electranet

Eyre Peninsula Upgrade

Project Assessment Draft Report

March 2025

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Revision Record

Date	Version	Description	Author	Checked by	Approved by
17/03/25	1.0	EP RIT-T PADR	F. Castellanos	Various	B. Harrison

Executive Summary

Large industrial load growth on the Eyre Peninsula

Over the coming years South Australia's Eyre Peninsula is expected to experience high levels of economic activity and associated growth in electricity demand, with energy intensive industries such as hydrogen industries, mining, green steel processing and data centres seeking connection to the transmission network. The Eyre Peninsula is close to resources that help underpin this expected economic growth, including good quality renewable energy sites.

This growth on the Eyre Peninsula was anticipated when ElectraNet conducted the Regulatory Investment Test for Transmission (RIT-T) analysis of the Eyre Peninsula Link project over 2017-18[1], which provided for the option of future low-cost expansion of the electrical transmission network. The likelihood of substantial load growth was also recognised in the AER's April 2023 Determination of ElectraNet's revenue for the 2023-2028 period by the inclusion of the Eyre Peninsula Upgrade contingent project.

Both of these processes recognised the likelihood that electricity transmission capacity on the Eyre Peninsula would need to be upgraded to supply potential load growth, but that the timing was uncertain.

Recently, ElectraNet has been engaging with proponents of several potential significant load developments on the Eyre Peninsula. This has led us to conclude that expansion of the network capacity is now required and that, without action, parts of the transmission network will serve as constraints on the growth of both new and existing loads on the Eyre Peninsula.

This RIT-T is being undertaken to ensure reliable supply

The identified need is to efficiently meet customer electricity demand growth on the Eyre Peninsula transmission network connected to Davenport. This RIT-T is a 'reliability corrective action' as defined by clause 5.10.2 of the National Electricity Rules (NER), as the objective is to meet the regulatory obligations and service standards contained in schedule 5.1 of the NER and within the applicable regulatory instrument of the Essential Services Commission of South Australia's (ESCOSA) Electricity Transmission code (ETC).

Without action, key network limitations on the Eyre Peninsula are likely to be:

- Cultana 275/132 kV transformers (which have a secure thermal limit of 200 MVA); or
- Cultana to Yadnarie double-circuit transmission line, operated at 132 kV (which has a secure thermal limit of 241 MVA[2]); or
- Davenport to Cultana 275 kV double-circuit transmission line (which has a secure thermal limit of 597 MVA).

[1] Eyre Peninsula Electricity Supply Options - PACR

[2] Due to the length of this transmission line its voltage constraint precedes the thermal one. Hence, the maximum secure (N-1) load that can be connected at Yadnarie is 120 MVA.

As a result, in a 'do nothing' base case and using the AEMO Step Change scenario ElectraNet would be in breach of the ETC from around 2030 and there would be significant involuntary load shedding to customers on the peninsula

These are not situations ElectraNet plans to encounter, and the NER obligations and this RIT-T have been initiated specifically to avoid them.

This Project Assessment Draft Report (PADR) represents the second stage of the formal RIT-T process and follows publication of the Project Specification Consultation Report (PSCR) in December 2023.

We have developed three different load forecasts, consistent with recently released AEMO criteria

A key determinant of the scope and timing of what is considered optimal to build on the Eyre Peninsula is the assumed level and location of new spot load.

We have developed three different load forecasts as part of this PADR to test the various upgrade options. Each forecast has been derived from the AEMO ISP Step Change forecast with adjustments made for differing views of future major load developments, consistent with AEMO's recently released draft Electricity Demand Forecasting Methodology document (in which it proposes a more granular classification of any large industrial future load than in the ISP).[3] The methodology is under its normal revision cycle and a final determination will be published by March 2025. If the final classification changes from the present proposal we will review its impact on this analysis and adjust accordingly as part of the PACR.

The three load forecasts can be summarised as:

- **Low forecast** – consists of all existing and 'committed' loads.
- **Central forecast** – all the loads in the low forecast plus the 'anticipated' large industrial loads.
- **High forecast** – all the loads in the central forecast plus the 'proposed' large industrial loads that are aligned with government policy.

We consider that amending the AEMO ISP Step Change forecasts is appropriate for this RIT-T in light of the additional information and communication ElectraNet has with proponents of these loads through the connections process. ElectraNet considers that using the unadjusted ISP Step Change forecast would under-represent the expected load potential for the peninsula, as informed through our connections process, and risk an inefficient investment decision.

The other two scenarios from the ISP (that is, the Progressive Change and Green Energy Exports scenarios) are not considered relevant for this RIT-T since wholesale market benefits are not expected to be materially different across the options (as outlined below).

[3] AEMO, 2024 Draft Electricity Demand Forecasting Methodology

Four options have been assessed, including two staged variants

We have identified four credible network options to meet the identified need, depending on the location of load growth on the Eyre Peninsula. Specifically:

- Three of these options (Options 1, 2 and 3) are alternatives to each other to provide additional capacity between Cultana and Yadnarie; while
- Option 4 can be implemented in combination with Options 1, 2 or 3 to accommodate further additional load on the peninsula.

While these four options were proposed in the PSCR,[4] we have refined their assessment following additional power system studies undertaken by ElectraNet and in more detail work scopes.

