-network options

| Year | Size – MVAr (absorbing) | Location | Time of the Day |
|---|---|---|---|
| 2022 | 6 | Coleambally 132 kV | Overnight |
| 2029 | 10 | | |
| 2022 | 8 | | Day |
| 2029 | 20 | | |

The prevailing conditions will require the non-network option to operate at night time during low NSW demand, with low to medium interconnector flows with adjacent states.

Like the network option, the switching of the non-network option must not exceed the voltage step limits (<3%) on the network. We note dynamic reactive support technologies are capable of providing reactive support to not exceed this voltage limit.

We welcome submissions to this PSCR from potential providers of non-network solutions.

# 5. Materiality of market benefits

The NER requires that all categories of market benefit identified in relation to the RIT-T are included in the RIT-T assessment, unless the TNSP can demonstrate that a specific category (or categories) is unlikely to be material in relation to the RIT-T assessment for a specific option.[23]

The PSCR is required to set out the classes of market benefit that the TNSP considers are not likely to be material for a particular RIT-T assessment.[24]

## 5.1. Avoided unserved energy has been estimated (but is not considered material to the RIT-T outcome)

We have estimated the expected unserved energy if action is not taken for each of the three scenarios, in order to specify the base case for the RIT-T assessment (refer Section 3.1).

Each option is expected to avoid all of this expected unserved energy from 2025/26 and so, given there is no difference in avoided expected unserved energy across the options, the level of USE does not have any impact on the identification of the preferred option under the RIT-T.

Other categories of market benefits prescribed in the NER have not been estimated and are not considered material for this RIT-T, as outlined below.

## 5.2. Wholesale electricity market benefits are not material

We consider at this stage that a number of classes of market benefits are not expected to be material in the RIT-T assessment, and so do not need to be estimated, since the credible options being considered are not anticipated to have a substantive impact on the wholesale electricity market.

The credible options considered in this PSCR do not address network constraints between competing generators and so will not have an impact on generation dispatch outcomes and the wholesale electricity market. Therefore, we consider that the following classes of market benefits are not material for this RIT-T assessment:

- changes in fuel consumption arising through different patterns of generation dispatch;
- changes in price-responsive voluntary load curtailment (since there is no significant impact on pool price);
- changes in costs for parties, other than for TransGrid (since there will be no deferral of generation investment);
- changes in ancillary services costs;
- competition benefits; and
- Renewable Energy Target penalties.

[23] NER clause 5.16.1(c)(6).
[24] NER clause 5.16.4(b)(6)(iii).

## 5.3. No other categories of market benefits are material

In addition to the classes of market benefits listed above, NER clause 5.16.1(c)(4) requires us to consider the following classes of market benefits, listed in Table 5-1, arising from each credible option.

The same table sets out the reasons we consider these classes of market benefits to be immaterial for this RIT-T assessment.

Table 5-1: Reasons non-wholesale electricity market benefits categories are considered not material

| Market benefits | Reason |
|---|---|
| Differences in the timing of unrelated network expenditure | The credible options considered are all designed to meet the required reliability requirements and are unlikely to affect decisions to undertake unrelated expenditure in the network. Consequently, material market benefits will neither be gained nor lost due to changes in the timing of expenditure from any of the options considered. |
| Option value | Given the immediate nature of the identified need, none of the credible options considered possess the flexibility required for there to be any option value. |
| Changes in network losses | There is not expected to be any material difference in transmission losses between options. |

# 6. Overview of the assessment approach

This section outlines the approach that Transgrid has applied in assessing the net benefits associated with each of the credible options against the base case.

## 6.1. Description of the base case

As outlined in section 3.1, all costs and benefits considered have been measured against a base case where the excessive voltage levels associated with declining minimum demand in the Deniliquin, Coleambally and Finley area remain unresolved and there is a resulting reduction in the reliability of supply.

