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Increasing capacity for generation in the Molong and Parkes area

RIT-T Project Specification Consultation Report

Region: Central West NSW

Date of issue: 29 July 2022

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Executive summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options for improving capacity for renewable generation in the Molong and Parkes area. Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

The Molong and Parkes area has seen significant growth in renewable generation connections to the transmission network, as part of the wider energy market transition. New renewable generators have connected or are planning to connect to the network west of our Molong 132/66 kV substation. Twelve solar and wind generation farms in the area with a combined output of 1135 MW are already in service, with a further 323 MW of generation committed or in advanced stage.

Line 94T plays a central role in transmitting the electricity from these renewable generators in the Molong and Parkes area to the load in Orange. It connects Molong substation to Orange North switching station, which in turn supplies Orange city, Cadia Mine and surrounding areas.

The existing rating of the 132 kV Line 94T (Molong – Orange North), is constraining renewable generation in the Molong and Parkes area. AEMO's monthly constraint reports since September 2021 have consistently identified Line 94T as a top 10 constraint on the National Electricity Market (NEM). Network modelling shows thermal overloading of Line 94T is expected under normal system conditions with the current level of in-service and committed generation dispatched to their maximum capacities. Hence, we have identified the opportunity to strengthen the transmission network to relieve this constraint and realise net market benefits by avoiding curtailment of low cost renewable generation in the Molong and Parkes area.

Identified need: provide net benefits to the market by improving capacity for renewable generation in the Molong and Parkes area

The identified need for this RIT-T is to increase overall net market benefits in the NEM through improving capacity and relieving existing constraints on renewable generation in the Molong and Parkes area. This will enable greater output from renewable generation in this region of the NEM.

Within the context of the RIT-T assessment, greater output from renewable generation is expected to deliver market benefits primarily through:

- reductions in total dispatch costs (including fuel costs), by enabling low cost renewable generation to displace higher cost conventional generation elsewhere; and
- reducing the need for new investment in generating plant, or a deferral of generation investment.

We consider this a 'market benefits' driven RIT-T as opposed to a 'reliability corrective action', and expect the preferred option to have positive net market benefits.

Two credible network options have been identified

We have identified two credible network options that would meet the identified need from a technical, commercial, and project delivery perspective.[1]

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

These options are summarised in Table E-1 below.

Table E-1: Summary of the credible options

Option	Description	Estimated capital cost ($m 2021/22)	Expected delivery time	Expected increase in Line 94T system normal rating
Option 1	Increase transmission line design temperature of Line 94T	1.4 (+/- 25%)	2023/24	13 MVA
Option 2	Restring Line 94T with a higher rated conductor on existing structures	7.5 (+/- 25%)	2024/25	38 MVA

Non-network options may also be able to form credible options for this RIT-T

We consider that non-network solutions may be able to assist with meeting the identified need, either as standalone options or in combination with network options (or components of these options).

At this stage, we consider that possible solutions include but are not limited to:

- bulk or aggregated energy storage systems, e.g.:
  - sealed batteries;
  - flow batteries;
  - concentrated solar thermal with storage;
  - compressed air storage;
  - pumped hydro; and
- voluntary curtailment of customer load.

This PSCR includes the following for the thermal constraint:

- magnitude of MW support required;
- expected cumulative exposure of 94T to overload per annum (hours);
- location; and
- expected time of the day.

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.

Wholesale market modelling will be adopted for the PADR analysis

The options considered are expected to affect outcomes in the wholesale market, relative to the base case. This additional capacity is expected to provide for more efficient outcomes in the wholesale market, by increasing the output of low cost renewable generation in the Molong and Parkes area.

At this stage, we consider that market benefits from changes in fuel consumption arising through different size and patterns of generation dispatch have the potential to be material for this RIT-T and will be estimated in the wholesale market modelling as part of the PADR.

Submissions and next steps

We welcome 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 26 October 2022.

Submissions should be emailed to Transgrid's Regulation team via regulatory.consultation@transgrid.com.au.[2] In the subject field, please reference 'Molong and Parkes area PSCR.'

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 the Project Assessment Draft Report (PADR). The PADR will include the full quantitative analysis of all credible options and is anticipated to be published in late 2022.

[2] 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 for improving capacity for renewable generation in the Molong and Parkes area. Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process.

The Molong and Parkes area has seen significant growth in renewable generation connections to the transmission network, as part of the wider energy market transition. New renewable generators have connected or are planning to connect to the network west of our Molong 132/66 kV substation. Twelve solar generation farms in the area with a combined output of 1135 MW are already in service, with a further 323 MW of generation committed or in advanced stage.

The existing rating of the 132 kV Line 94T (Molong – Orange North), is constraining renewable generation in the Molong and Parkes area. Line 94T plays a central role in transmitting the electricity from renewable generators in the Molong and Parkes area to the load in Orange. It connects Molong substation to Orange North switching station, which in turn supplies Orange city, Cadia Mine and surrounding areas.

We have identified the opportunity to increase the capacity for renewable generation by relieving this constraint to realise net market benefits. This will result in an overall increase in benefits to participants in the National Electricity Market (NEM), and is consequently a market benefits RIT-T.

1.1. Purpose of this report

The purpose of this PSCR[3] is to:

- set out the reasons why we propose that action be taken (the 'identified need')
- present the options that we currently consider to address the identified need
- outline the technical characteristics that non-network options would need to provide
- summarise how we intend to assess options for addressing the identified need in the Project Assessment Draft Report (PADR)
- allow interested parties to make submissions and provide inputs to the RIT-T assessment.

1.2. Submissions and next steps

We welcome 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 26 October 2022.

Submissions should be emailed to Transgrid's Regulation team via regulatory.consultation@transgrid.com.au.[4] In the subject field, please reference 'Molong and Parkes area PSCR.'

[3] See Appendix A for the National Electricity Rules requirements.