In summary:

- Options 1, 2 and 3 would address the possible overloading of the transformers at Cultana and augment the transmission capacity between Cultana and Yadnarie;
- Option 4 would address the possible future overload of the link between Davenport and Cultana.

The four options are summarised in the table below. The capital costs for the network options have been revised since the PSCR to reflect current market trends and risks, drawing on the experience of recent projects and more detail work scopes.

[4] While the PSCR also included a further option – Option 5 – which was designed to address large load increases on the Eyre Peninsula south of Whyalla, additional studies undertaken since then have deemed this not necessary at this point in time. We have therefore discontinued the consideration of this option, as outlined in section 4.5 of this PADR.

Table 1: Summary of the credible options assessed

Option	Capacity increases, MVA		Estimated capital cost, $million 2024-25[5]
	Cultana	Yadnarie[6]	
Alternatives to each other to provide additional capacity between Cultana and Yadnarie			
Option 1 – Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation[7]	79*	480	179
Option 2 (Stage 1) – Add a third 200 MVA transformer at Cultana	200	-	33
and a capacitor bank at Yadnarie North	-	90	75
Option 2 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	79*	480	139.5
Option 3 (Stage 1) – Replace the transformers at Cultana with 300 MVA rated transformers	100	-	27
and a capacitor bank at Yadnarie North	-	90	75
Option 3 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	79*	480	139.5
Option to accommodate further additional load on the peninsula			
Option 4: Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits	1,200	-	484

* This option does not increase the capacity at Cultana, but it releases existing capacity as it transfers loads to the 275 kV network, via the new 275/132 kV Yadnarie North substation. This value is based on the present load connected to Yadnarie.

While the load forecasts have been updated since the PSCR, with latest SA Power Networks forecasts and recent information regarding potential new connections, this has not affected the consideration of options. Instead, the updating of the load forecasts has enabled the *timing* of the options to be refined since the PSCR – as summarised in the table below.

[5] All costs and benefits quoted in this PADR are in 2024-25 dollars unless stated otherwise.
[6] The increase is based on the transmission line voltage constraint of 120 MVA.
[7] The completion of the Eyre Peninsula Link project in 2023, retained the availability to upgrade the transmission line with the construction of a double-circuit transmission line between Cultana and Yadnarie designed for 275 kV, but operated initially at 132 kV.

Table 2: Timing of the credible options across the three load scenarios assumed

Option	Low	Central	High
Alternatives to each other to provide additional capacity between Cultana and Yadnarie			
Option 1 – Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation	2029/30	2026/27	2026/27
Option 2 (Stage 1) – Add a third 200 MVA transformer at Cultana	2029/30	2026/27	2026/27
Option 2 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	-	2027/28	2027/28
Option 3 (Stage 1) – Replace the transformers at Cultana with 300 MVA rated transformers	2029/30	2026/27	2026/27
Option 3 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	-	2027/28	2027/28
Option to accommodate further additional load on the peninsula			
Option 4: Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits	-	2035/36	2029/30

ElectraNet has not identified any non-network solution that could help address the identified need for this RIT-T and the PSCR outlined why these solutions were not expected to be able to assist. No submissions relating to non-network proposals were received in response to the PSCR.

Wholesale market modelling has not been required for this PADR

The only two categories of market benefit under the RIT-T that are expected to be material are:

- changes in involuntary load shedding – due to each option being able to avoid different levels of unserved energy under the base case; and
- changes in network losses – due to the different capacity options resulting in different levels of electrical losses on the peninsula.

Both of these have been modelled using PLEXOS and included in the PADR assessment.

While all options are also expected to deliver significant other categories of market benefit compared to the base case (e.g. through improving the efficiency of wider wholesale market build and operational decisions), these impacts are not expected to materially affect the decision and reorder the preference across the options and so have not been estimated. Put another way, the option that is likely to deliver the greatest market benefits in the other categories of benefits, is the preferred option and further analysis would only improve its relative standing.

Option 1 plus Option 4 is the preferred option at this stage

ElectraNet's analysis, which is summarised in Table 3 shows that Option 1 in combination with Option 4 has the greatest net benefit under central, high and weighted demand scenarios. The analysis adopts a 20-year assessment period and draws on the central discount rate in AEMO's 2023 Inputs, Assumptions and Scenarios Report (IASR).

Table 3. Net benefits relative to the base case ($m 2024-25)

Option	Low demand scenario[8]		Central demand scenario		High demand scenario		Weighted	
	NPV	Rank	NPV	Rank	NPV	Rank	NPV	Rank
Option 1 + Option 4	-110.73	3	-263.73	1	-449.16	1	-274.54	1
Option 2 + Option 4	-65.11	2	-304.10	3	-489.26	3	-286.16	3
Option 3 + Option 4	-60.48	1	-298.07	2	-483.26	2	-280.60	2

While net benefits are negative, the investment can still be justified under the RIT-T since the identified need is a reliability corrective action. Sensitivity analysis with respect to capital costs and other assumptions further support Option 1 + Option 4 as the preferred option.

Option 1 is significantly lower cost than Option 2 and Option 3 and the second stages of those options mean that they rank behind Option 1 under the central and high demand scenarios. While Option 1 ranks behind Option 2 and Option 3 under the low scenario, we note that this scenario would need to be given unreasonably high chance of occurring in the analysis in order to change the weighted result.