## 6.2. Assessment period and discount rate

The RIT-T analysis considers a 20-year assessment period from 2021-22 to 2040-41. A 20-year period reflects the timeframe for which demand forecasts for the area are available. It also takes into account the size, complexity and expected lives of the options and provides a reasonable indication of the costs and benefits over a long outlook period.

Where the capital components of the credible options have asset lives extending beyond the end of the assessment period, the NPV modelling includes a terminal value to capture the remaining asset life. This ensures that the capital cost of long-lived options over the assessment period is appropriately captured, and that all options have their costs and benefits assessed over a consistent period, irrespective of option type, technology or asset life. The terminal values have been calculated as the undepreciated value of capital costs at the end of the analysis period and can be interpreted as a conservative estimate for benefits (net of operating costs) arising after the analysis period.

A real, pre-tax discount rate of 5.50 per cent has been applied as the central assumption for the NPV analysis, consistent with the central estimate discount rate adopted by AEMO in its 2021 IASR[25] and used in the draft 2022 Integrated System Plan (ISP). The RIT-T requires that sensitivity testing be conducted on the discount rate and that the regulated weighted average cost of capital (WACC) be used as the lower bound. We therefore have tested the sensitivity of the results to a lower bound discount rate of 2.30 per cent[26], and an upper bound discount rate of 7.50 per cent (i.e., the upper bound proposed for the 2022 ISP[27]).

## 6.3. Approach to estimating option costs

Transgrid has estimated the capital and operating costs of the options based on the scope of works necessary together with costing experience from previous projects of a similar nature. Transgrid estimates that the actual cost is within +/- 25 per cent of the central capital cost.

[25] AEMO, 2021 Inputs, Assumptions and Scenarios Report, July 2021

[26] The lower bound discount rate is based on the WACC (pre-tax, real) in the most recent final decision for a TNSP revenue determination which was Powerlink in April 2022.

[27] AEMO, 2021 Inputs, Assumptions and Scenarios Report, July 2021, p. 105.

## 6.4. Three different scenarios have been modelled to address uncertainty

The RIT-T is focused on identifying the top-ranked credible option in terms of expected net benefits. However, uncertainty exists in terms of estimating future inputs and variables (termed future 'states of the world').

To deal with this uncertainty, the NER requires that costs and market benefits for each credible option are estimated under reasonable scenarios and then weighted based on the likelihood of each scenario to determine a weighted ('expected') net benefit. It is this 'expected' net benefit that is used to rank credible options and identify the preferred option.

We have applied three alternative scenarios in the PADR assessment – namely:

- a 'low net economic benefits' scenario, involving a number of assumptions that gives a lower bound and conservative estimates of net present value of net economic benefits;
- a 'central' scenario which consists of assumptions that reflect our central set of variable estimates that provides the most likely scenario; and
- a 'high net economic benefits' scenario that reflects a set of assumptions, which have been selected to investigate an upper bound of net economic benefits.

We have applied a NSW-wide VCR value based on the estimates developed and consulted on by the AER[28] and used a -/+ 30% for the low and high benefit scenarios, respectively. However, we note that as outlined in section 5.1, each option is expected to avoid the same amount of unserved energy and so the value of this is not considered material for this RIT-T, i.e., it does not have any impact on the identification of the preferred option under the RIT-T.

A summary of the key variables in each scenario is provided in the table below.

Table 6-1 Summary of scenarios

| Variable / Scenario | Central | Low benefit scenario | High benefit scenario |
|---|---|---|---|
| *Scenario weighting* | *50%* | *25%* | *25%* |
| Discount rate | 5.50% | 7.50% | 2.30% |
| Network capital costs | Base estimate | Base estimate + 25% | Base estimate - 25% |
| Operating and maintenance costs | Base estimate | Base estimate + 25% | Base estimate - 25% |
| Value of Customer Reliability (VCR) | $43.69/MWh | $30.58/MWh | $56.79/MWh |
| Minimum demand forecast | POE50 | POE50 | POE50 |

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

[28] AER, Values of Customer Reliability, Final report on VCR values, December 2019. Escalated to December 2021 values.