[4] 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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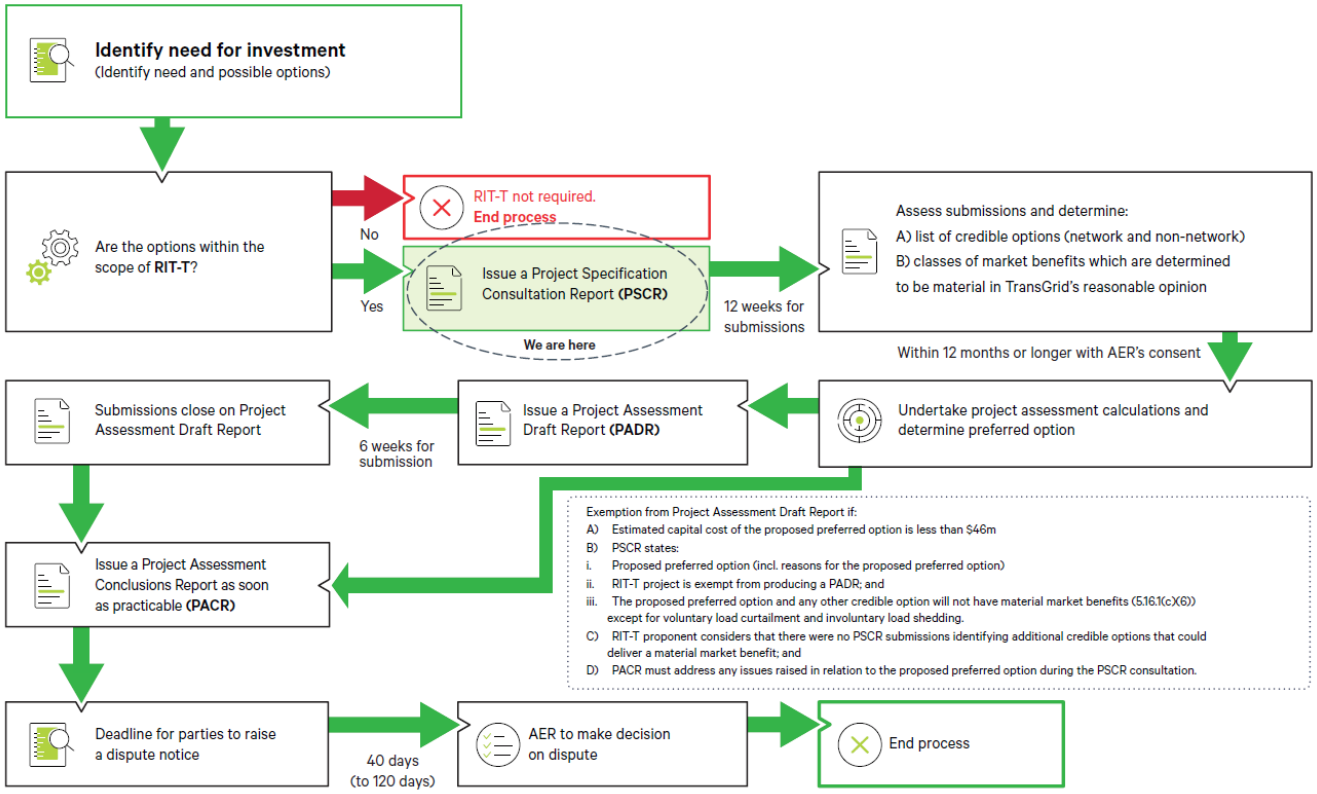
The next formal stage of this RIT-T is the publication of the Project Assessment Draft Report (PADR). The PADR will include the full quantitative analysis of all credible options and is anticipated to be published in late 2022.

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



2. The identified need

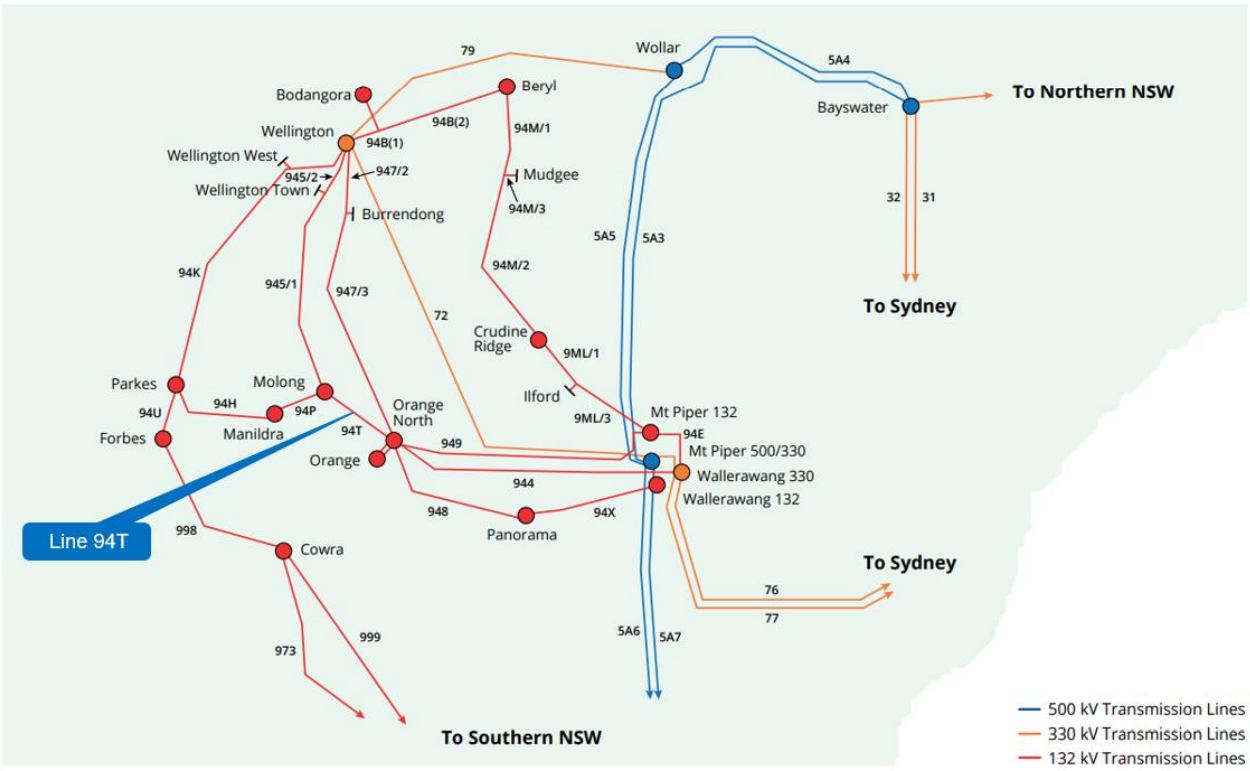
This section outlines the identified need for this RIT-T, as well as the assumptions and data underpinning it. It sets out background information related to the Central West NSW transmission network and existing electricity supply arrangements.