Moreover, ElectraNet expects that the more granular classification of large industrial future load currently being consulted on by AEMO as part of its Electricity Demand Forecasting Methodology document will be upheld in the final determination (expected to be published in March 2025), which would further support the use of load forecasts in-line with our central and high demand scenarios.

The proposed preferred option identified in this PADR is the combination of two of the options:

- **Option 1** - Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation; and
- **Option 4** - Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits, subject to commitment of a further around 400 MW of electrical load by 1 January 2030 on the Eyre Peninsula network, supplied out of Davenport. This will increase the total load in the Eyre Peninsula to around 570 MW.

[8] Under the low forecast scenario none of the options 1-3 require option 4, as the total demand in the Eyre Peninsula can be served with the existing transmission line between Davenport - Cultana. Additionally, options 2 and 3 will only require stage 1.

These options consist of:

- **Option 1**
  - Constructing a new Yadnarie North substation;
  - Introducing 275/132 kV transformation at the Yadnarie North substation; and
  - Reconnecting the 132 kV exits at the existing Cultana substation on the 275 kV side.
- **Option 4**
  - Establishing a new substation approximately 30 km north of Davenport, close to Carriewerloo;
  - Expansion of Davenport and Cultana at 275 kV;
  - A double circuit 275 kV overhead transmission line of approximately 30 km and rated at around 600 MVA per circuit or higher, connecting Davenport to the new site at Carriewerloo; and
  - A new double circuit 275 kV overhead transmission line of approximately 70 km and rated at around 600 MVA per circuit or higher, connecting the new site at Carriewerloo to Cultana.

The proposed preferred Option 1 has a capital cost of approximately $179 million, while the proposed preferred Option 4 has a capital cost of approximately $484 million.

Load not supporting the Option 4 components is the key proposed re-opening trigger for this RIT-T

Consistent with the recent change to the Material Change in Circumstance (MCC) provisions in the NER, we have considered the impact of changes in key underlying assumptions on what is considered optimal to procure, if our obligations change in the future, and identified re-opening triggers. This assessment may allow us to demonstrate that any future change in the preferred portfolio option due to the occurrence of these triggers is consistent with the RIT-T, in the event that a re-opening trigger occurs, without needing to redo the RIT-T assessment.

The key proposed re-opening trigger for this RIT-T is the load required to justify establishing a new site close to Davenport and duplicating the Davenport to Cultana 275 kV circuits (i.e. Option 4) not eventuating. Specifically, based on the assessment included in this PADR, we consider that the following is expected to form the re-opening trigger for Option 4 under this RIT-T:

- A central demand forecast published before 1 January 2030, with a total load forecast for the Eyre Peninsula below 570 MW[9].

Based on the sensitivity assessment included in this PADR, we do not consider there to be any other relevant opening triggers for this RIT-T. Specifically, the finding that Option 1 (plus Option 4) is the preferred option is found to be robust to all key assumptions (e.g. assumed capital costs, discounts rates, etc).

[9] This corresponds to the N-1 thermal capacity of the double circuit 275 kV Davenport-Cultana transmission line assuming a 0.95 power factor.

Should a re-opening trigger occur (e.g. outturn demand not being sufficient to justify Option 4), ElectraNet would prepare a letter to the AER outlining how, as a consequence, the preferred option for this RIT-T would change. A new RIT-T would not be commenced (which would require significant time to complete and would likely jeopardise ElectraNet's ability to meet its ETC reliability standards). Instead, ElectraNet would refer back to this RIT-T to confirm that the action ElectraNet is proposing to take is considered optimal.

Submissions and next steps

ElectraNet welcomes written submissions on materials contained in this PADR. In particular, we would like to hear from proponents of new spot load developments on the Eyre Peninsula regarding the status of these proposals.

We especially welcome submissions from potential customers planning to connect to the Eyre Peninsula that can help to clarify the size and timing of additional load that may connect. ElectraNet is interested in any potential changes on connection details from customers already consulting with us or new potential connections. Evidence on the likelihood of individual projects going ahead will be very useful for our PACR analysis.

For example, demonstrating when the key criteria for a prospective large industrial load (LIL) to be classified as a committed, anticipated or proposed project is applicable, as per the latest AEMO demand forecasting proposal[10]. All information will be managed as confidential.

The Project Assessment Conclusions Report (PACR), which is the third stage of the RIT-T process, will include a full options analysis. ElectraNet expects to publish the PACR by March 2026.

Submissions are due on 9th May 2025.

Submissions should be emailed to our Planning team via consultation@electranet.com.au. In the subject field, please reference 'Eyre Peninsula Upgrade - PADR feedback'.

[10] AEMO Forecasting Approach - Draft Electricity Demand Forecasting Methodology. Nov. 2024

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1 Introduction

1.1 Background

In February 2023, following two years of construction and over five years of planning, ElectraNet energised a new high-voltage power line on the Eyre Peninsula and upgraded five electricity substations. This new line, referred to as 'Eyre Peninsula Link',[11] replaced the previous line, which had been in service for more than 50 years and was near the end of its operational life.