# 7. Assessment of credible options

This section outlines the assessment TransGrid has undertaken of the credible options.

The assessment compares the costs and benefits of the option to a base case 'do nothing' option, where the excess voltage levels associated with declining minimum demand around Deniliquin, Coleambally and Finley are unresolved.

## 7.1. Gross benefits

The table below summarises the gross benefit estimated for each of the options relative to the 'do nothing' base case in present value terms. The benefits included in this assessment are avoided involuntary load shedding.

Table 7-1: Gross economic benefits relative to the base case, PV $M

| Option/scenario | Central | Low benefit | High benefit |
|---|---|---|---|
| Scenario weighting | 50% | 25% | 25% |
| Option 1 | 5.7 | 3.3 | 10.3 |
| Option 2 | 5.7 | 3.3 | 10.3 |

The gross benefit has been calculated for each of the three reasonable scenarios outlined in the section 6.2 above and is comprised entirely of avoided unserved energy (which is the same for each option under each scenario). The present values presented above reflect different underlying assumed demand growth rates and commercial discount rates, across the scenarios (as set out in Table 6-1).

## 7.2. Estimated costs

The table below summarises the costs of each option, relative to the base case, in present value terms.

Table 7-2: Costs relative to the base case, PV $M

| Option/scenario | Central | Low benefit | High benefit |
|---|---|---|---|
| Scenario weighting | 50% | 25% | 25% |
| Option 1 | 7.3 | 9.2 | 5.1 |
| Option 2 | 6.4 | 8.1 | 4.5 |

The present value of the cost of the options has been calculated for each scenario using different assumed capital costs and discount rates (as set out in Table 6-1).

## 7.3. Net market benefits

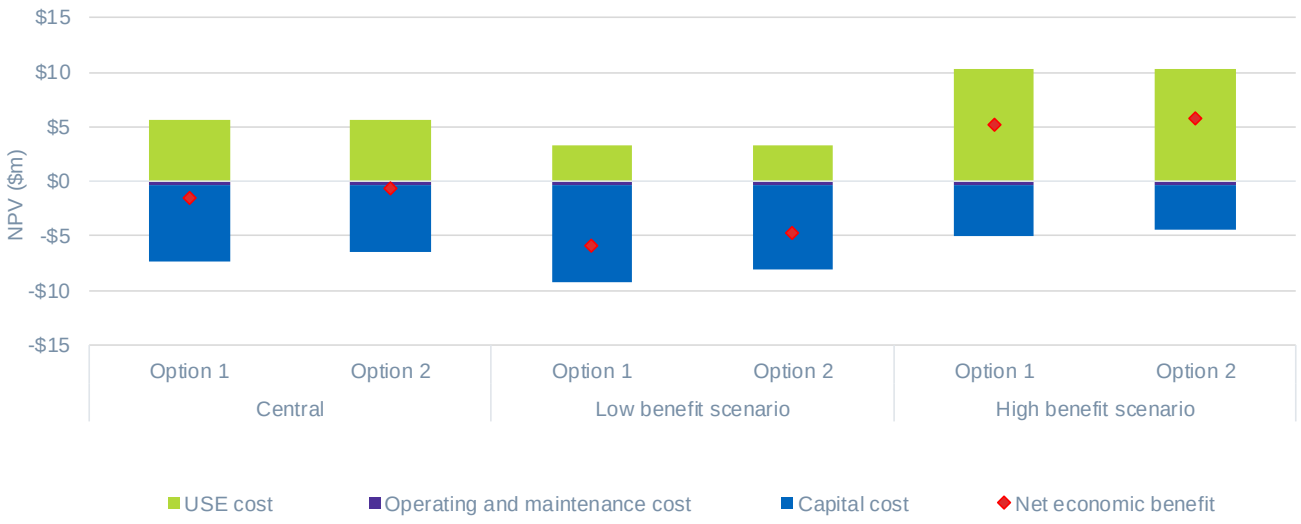
The table below summaries the net market benefit in NPV terms for each option across the three scenarios, as well as on a weighted basis. The net market benefit is the gross benefits (as set out in section 7.1 above) minus the costs (as outlined in section 7.2 above), all in present value terms. The option ranking for each scenario is shown in parentheses.