2.1. Background to the identified need

Molong 132/66 kV substation is located in Central West NSW in an area of interest for new renewable generation. New renewable generation with a combined output of 1135 MW is in service in the region and a further 323 MW of renewable generation is committed or in advanced stage. See section 2.3.3 for details.

Line 94T forms part of the network that serves the Central West region of NSW. It plays a central role in transmitting electricity from renewable generators in the Molong and Parkes area, northwest of Molong substation, to the load in Orange and Panorama, south of Molong substation. The location of Line 94T and supply arrangements for the Central West network is provided in Figure 2-1 below.

Figure 2-1 Location of Line 94T on our Central West transmission network



Line 94T is a 132 kV transmission line which connects our Molong 132/66 kV substation to our Orange North 132 kV switching station. It connects:

- to the north-west at Molong 132/66kV substation. Molong substation is a customer connection point supplying the Essential Energy distribution network. It is located in the Cabonne Shire and supports the flow of electricity to local industries[5], as well as a residential population of approximately 13,000[6], and
- to the south-east at Orange North switching station. Line 94T is one of four 132 kV transmission lines which supply Orange North switching station. The switching station supplies Orange — a city in the Central Tablelands region with a population of approximately 38,000[7]. It also supplies Cadia Mine which is one of Australia's largest gold mining operations, and surrounding areas. The total POE 50 forecast summer peak demand for Orange and Panorama is expected to grow from approximately 309 MW in 2022/23 to 322 MW by 2030/31.[8]

Due to a combination of increasing demand in the Orange area and increasing generation west of Molong substation, network studies have identified high power transfer from these new generators though Line 94T to supply load in the Orange and Panorama area. If the constraint caused by the existing 112 MVA (summer daytime) thermal capacity limit of Line 94T is not addressed by a technically and commercially feasible credible option, the output curtailment of low cost renewable generation in the Molong and Parkes area will increase.

2.2. Description of the identified need

The thermal constraints imposed due to the rating of 132 kV Line 94T (Molong – Orange North) are constraining the output of renewable generation in the Molong and Parkes area. At times of high renewable generation output, thermal overloading of the 132 kV Line 94T can occur. This resulted in the Australian Energy Market Operator (AEMO) introducing operational constraints in the NEM Dispatch Engine (NEMDE) to limit power flows in order to manage the risk of thermal overload on Line 94T.

AEMO's monthly constraint reports[9] since September 2021 have consistently identified Line 94T as a top 10 constraint on the National Electricity Market (NEM). Since December 2021, the Line 94T constraint has been the highest binding impact network constraint. The table below summarises Line 94T binding constraints since September 2021 based on AEMO's monthly constraint reports.

Table 2-1 Line 94-T constraints on the market

Year	Month	System Normal Binding hours (h)	System Normal Binding Impact (sum of marginal values)
2021	September	152	1,945,881
2021	October	138	1,785,029

[5] Major industries within Carbonne include agriculture, mining and tourism and contribute towards the $849.5 million annual economy and contribute significantly to the regional economy. Carbonne Council. "Carbonne Local Strategic Planning Statement 2020" 2020.10. Accessed 22 September 2021. https://www.cabonne.nsw.gov.au/files/sharedassets/public/planning-and-development/local-strategic-planning-statement/cabonne-local-strategic-planning-statement-2020.pdf

[6] The population of the Carbonne Local Government Area is 13,386, as per the 2016 Census. Australian Bureau of Statistics, "2016 Census QuickStats", accessed 22 September 2021. https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA11400?opendocument

[7] The population of Orange is 38,097, as per the 2016 Census. Australian Bureau of Statistics, "2016 Census QuickStats", accessed 22 September 2021. https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC13092?opendocument

[8] Forecast for Orange region (listed as Orange 66 kV, Orange 132 kV and Panorama 66 kV) for summer 2022/23 and summer 2030/31. TransGrid. "Transmission Annual Planning Report 2021." Sydney: TransGrid, 2021.119. Accessed 22 September 2021. https://www.transgrid.com.au/news-views/publications/Documents/TAPR_2021.pdf

[9] AEMO, Statistical reporting streams - Monthly Constraint Report

Year	Month	System Normal Binding hours (h)	System Normal Binding Impact (sum of marginal values)
2021	November	87	1,128,590
2021	December	270	5,031,559
2022	January	220	4,083,176
2022	February	170	3,006,655
2022	March	167	2,461,143
2022	April	145	2,244,030
2022	May	75	1,221,198

2.3. Assumptions underpinning the identified need

This section sets out the key assumptions underpinning the identified need.