The decision to build Eyre Peninsula Link and upgrade the associated substations followed assessment under a Regulatory Investment Test for Transmission (RIT-T) undertaken over 2017-2018. This earlier RIT-T noted that future load growth was likely on Eyre Peninsula, but that the timing was uncertain.

Considering that uncertainty, ElectraNet concluded that the most efficient way to provide a reliable supply to the Eyre Peninsula at the time was to configure Eyre Peninsula Link as:[12]

- A new double-circuit line from Cultana to Yadnarie that is initially energised at 132 kV, but which has the option to be energised at 275 kV if required in the future; and
- A new 132 kV double-circuit line from Yadnarie to Port Lincoln.

By retaining the ability to upgrade the Cultana to Yadnarie section of Eyre Peninsula Link to 275 kV, ElectraNet ensured that it is 'future proof' – having the ability to be upgraded at relatively low cost to supply the loads that were anticipated but uncertain at the time.

Consistent with this approach and considering the continuing potential for substantive load growth on the Eyre Peninsula in the near term, the potential upgrade of the Cultana to Yadnarie section of the Eyre Peninsula Link to 275 kV, together with the potential for further augmentation of the network to Davenport, was recognised as a contingent project by the AER in its revenue determination for our 2023-2028 regulatory control period.

That contingent project will be triggered if:

1. There is commitment for additional load from one or more customers to connect to the transmission network with aggregate load sufficient to cause the:
   a) Cultana 275/132 kV transformers to exceed their thermal limit of 200 MVA; or
   b) Whyalla Central 132/33 kV transformers to exceed their thermal limit of 120 MVA; or
   c) Whyalla Central to Cultana 132 kV lines to exceed their thermal limit of 121 MVA; or
   d) Cultana to Stony Point 132 kV line to exceed its thermal limit of 144 MVA; or
   e) Davenport to Cultana 275 kV lines to exceed their thermal limit of 594 MVA

[11] AEMO, *Appendix 5. Network investments - Appendix to the 2022 ISP for the National Electricity Market*, June 2022, p 11.
[12] All RIT-T documentation for this previous RIT-T is available at: ElectraNet's RIT archive

Causing a need for the upgrade of the 132 kV Eyre Peninsula Link between Cultana and Yadnarie to 275 kV and/or augmentation of power transfer capacity between Davenport and Cultana and/or Cultana and Whyalla and/or Cultana and Stony Point.

2. The AER is satisfied that ElectraNet has successfully completed a RIT-T, including an assessment of credible options, showing the upgrade of the 132 kV Eyre Peninsula Link between Cultana and Yadnarie to 275 kV and/or augmentation of power transfer capacity between Davenport and Cultana and/or between Cultana and Whyalla and/or Cultana and Stony Point is the preferred option:

   f) Demonstrating positive net market benefits; and/or

   g) Addressing a reliability corrective action.

3. The ElectraNet Board commits to proceed with the project subject to the AER amending the revenue determination pursuant to the Rules.

Recently, ElectraNet has been engaging closely with proponents of several likely load developments on the Eyre Peninsula. Based on the load locations and commencement timing we expect that the Cultana 275 kV transformers, the transmission line operating at 132 kV between Cultana and Yadnarie and the Davenport to Cultana 275 kV circuits will be overloaded, much sooner than as forecasted, than if looking only at the underlying growth.

This PADR follows on from our PSCR of December 2023.[13] It seeks to assess which investment option is the prudent and efficient choice to make now considering the reasonable likelihood that these overloads will occur soon.

1.2 Role of this report

This Project Assessment Draft Report (PADR) is the second step in the RIT-T process. The purpose of this PADR is to:

- Summarise the reasons why ElectraNet has determined that investment is necessary;
- Summarise the consultation processes to date and submissions to the PSCR;
- Describe the credible options that ElectraNet considers may address the identified need;
- Provide a description of the methodologies used in quantifying each class of material market benefit and cost, together with the reasons why ElectraNet has determined that some classes of market benefit are not material for this RIT-T;
- Present the NPV economic assessment of each of the credible options, including the assumptions underpinning this analysis;
- Identify and provide a detailed description of the credible option that satisfies the RIT-T, and is therefore the preferred option at this draft stage;
- set out the proposed re-opening triggers, building on the sensitivity assessments undertaken, to provide transparency to stakeholders on what may constitute a later material change in circumstance for this RIT-T; and

[13] ElectraNet - PSCR Eyre Peninsula RIT-T

- Provide stakeholders with the opportunity to comment on this assessment so that ElectraNet can refine the analysis (if required) as part of the Project Assessment Conclusions Report (PACR), which is the final step in the RIT-T process.

The entire RIT-T process is detailed in Appendix C. The next steps for this RIT-T assessment are discussed further below.

1.3 Submissions and next steps

ElectraNet welcomes written submissions on the information contained in this PADR by 9th May 2025. Submissions are particularly sought on the credible options presented and the assessment of these credible options.

We especially welcome submissions from potential customers planning to connect to the Eyre Peninsula that can help to clarify the size and timing of additional load that may connect. Evidence on the likelihood of individual projects going ahead will be very useful for our PACR analysis.

For example, demonstrating when the key criteria for a prospective large industrial load (LIL) to be classified as a committed, anticipated or proposed project is applicable, as per the latest AEMO demand forecasting proposal[14].