The table shows that Option 2 is found to have the greatest net market benefits of all the options considered. Since this RIT-T is a reliability corrective action, the top-ranked option is permitted to have a negative market benefit.

Table 7-3: Net benefits relative to the base case, PV $M

| Option/scenario | Central | Low benefit | High benefit | Weighted |
|---|---|---|---|---|
| Scenario weighting | 50% | 25% | 25% | |
| Option 1 | -1.6 (2) | -6.0 (2) | 5.2 (2) | -1.0 (2) |
| Option 2 | -0.8 (1) | -4.8 (1) | 5.8 (1) | -0.2 (1) |

Figure 7-1 Net economic benefits, PV $M




## 7.4. Sensitivity testing

In addition to the scenario analysis, we have also considered the robustness of the outcome of the cost benefit analysis through undertaking a range of sensitivity testing. These tests all relate to the central scenario.

The range of factors tested as part of the sensitivity analysis in this PSCR are:

- lower and higher assumed VCRs,
- network capital costs of the credible options, and
- alternate commercial discount rate assumptions.

Each of the sensitivity tests undertaken are discussed in the sections below.

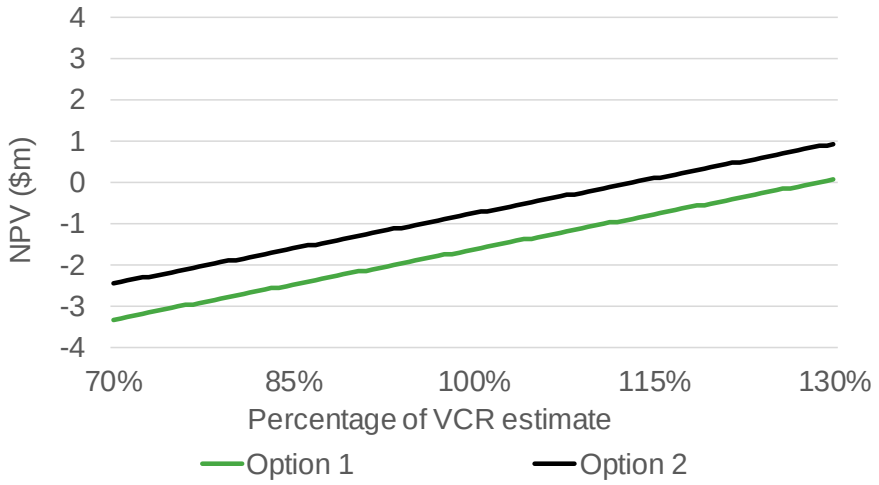
### 7.4.1. Assumed VCR

The table and figure below summarises the net benefit estimated for each of the options relative to the 'do nothing' base case assuming both a 30 per cent higher and a 30 per cent lower VCR value. The option ranking for each sensitivity is shown in parentheses and does not change, compared to the core results above, for either sensitivity, i.e., Option 2 is always ranked first.

Table 7-4: Net economic benefits relative to the base case under a lower and higher VCR, PV $M

| Option/scenario | Low VCR | High VCR |
|---|---|---|
| Option 1 | -3.3 (2) | 0.1 (2) |
| Option 2 | -2.5 (1) | 0.9 (1) |

Figure 7-2 Net economic benefits relative to the base case with lower and higher VCR, PV $M