2.3.1. Thermal capacity of Line 94T is insufficient to meet increasing generation requirements

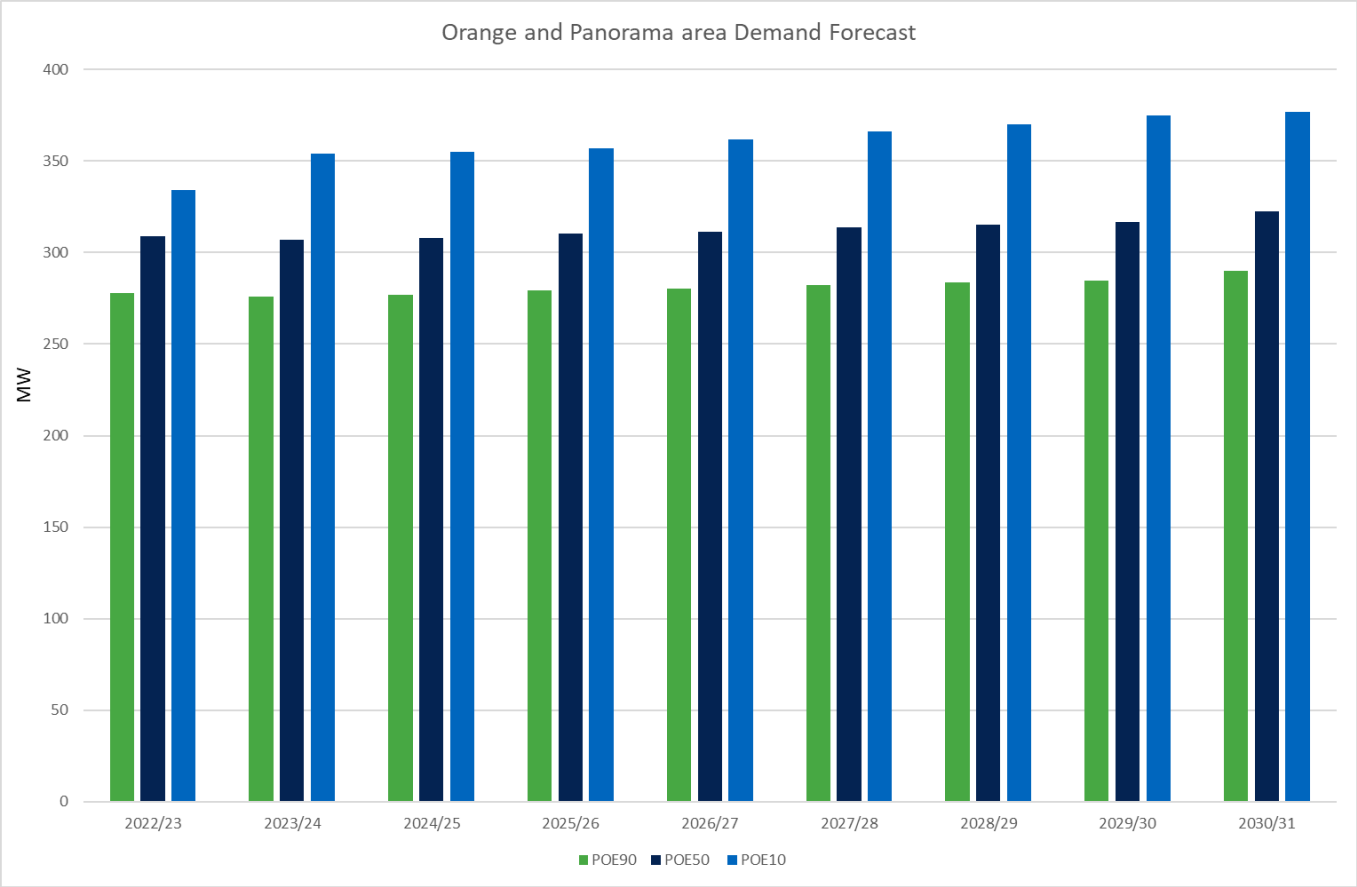
Line 94T consists of sections of Oxygen, Wolf and Neon conductors. Oxygen and Neon are installed on approximately 2km of the line. The Wolf conductor, which is installed for approximately 27km of the line, has the lowest rating of 112 MVA.

Network modelling shows thermal overloading of Line 94T is expected under system normal and single contingency conditions, with the current level of in-service and committed or advanced generation dispatched to their maximum capacities. Regular limitations on the output of generators will be required at the current Line 94T rating. Consequently, a substantial quantity of low-cost renewable energy from these generators will be curtailed throughout the course of a year.

2.3.2. Electricity demand in the Orange area

As described in Section 2.2, the increasing load in the Orange area over time will contribute to ongoing curtailment and constraints on generation output in the Molong and Parkes area. Load in the Orange and Panorama area is expected to grow from approximately 309 MW in 2022/23 to 322 MW by 2030/31 due to expansion of industrials load in the area. Figure 2-2 shows the load forecast for the Orange and Panorama area.

Figure 2-2 Orange and Panorama area load forecast



2.3.3. Renewable generation in the Molong, Parkes and Wellington area

Renewable generation west of Molong will contribute to ongoing curtailment and constraints on generation output. Renewable generation with a combined output of 1135 MW is in service in the region and a further 323 MW of renewable generation is planned as summarised in Table 2-2.