Submissions should be emailed to consultation@electranet.com.au.

In the subject field, please reference 'Eyre Peninsula Upgrade - PADR feedback'. Submissions will be published on the ElectraNet website. If you do not wish your submission to be made publicly available, please clearly specify this at the time of lodging your submission.

The PACR as part of this RIT-T is expected to be published by March 2026.

[14] AEMO Forecasting Approach - Draft Electricity Demand Forecasting Methodology. Nov. 2024

2 The identified need

This section provides a description of the identified need for this RIT-T as well as outlining the assumptions used in assessing the identified need and why ElectraNet considers that reliability corrective action is necessary.

2.1 New load developments on the Eyre Peninsula

2.1.1 Near and medium-term large industrial load developments

ElectraNet has received significant interest in large new load connections to the transmission network on the Eyre Peninsula. Without action, connection of these loads would be limited by the existing network capability.

ElectraNet has documented this interest starting with our May 2023 update[15] to our 2022 Transmission Annual Planning Report and our October 2023 and October 2024 Transmission Annual Planning Reports.[16] These reports identified the potential for 850 MW of new load at or south of Whyalla on the Eyre Peninsula.

Table 4 provides a summary of potential near- and medium-term load developments that are planned to connect to the 132 kV network and have now submitted formal 'connection enquiries' as part of the connection process. These loads are a mixture of commercial and industrial developments. Because the high likelihood of connection of these loads and based on AEMO's proposed categories for large industrial loads, ElectraNet considers that all the loads in Table 4 can be classified as "anticipated"[17].

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[15] 2023 ElectraNet TAPR Update

[16] ElectraNet Transmission Annual Planning Reports

[17] AEMO has proposed in its draft Electricity Demand Forecasting Methodology that anticipated projects could be considered in the Step Change scenario only if they are proposed for beyond the "T-3 period". ElectraNet is of the opinion that this 3-year period underestimates the speed at which industry could act and establish a large industrial load.

Table 4 - Summary of potential near- and medium-term load developments connecting to 132 kV

Customer	Load Type	Assumed commencement year	Project Status[18]
Customer 8	Mine	2027	Anticipated
Customer 5 Stage 1*	Data centre	2027	Anticipated
Customer 5 Stage 2*	Data centre	2028	Anticipated
SA Government Northern Water[19] Stage 1*	Desalination	2027	Anticipated
SA Government Northern Water Stage 2*	Desalination	2030	Anticipated

To maintain confidentiality, we have not revealed the customers and have used the same naming convention applied initially on our May 2023 TAPR Update and thereafter. Note that some rows represent projects across multiple sites.
** Load contributes towards the loading of the Cultana transformers and the line between Cultana and Yadnarie.*

All the above projected loads would contribute towards the loading of the 275/132 kV transformers at Cultana (since they would be connecting to the 132 kV network). Of these loads, the last four loads in the table would be connecting at Yadnarie itself or south of it.

These loads represent 230 MW of connections during the year 2027, an additional 100 MW during 2028 and a final 40 MW during 2030. These loads will increase the loading of the existing double-circuit transmission line between Cultana and Yadnarie, which is operating at 132 kV, but it is designed to operate at 275 kV.

Table 5 shows additional proposed loads connecting at 275 kV at Cultana. These loads would increase the load between Cultana and Davenport.

Table 5 - Summary of potential near- and medium-term load developments connecting to 275 kV