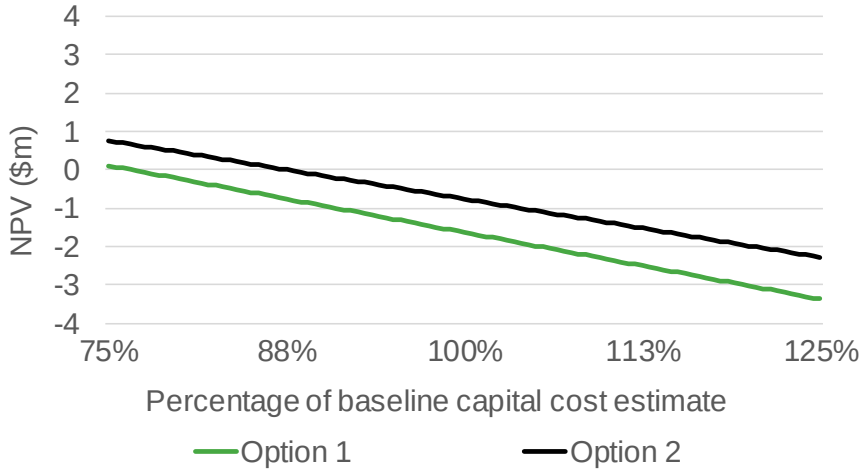

### 7.4.2. Assumed capital costs

The table and figure below summarises the net benefit estimated for each of the options relative to the 'do nothing' base case assuming both a 25 per cent higher and a 25 per cent lower capital cost for each option. The option ranking for each sensitivity is shown in parentheses and does not change, compared to the core results above, for either sensitivity, i.e., Option 2 is always ranked first.

Table 7-5: Net economic benefits relative to the base case under a lower and higher capital costs, PV $M

| Option/scenario | Low capex | High capex |
|---|---|---|
| Option 1 | 0.1 (2) | -3.4 (2) |
| Option 2 | 0.8 (1) | -2.3 (1) |

Figure 7-3 Net economic benefits relative to the base case with lower and higher capital costs, PV $M



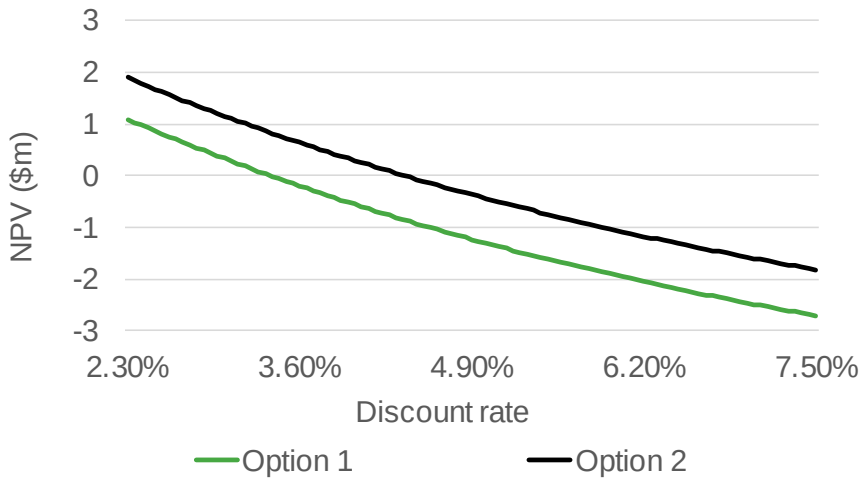
### 7.4.3. Assumed commercial discount rate

The table and figure below summarises the net benefit estimated for each of the options relative to the 'do nothing' base case assuming both a low commercial discount rate (2.30 per cent) and a high commercial discount rate (7.50 per cent). The option ranking for each sensitivity is shown in parentheses and does not change, compared to the core results above, for either sensitivity, i.e., Option 2 is always ranked first.

Table 7-6: Net economic benefits relative to the base case under a lower and higher discount rates, PV $M

| Option/scenario | Low discount rate | High discount rate |
|---|---|---|
| Option 1 | 1.1 (2) | -2.7 (2) |
| Option 2 | 1.9 (1) | -1.8 (1) |

Figure 7-4 Net economic benefits relative to the base case with lower and higher discount rates, PV $M



# 8. Draft conclusion and exemption from preparing a PADR

Option 2 is the preferred option at this draft stage and involves installing two new 11 MVAr reactors at Deniliquin to the 66kV bus.