Table 2-2 Current and planned renewable generation in the Molong/Parkes/Wellington area

Generating System	Connection location	Capacity (MW)	Status
Bango wind farm	Line 973	155 MW	In service
Beryl solar farm	Beryl substation	89 MW	In service
Bodangora wind farm	Line 94B	113 MW	In service
Jemalong solar farm	West Jemalong substation	50 MW	In service
Manildra solar farm	Manildra substation	50 MW	In service
Molong solar farm	Molong substation	30 MW	In service
Parkes solar farm	Parkes substation	51 MW	In service
Goonumbla solar farm	Parkes substation	70 MW	In service
Nyngan solar farm	Nyngan SF substation	102 MW	In service

Generating System	Connection location	Capacity (MW)	Status
Nevertire solar farm	Line 94W	105 MW	In service
Wellington solar farm	Wellington substation	170 MW	In service
Suntop solar farm	Line 94K	150 MW	In service
Bango wind farm	Line 999	82.8 MW	Committed
Quorn Park solar farm	Line 300	80 MW	Advanced
Apsley BESS	Line 945	160 MW	Advanced

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.[10] This will include any credible options that are put forward by proponents in response to this PSCR.

We have identified two network options that we consider meet the identified need for this RIT-T, as summarised in Table 3-1.Table 3-1

Table 3-1: Summary of the credible options

Option	Description	Estimated capital cost ($m 2021/22)	Expected delivery time	Expected increase in Line 94T system normal rating
Option 1	Increase transmission line design temperature of Line 94T	1.4 (+/- 25%)	2023/24	13 MVA
Option 2	Restring Line 94T with a higher rated conductor on existing structures	7.5 (+/- 25%)	2024/25	38 MVA

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.

While we have provided indicative cost estimates for the credible options, more accurate figures may be used for the cost-benefit analysis in the PADR.

The remainder of this section provides further detail on each of these credible options. It also outlines six other options that have been considered, but not progressed for various reasons.

3.1. Base case

Consistent with the RIT-T requirements, the assessment undertaken will compare the costs and benefits of each option to a base case. The base case is the projected case where no action is taken to address the identified need as per section 3.3 of the RIT-T Application Guidelines, which is extracted below[11].

"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."

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

[11] As per the RIT-T Application Guidelines, the base case provides a clear reference point for comparing the performance of different credible options. Australian Energy Regulator. "*Application guidelines Regulatory Investment Test for Transmission - August 2020*." Melbourne: Australian Energy Regulator, 2020.21. Accessed 22 March 2021. https://www.aer.gov.au/system/files/AER%20-%20Regulatory%20investment%20test%20for%20transmission%20application%20guidelines%20-%2025%20August%202020.pdf

Under the base case, no investments are made to meet the identified need to improve capacity for renewable generation in the Molong and Parkes area. This will result in curtailment of renewable generation to avoid thermal overloading of Line 94T.

Figure 3-1 shows the forecasted impact of this curtailment on the NEM, which will increase from approximately $4.6m per annum in 2022 to $5.04m per annum by 2030.

Figure 3-1 Value of constrained renewable generation per year for base case scenario