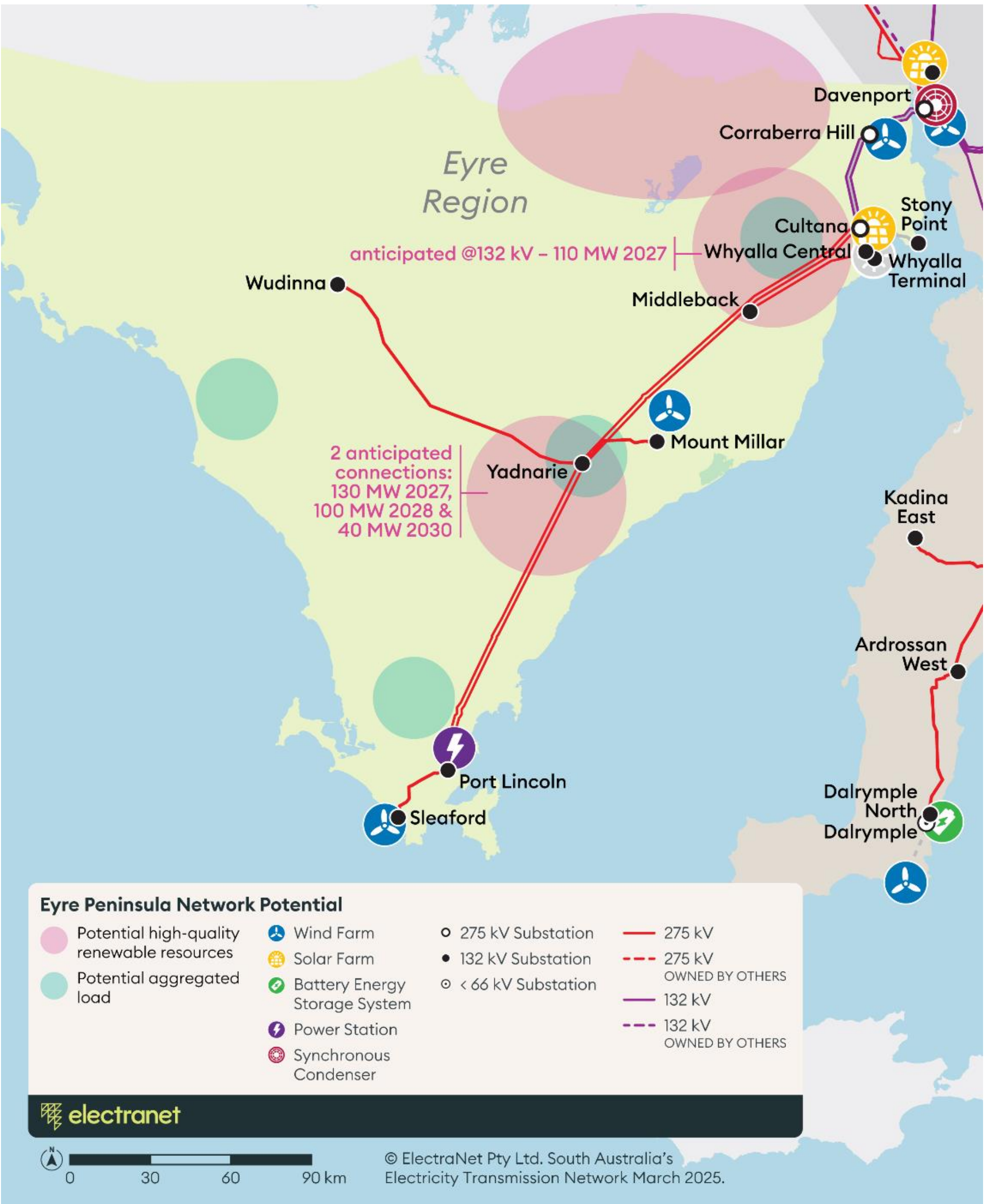
Customer	Load Type	Tentative commencement year	Status[20]
SA Government Port Bonython Hydrogen Hub[21]	Green hydrogen and other industries	2030 & 2035	Proposed

[18] The status is based on the categories defined in AEMO Forecasting Approach - Draft Electricity Demand Forecasting Methodology. Nov. 2024
[19] Includes assumed capacity for the desalination plant and one pumping stations south of Yadnarie SA Government - North Water.
[20] The status is based on the categories defined in AEMO Forecasting Approach - Draft Electricity Demand Forecasting Methodology. Nov. 2024
[21] SA Government - Port Bonython Hydrogen Hub

In addition, ElectraNet is aware of additional potential spot loads connecting in the Eyre Peninsula, which are less defined but could contribute to the total load at Cultana. This is discussed in the next section.

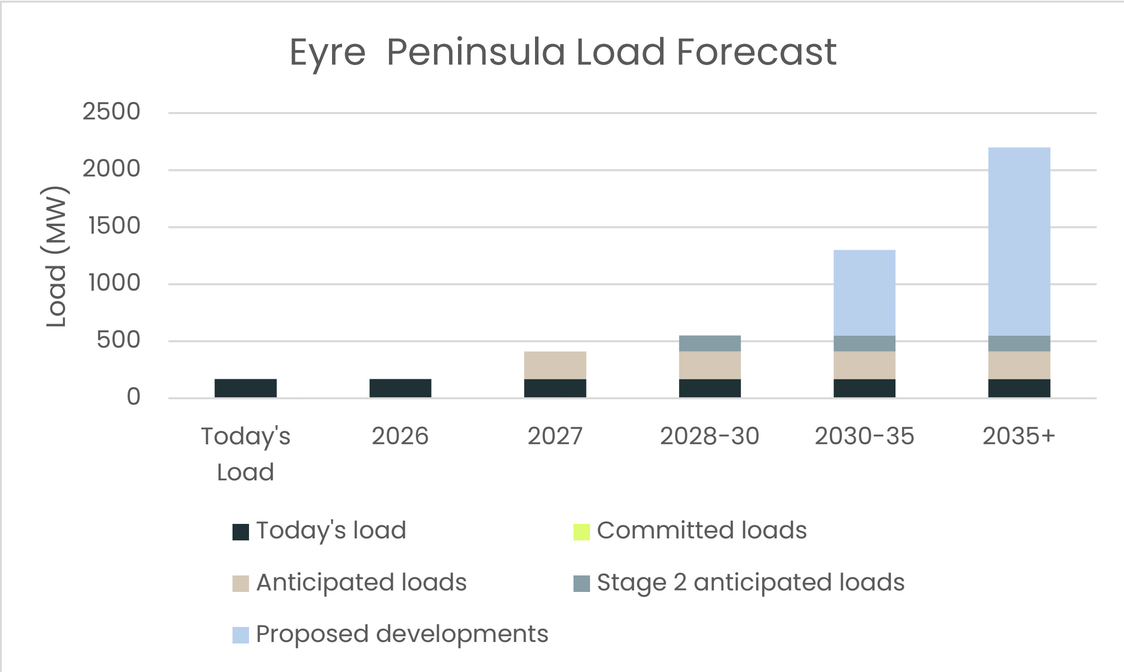
Figure 1 below summarises the locations and magnitude of the potential spot loads from the previous two tables on the Eyre Peninsula.