The estimated capital cost of Option 2 is approximately $8.1 million. Routine operating and maintenance cost are estimated at approximately $40,000/annum.

We estimate that it will take 42 months to complete Option 2 with commissioning in 2024/25.

NER clause 5.16.4(z1) provides for a TNSP to be exempt from producing a PADR for a particular RIT-T application, in the following circumstances:

- if the estimated capital cost of the preferred option is less than $46 million;
- if the TNSP identifies in its PSCR its proposed preferred option, together with its reasons for the preferred option and notes that the proposed investment has the benefit of the clause 5.16.4(z1) exemption; and
- if the TNSP considers that the proposed preferred option and any other credible options in respect of the identified need will not have a material market benefit for the classes of market benefit specified in clause 5.16.1(c)(4), with the exception of market benefits arising from changes in voluntary and involuntary load shedding.

We consider that investment in relation to Option 2 is exempt from the requirement to publish a PADR under NER clause 5.16.4(z1).

This exemption would no longer apply if an additional credible option that we consider could deliver a material market benefit is identified during the consultation period. In that case, we will produce a PADR which includes an NPV assessment of the net market benefit of each additional credible option.

If we consider that no additional credible options have been identified during the consultation period that have material market benefits, the next step in this RIT-T process will be the publication of a PACR that addresses all submissions received, including any issues in relation to the proposed preferred option raised during the consultation period.[29]

[29] In accordance with NER clause 5.16.4(z2).

# Appendix A Compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PSCR with the requirements of the National Electricity Rules version 182.

| Rules clause | Summary of requirements | Relevant section |
|---|---|---|
| 5.16.4 (b) | A RIT-T proponent must prepare a report (the project specification consultation report), which must include: | – |
| | (1) a description of the identified need; | 2 |
| | (2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-T proponent considers reliability corrective action is necessary); | 2 |
| | (3) the technical characteristics of the identified need that a non-network option would be required to deliver, such as:<br>(i) the size of load reduction of additional supply;<br>(ii) location; and<br>(iii) operating profile; | 4 |
| | (4) if applicable, reference to any discussion on the description of the identified need or the credible options in respect of that identified need in the most recent National Transmission Network Development Plan; | NA |
| | (5) a description of all credible options of which the RIT-T proponent is aware that address the identified need, which may include, without limitation, alterative transmission options, interconnectors, generation, demand side management, market network services or other network options; | 3 |
| | (6) for each credible option identified in accordance with subparagraph (5), information about:<br>(i) the technical characteristics of the credible option;<br>(ii) whether the credible option is reasonably likely to have a material inter-network impact;<br>(iii) the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.16.1(c)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material;<br>(iv) the estimated construction timetable and commissioning date; and<br>(v) to the extent practicable, the total indicative capital and operating and maintenance costs. | 3 & 5 |
| 5.16.4(z1) | A RIT-T proponent is exempt from [preparing a PADR] (paragraphs (j) to (s)) if: | 8 |

| | | |
|---|---|---|
| | 1. the estimated capital cost of the proposed preferred option is less than $35 million[30] (as varied in accordance with a cost threshold determination);<br>2. the relevant Network Service Provider has identified in its project specification consultation report: (i) its proposed preferred option; (ii) its reasons for the proposed preferred option; and (iii) that its RIT-T project has the benefit of this exemption;<br>3. the RIT-T proponent considers, in accordance with clause 5.16.1(c)(6), that the proposed preferred option and any other credible option in respect of the identified need will not have a material market benefit for the classes of market benefit specified in clause 5.16.1(c)(4) except those classes specified in clauses 5.16.1(c)(4)(ii) and (iii), and has stated this in its project specification consultation report; and<br>4. the RIT-T proponent forms the view that no submissions were received on the project specification consultation report which identified additional credible options that could deliver a material market benefit. | |

[30] Varied to $46m based on the AER Final Determination: Cost threshold review November 2021.