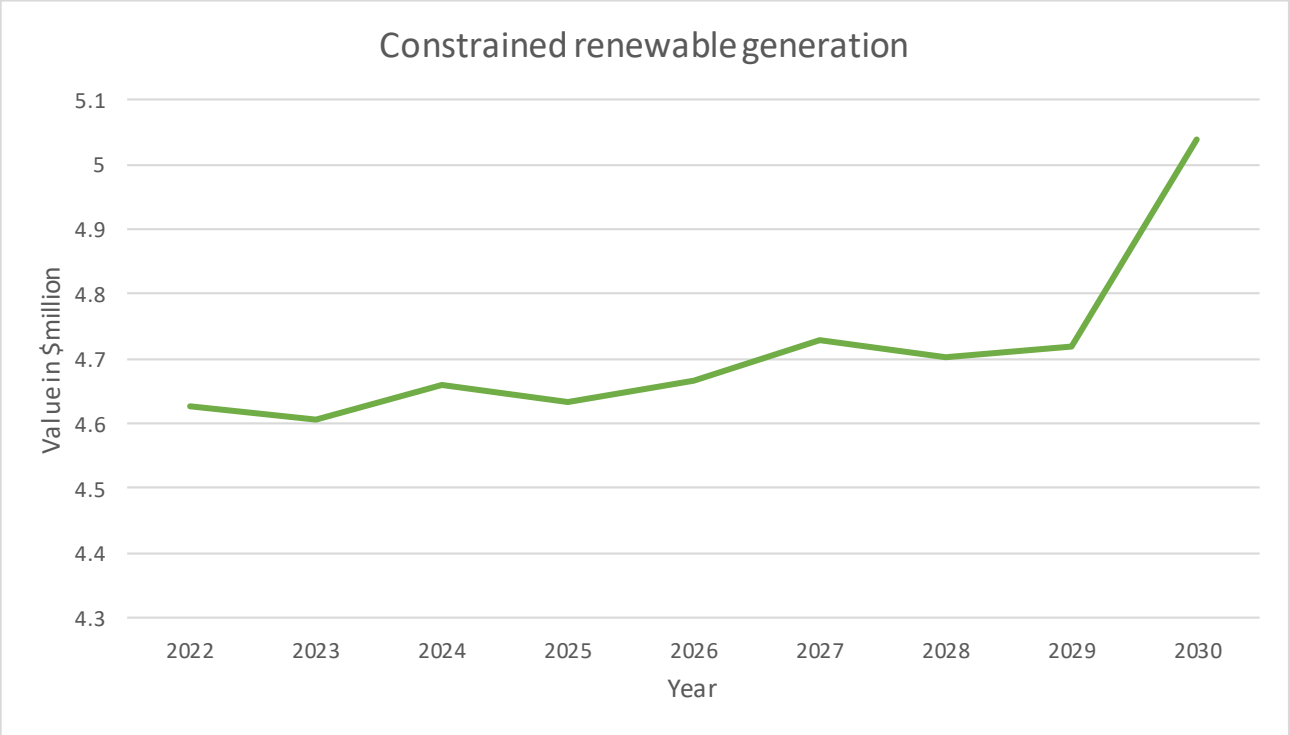
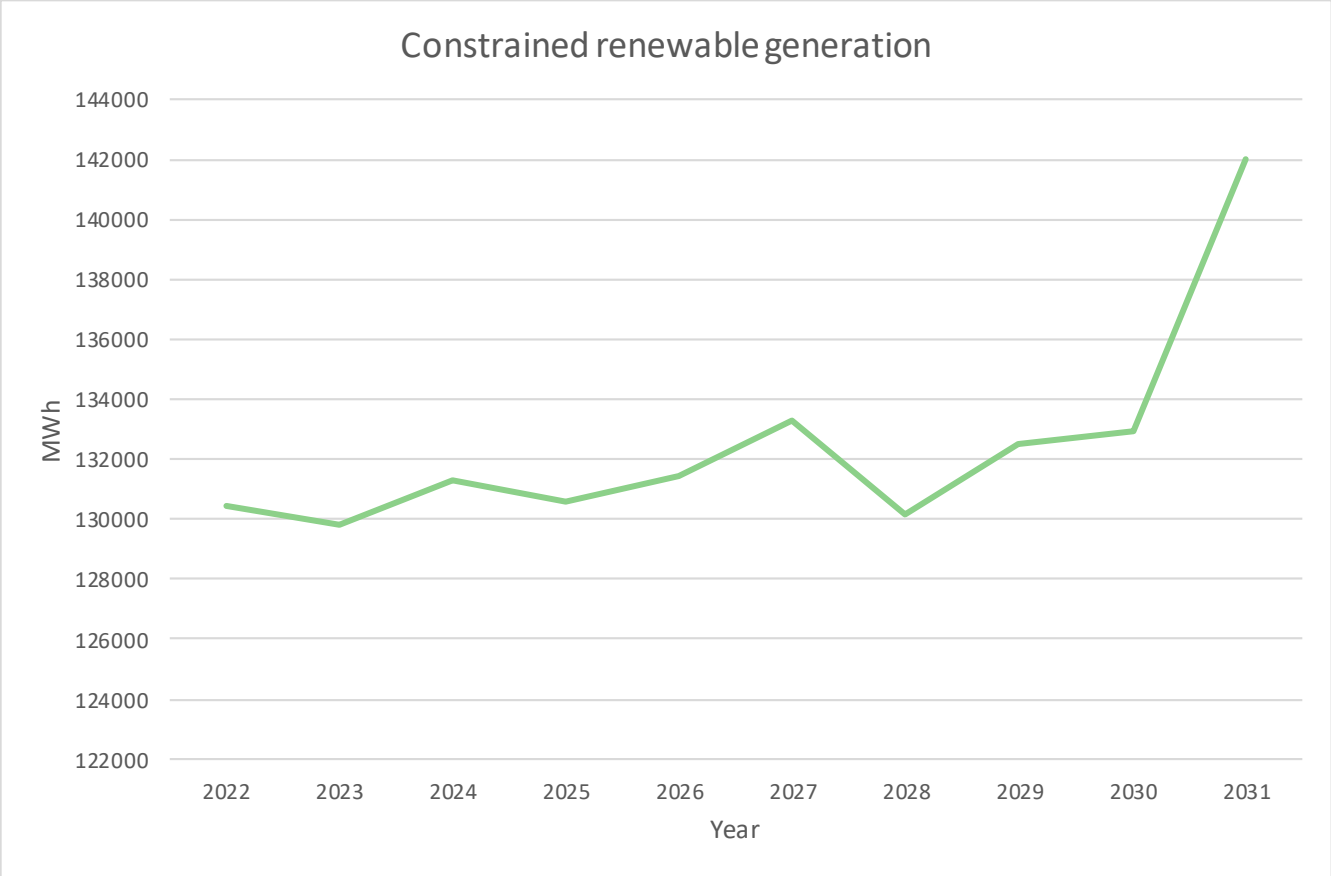


Figure 3-2 shows the corresponding forecasted MWh curtailment on the NEM, which will increase from approximately 130,000 MWh per annum in 2022 to 142,000 MWh per annum by 2030.

Figure 3-2 Constrained renewable generation per year for base case scenario



3.2. Option 1 – Increase transmission line design temperature of Line 94T

Option 1 involves increasing Line 94T summer daytime thermal rating from 112 MVA to 125 MVA by increasing the maximum design temperature of the existing Wolf conductor from 85^0C to 100^0C and Neon conductor from 85^0C to 92^0C. This is achieved by:

- Replacing one structure; and
- Converting insulator arrangements of 18 structures.

While this option will increase the thermal rating of Line 94T, it will not completely relieve renewable generation curtailment in the Molong and Parkes area.

The estimated capital cost of this option is approximately $1.4m +/-25 per cent.

Table 3-2 shows the expected expenditure profile of this option.

This option is expected to take 21 months to deliver, with commissioning possible in 2023/24.

Table 3-2 Capital expenditure breakdown under Option 1 ($m 2021/22)

Item	Capital expenditure ($m)
FY23	0.1
FY24	1.3
Total capital cost	**1.4 (+/- 25%)**

3.3. Option 2 – Restring Line 94T with a higher rated conductor on existing structures

Option 2 involves increasing Line 94T summer daytime thermal rating from 112 MVA to at least 150 MVA by restringing Line 94T with a higher capacity conductor. This is achieved by:

- Replacing existing conductor between structures 1 and 95 with Flicker ACSS conductor;
- Replacing existing conductor between structure 96 and the gantry of Molong substation;
- Replacing two structures; and
- Converting three suspension structures to tension structures.

The estimated total capital costs for the option is approximately $7.5 million +/-25 per cent. Table 3-3 shows the expected expenditure profile of this option.

This option is expected to take 28 months to deliver, with commissioning possible in 2024/25.

Table 3-3: Capital expenditure breakdown under Option 2 ($m 2021/22)

Item	Capital expenditure ($m)
FY23	0.1
FY24	2.7
FY25	4.7
Total capital cost	**7.5 (+/- 25%)**

3.4. Options considered but not progressed

We have also considered whether other options could meet the identified need. **Error! Reference source not found.** summarises the reasons these options were not progressed.