Figure 1 - Potential large industrial spot load developments



In addition, Figure 2 shows a breakdown of these loads over time.

Figure 2 - Eyre Peninsula Load Forecast



2.1.2 Longer-term large industrial load developments

Over the longer-term, there is also the potential for much more load to connect on the Eyre Peninsula associated with the development of green hydrogen facilities at Port Bonython and Cape Hardy. This would increase the required network capacity in the Northern Eyre Peninsula.

In addition to the potential spot loads set out in Table 4 and Table 5, ElectraNet is also aware of other potential spot loads on the peninsula that are currently at a less certain level of development, but which would also contribute to the need for investment if they were to proceed.

An example of this is the agreement signed by Amp Energy in April 2023 to develop green hydrogen at scale on the Cape Hardy Port Precinct in conjunction with Iron Road.[22] While the project is in the early stages of development, it is expected to involve up to 5 GW of load and has received support from governments, including direct support in the form of a $25 million commitment from the Federal Government for the development of the deep-sea port and indirect support via the South Australian Government's via the Hydrogen and Renewable Energy Act 2023.[23] Pre-front End Engineering Design is expected to be completed for the first stage by the beginning of 2025 with a tentative first production date by 2030.

In addition, there are plans to establish new mining operations or electrify existing ones on the Eyre Peninsula.

[22] Cape Hardy Advanced Fuels Project
[23] Hydrogen and Renewable Energy Act

The addition of load of such magnitudes would be expected to require further augmentation of the transmission network on the Eyre Peninsula, over and above the upgrades assessed in this RIT-T, and independent of the preferred option for this RIT-T.

2.2 Potential renewable generation and BESS

The Eyre Peninsula, like a lot of South Australia, has significant, high-quality, wind and solar resources.

ElectraNet has received significant interest in new generator connections to the transmission network on the Eyre Peninsula. These potential renewable generation developments on the Eyre Peninsula may interact with any upgrade of the current network capacity.

Table 6 shows the generation and storage projects in the Eyre Peninsula that are committed or can be declared anticipated.

Table 6 - Committed and anticipated generation and storage projects in the Eyre Peninsula

Site name (Connection point)	Technology type	Nameplate capacity (MW) storage (MWh)	Tentative commencement	Status
Clement Gap – BESS (Clement Gap)	Storage - Battery	60 MW 120 MWh	May 2026	Committed
Lincoln Gap Wind Farm – BESS (Lincoln Gap)	Storage - Battery	10 MW 10 MWh	April 2025	Anticipated

In addition to these firm projects, ElectraNet has responded to several other proposed connections around the Eyre Peninsula. There are two proposed wind farms and three solar farms with a total potential capacity of more than 2 GW. Similarly, there are several BESS proposals with an accumulated total capacity above 500 MW.

The South Australian Government completed the first stage of consultation for the first release areas,[24] as part of the Hydrogen and Renewable Energy Act 2023 (HRE Act). The HRE Act establishes Australia's first dedicated licensing and regulatory framework for large-scale hydrogen and renewable energy projects. After the consultation, the next step is to consider the feedback and determine if the lands within the proposed release area are suitable for declaration as a release area. Following this declaration renewable energy companies will be able to submit a competitive tender to develop large scale renewable energy projects on the land.

Consultation on the Gawler Ranges East and Whyalla West proposed release areas closed on last October. These two areas are near the existing transmission lines between Davenport, Cultana and Middleback and already proponents are enquiring about possible connections for large renewable projects.

[24] Hydrogen and Renewable Energy Regulation - Release areas - Government of South Australia

At this stage, if there is no upgrade to the network on the Eyre Peninsula and these generators connect, ElectraNet expects that their output may be constrained at times. However, we consider that all options assessed in this PADR would affect the ability of potential wind generators to connect and dispatch *equally* and so this interaction is not considered material for this RIT-T (i.e. since it is not expected to differ across the options).

2.3 Statement of the 'identified need'

The identified need is to meet customer electricity demand growth on the Eyre Peninsula transmission network connected to Davenport.

This RIT-T is a 'reliability corrective action' as defined NER 5.10.2, as the objective is to meet the regulatory obligations and service standards contained in schedule 5.1 of the NER and within the applicable regulatory instrument of the Essential Services Commission of South Australia's (ESCOSA) Electricity Transmission code (ETC).

The ETC transmission reliability standards are generally expressed in terms of the amount of 'redundancy' that must be built into the network to avoid supply outages. Redundancy is generally expressed in 'N-x' terms, where 'x' reflects the number of critical elements[25] that could fail (or be out of service for maintenance) on the network without electricity supply being lost. For example:

- 'N-1' means that electricity supply will not be disrupted if one critical element of the network is out of service
- 'N-2' means that supply will not be disrupted if two separate elements are out of service

Generally, the higher the 'x', the more reliable the network, as it means that electricity will continue to be supplied, even with more elements of the network out of service.

The ETC specifies that ElectraNet must exert its reasonable endeavours in planning, developing and operating the *transmission network*[26] to fulfill the quality standards as mandated by the National Electricity Rules and the ETC. The main objective is to ensure that under normal and reasonable anticipated operating conditions, there will be no need of load shedding to meet these standards.