Table 3-4 Options considered but not progressed

Option	Reason(s) for not progressing
Increase Line 94T conductor rating to 138MVA for contingency events only	This option increases the contingency rating for Line 94T to 138 MVA. However, it does not increase the continuous rating of Line 94T. Network modelling shows thermal overloading of Line 94T is expected under normal system conditions. Hence, achieving a higher rating for contingency situations only, which enables overloading for approximately 30 minutes, will not address the identified need and therefore is not technically feasible.
Rebuild Line 94T as a higher rated single circuit transmission line	This option involves removing the existing structures and conductors of Line 94T and replacing with new single circuit towers and conductors with higher ratings. This option would be considerably more expensive than the other network options and is not expected to deliver significantly higher benefits. This option will also need significant outage of existing Line 94T which will lead to more generation curtailment during construction period. Therefore this option is considered not commercially feasible under the RIT-T.
Rebuild Line 94T as a double circuit transmission line	This option involves removing the existing structures and conductors of Line 94T and replacing with new dual circuit towers and dual conductors with higher ratings. It will also require additional switch bays at each substation. This option would be considerably more expensive than other network options outlined above and would require extended outage of Line 94T during the construction period, which would exacerbate the effects of generation constraints in the area. This options is therefore considered not commercially feasible under the RIT-T.
New transmission line parallel to existing Line 94T	This option involves building a new single circuit transmission line parallel to the existing Line 94T and may require widening of the existing Line 94T easement. This option would be considerably more expensive than the other network options and is not expected to deliver significantly higher benefits. Therefore this option is considered not commercially feasible under the RIT-T.
Install line impedance controllers	This option involves installing a device that in close to real time increases or decreases the reactance of a transmission line and diverts power away from Line 94T towards lines with higher rating. This option would be considerably more expensive than the other network options and is not expected to deliver significantly higher benefits. Therefore this option is considered not commercially feasible under the RIT-T.
Implement Stage 2 of the Maintaining Reliable Supply to Bathurst, Orange and Parkes area project	This option would bring forward the timing for Stage 2 of this project. The preferred option for Stage 2 in the Maintaining Reliable Supply to Bathurst, Orange and Parkes area RIT-T PACR is establishing a Wellington to Parkes 132 kV transmission line. Establishing this transmission line will not address the identified need in this RIT-T as it will not relieve the constraints on Line 94T and is therefore considered not technically feasible under this RIT-T. Alternate Stage 2 options, such as establishing a 330/132 kV supply point at Orange will cost substantially more than other network options considered. The timing of Stage 2 is also uncertain and it will take significantly longer to implement. Therefore this option is considered not commercially feasible under this RIT-T.

3.5. No material inter-network impact is expected

We have considered whether the credible options listed above is expected to have material inter-regional impact[12]. A 'material inter-network impact' is defined in the NER as:

> "*A material impact on another Transmission Network Service Provider's (TNSP's) network, which impact may include (without limitation): (a) the imposition of power transfer constraints within*

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

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[13]:

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

We note that each credible option satisfies these conditions. By reference to AEMO's screening criteria, there is no material inter-network impacts associated with any of the credible options considered.

[13] 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

4. Technical characteristics for non-network options

We consider that non-network solutions may be able to assist with meeting the identified need, either as standalone options or in combination with network options (or components of these options).

At this stage, we consider that possible solutions include but are not limited to:

- bulk or aggregated energy storage systems, e.g.:
  - sealed batteries;
  - flow batteries;
  - concentrated solar thermal with storage;
  - compressed air storage;
  - pumped hydro; and
- voluntary curtailment of customer load

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 NER requires a PSCR to include characteristics, such as:[14]

- the size of load reduction or additional supply required;
- the location; and
- the operating profile.

The table below outlines the size, location and nature of the required non-network option. It is anticipated that non-network support will be required on most days as solar generation will breach the thermal limits of Line 94T under normal system conditions.

Table 4-1 Requirements for the non-network option[15]

Year	Magnitude of power reduction required on Line 94T (MW)	Expected cumulative exposure of Line 94T to overload per annum (hours)	Location	Time of the day
From 2022[16]	Up to 60	1900[17]	Molong and Orange area	Day time

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

[14] NER clause 5.16.4(b)(3)
[15] Non-network option can include generation and/or load reduction
[16] The Line 94-T constraint is an existing constraint as evidenced by AEMO's 2021 and 2022 monthly constraint reports
[17] Annual hours has been extrapolated from AEMO's monthly constraint reports from September 2021 to May 2022.

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.[18]

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.

5.1. Options uprating Line 94T would avoid future replacement costs

Under the base case, we expect to remediate low clearance conductors which pose a public safety risk on Line 94T in the next five to ten years. Options which increase the rating of Line 94T are expected to avoid this future replacement cost (and so provide an economic benefit). We expect to include this in the PADR cost benefit assessment.

5.2. Wholesale market modelling will be adopted for the PADR

The options considered in this PSCR are expected to affect outcomes in the wholesale market, relative to the base case, as it increases the capacity of Line 94T. This additional capacity is expected to provide more efficient outcomes in the wholesale market, by increasing the output of low cost renewable generation in the Molong and Parkes area.

At this stage, we consider that market benefits from changes in fuel consumption arising through different size and patterns of generation dispatch have the potential to be material for this RIT-T and will be estimated in the wholesale market modelling as part of the PADR.

5.3. No other classes of market benefits are material

In addition to the classes of market benefits listed above, NER clause 5.15A.2(b)(4) requires Transgrid to consider the following classes of market benefits, listed in Table 5-1, arising from each credible option. We consider that none of the classes of market benefits listed are material for this RIT-T assessment for the reasons in Table 5-1.

Table 5-1 Reasons non-wholesale electricity market benefits are considered immaterial

Market benefits	Reason
Changes in involuntary load curtailment	As the identified need for this RIT-T is to increase overall net market benefits in the NEM by relieving existing Line 94T constraints on renewable generation in the Molong and Parkes area, it will have an immaterial impact on load.
Changes in involuntary load shedding	

[18] NER clause 5.15A.2(b)(6)

Market benefits	Reason
Changes in costs for parties, other than the RIT-T proponent due to differences in timing of new plant, capital costs and operating and maintenance costs	The change in costs for other parties is not expected to be material in this RIT-T assessment.
Changes in network losses	There is not expected to be any material difference in transmission losses between options.
Changes in ancillary service costs	While the cost of Frequency Control Ancillary Services (FCAS) may change, as a result of changed generation dispatch patterns and changed generation development following any increase to transfer capacity, we consider that changes in FCAS costs are not likely to be materially different between options and are not expected to be material in the selection of the preferred option. There is no expected change to the costs of Network Control Ancillary Services (NCAS), or System Restart Ancillary Services (SRAS) as a result of the options being considered. These costs are therefore not considered material to the outcome of the RIT-T assessment.
Competition benefit	Competition benefits under the RIT-T relate to net changes in market benefits, arising from the impact of the credible option on the bidding behaviour of market participants in the wholesale market. While each of the credible options considered are designed to address network constraint, we consider that competition benefits are unlikely to be material and do not intend to estimate them as part of this RIT-T. This is due to all options being expected to have a similar effect on the wholesale market through relieving the existing constraint of Line 94T in Central NSW. In addition, the calculation of competition benefits requires substantial additional market modelling. We consider that this modelling exercise would be disproportionate to any competition benefits that may be identified for this specific RIT-T assessment, particularly the difference between options in terms of competition benefits
Option value	Option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available is likely to change in the future, and the credible options considered by the TNSP are sufficiently flexible to respond to that change. We note that no credible option identified is sufficiently flexible to respond to change or uncertainty. Additionally, a significant modelling assessment would be required to estimate the option value benefit but it would be disproportionate to potential additional benefits for this RIT-T. Therefore, we have not estimated any additional option value benefit.

6. Overview of the assessment approach

This section outlines the approach that we are proposing to apply in assessing the net benefits associated with each of the credible options.

6.1. Assessment period and discount rate

The RIT-T will consider a 25 year period from 2022/23 to 2046/47. We consider that this takes into account the size, complexity and expected lives of the options and provide 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 will include 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 will be 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.

We will adopt a central real, pre-tax 'commercial'[19] discount rate of 5.50 per cent as the central assumption for the NPV analysis. We consider that this is a reasonable contemporary approximation of a commercial discount rate, consistent with the latest AEMO Inputs, Assumptions and Scenarios (IASR) released in July 2021.

We will also test the sensitivity of the results to discount rate assumptions. A lower bound real, pre-tax discount rate of 2.30 per cent equal to the latest AER Final Decision for a TNSP's regulatory proposal at the time of preparing this PSCR,[20] and an upper bound discount rate of 7.50 per cent (consistent with the upper bound in the latest IASR).

6.2. Approach to estimating option costs

The initial cost estimates presented in this PSCR have been at a high level, based on experience from previous projects involving similar options or based on publicly available information.

It is intended that cost estimates will be further refined in the PADR stage and this process may be informed by responses to the PSCR. Our objective is to achieve costs that are estimated to be within +/- 25 per cent of the actual cost as part of the PADR.

6.3. Three different scenarios will be 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').

[19] The use of a 'commercial' discount rate is consistent with the RIT-T and is distinct from the regulated cost of capital (or 'WACC') that applies to network businesses like Transgrid.

[20] See Powerlink's Post-tax Revenue Model (PTRM) for the 2022-27 period, available at: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/powerlink-determination-2022%E2%80%9327/final-decision

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 propose to adopt 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.

A key expected driver of the net market benefits is likely to be the generation cost saving. We are proposing to use a simplified generation cost saving calculation methodology based on the forecast generation[21] and load traces[22] and their respective contribution factors[23] to Line 94T loading in the PADR assessment.

A summary of the key variables in each scenario is provided in Table 6-1.

Table 6-1: Summary of scenarios

Variable	Central	Low net economic benefits	High net economic benefits
Capital costs	Base estimate	Base estimate + 25%	Base estimate - 25%
Load forecasts	Central demand (POE50)	Low demand (POE90)	High demand (POE10)
New renewable generation in the area	In-service and committed generators.	In-service and committed generators.	All in-service, committed and advanced generators.
Fuel cost	Average NSW Coal-fired Generator Short Run Marginal Costs[24]	Central - 25%	Central + 25%
Discount rate	5.50%	7.50%	2.30%

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.

[21] AEMO 2021 ESOO Variable Renewable Energy Trace data is used to calculate future generation trace.
[22] Load trace is based on the historical demand data and scaled based on the POE50 BSP forecast.
[23] Contribution factor for each generator and load in the region is calculated based on the same method as in Line 94T constraint equation development.
[24] The Short Run Marginal Costs (SRMC) of NSW coal-fired generators (exclude Liddell) from AEMO 2021 Inputs, Assumptions and Scenarios workbook will be used to calculate average SRMC cost.

Appendix A Compliance checklist

This appendix sets out a checklist which demonstrates the compliance of this PSCR with the requirements of clause 5.16.4(b) of the National Electricity Rules version 183.

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: (i) the size of load reduction of additional supply; (ii) location; and (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 Integrated System 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: (i) the technical characteristics of the credible option; (ii) whether the credible option is reasonably likely to have a material inter-network impact; (iii) the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.15A.2(b)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; (iv) the estimated construction timetable and commissioning date; and (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3 & 5