Additionally, the ETC assigns specific reliability standards for loads on the Eyre Peninsula, with Port Lincoln having ETC 'Category 3' which essentially requires an 'N-1' level of reliability. At present, ElectraNet meets the ETC reliability requirements for all the connection points on the lower Eyre Peninsula, but new proposed load connections will reduce this reliability.

Without action, key network limitations on the Eyre Peninsula are likely to be the:

- Cultana 275/132 kV transformers which have a secure thermal limit of 200 MVA; or

[25] Elements of the transmission network include lines, transformers and other network equipment.

[26] Excerpt from Electricity Transmission Code, Definitions clause: "Means a system of electric lines (generally at nominal voltages of 66 kV or above) and other apparatus, equipment, plant and buildings used to convey electricity, but excluding connection assets."

- Cultana to Yadnarie double-circuit transmission line, operated at 132 kV which has a secure thermal limit of 241 MVA[27]; or
- Davenport to Cultana 275 kV double-circuit transmission line which has a secure thermal limit of 597 MVA.

Large Industrial Loads are typically connected to Category 1 exit points. This requires control schemes are in place that should a contingency event occur, the load will be shed very quickly to prevent overloads of transmission network infrastructure.

Using forecast demands for the Eyre Peninsula from SA Power Networks and directly connected existing large industrial loads (LIL), we can conclude that, without action, by 2030:

- The Cultana 275/132 kV transformer secure (N-1) rating will be reached. An additional 187 MW of LIL connections could be accommodated before reaching the transformer satisfactory (N) ratings.
- The Cultana to Yadnarie double circuit transmission line operated at 132 kV will exceed the N-1 voltage stability limits with the addition of 42 MW, larger LIL connections could be accommodated beyond this rating if they were to operate under emergency controls for the loss of a Cultana to Yadnarie line and a Cultana transformer. Emergency controls under these conditions will need to be very fast acting.
- The Davenport to Cultana secure (N-1) thermal line ratings will also be exceeded with an additional 391 MW.

These are not situations ElectraNet plans to encounter, and this RIT-T has explicitly been commenced to avoid them.

2.4 Assumptions underpinning the identified need

AEMO's ISP Step Change forecast includes LIL if they meet the following commitment criteria:

- Publicly announced their Final Investment Decision and/or commenced construction
- Have obtained connection approvals with a TNSP
- Have obtained environmental approvals.

Importantly, this definition only captures loads that are very close to operation and at the moment, there are no large industrial loads recognised as 'committed' by AEMO.

ElectraNet believes that more consideration should be given to other proposed LIL due to the number, scale and range of industries and proponents seeking connection (as outlined in the sections above).

Due to our necessarily close communication with load proponents as part of the formal connection process, ElectraNet considers we have a closer and clearer understanding of the potential new loads and customers than AEMO. While most of this information is confidential as these loads have not reached a financial approval and have not been publicly announced,

[27] Due to the length of this transmission line its voltage constraint precedes the thermal one. Hence, the maximum secure (N-1) load that can be connected at Yadnarie is 120 MVA.

these insights allow ElectraNet to determine the loads connection likelihood and a possible time to connect with a greater degree of accuracy than is included by AEMO in the ISP.

At the end of November 2024, AEMO published its 2024 draft Electricity Demand Forecasting Methodology document[28], in which it proposes a more granular classification of load than in the ISP. Specifically, the draft methodology process three categories for future prospective loads: committed, anticipated and proposed.

Based on ElectraNet's knowledge of the customer, their expected load and their stage on the connections process, we can develop a forecast for future loads in the short/medium-term that are not considered 'committed' in the ISP Step Change scenario. ElectraNet see this as a critical need as we require to plan for the future and anticipate the network needs, especially because of the delivery time difference between network and industrial load projects and the size of the potential loads.

Specifically, based on AEMO's proposed categories for large industrial loads, ElectraNet considers that all the loads in Table 4 can be classified as "anticipated" – all the "anticipated" loads have lodged connection enquiries with ElectraNet and are active, in terms of maintaining communications and consultations with ElectraNet.

We have developed three different load forecasts as part of this PADR. Each forecast has been derived from the AEMO ISP Step Change forecast with adjustments made for differing views of future major load developments.

The three load forecasts can be summarised as:

- Low forecast:
  - Consists of all the existing and committed loads.
  - This includes all existing SA Power Networks connected loads and all existing directly connected customers.
- Central forecast:
  - This scenario consists of all the loads in the low scenario plus the "anticipated" large industrial loads (i.e. all the loads in Table 4).
- High forecast:
  - This scenario consists of all the loads in the Central Scenario plus the "proposed" large industrial loads that are aligned with government policy (i.e. all the proposed loads in Table 5.

These scenarios are based on future SA Power Networks loads and expected future large industrial loads (as described in above) and look at the needs after 2027. It is important to note that after 2027 the maximum demand will be driven by the large industrial loads, with a smaller component due to SA Power Networks organic growth.

[28] AEMO, 2024 Draft Electricity Demand Forecasting Methodology

The three load forecasts are shown in the figures below (and use the same scale to show the difference between them).

Figure 3 - Low scenario load forecast

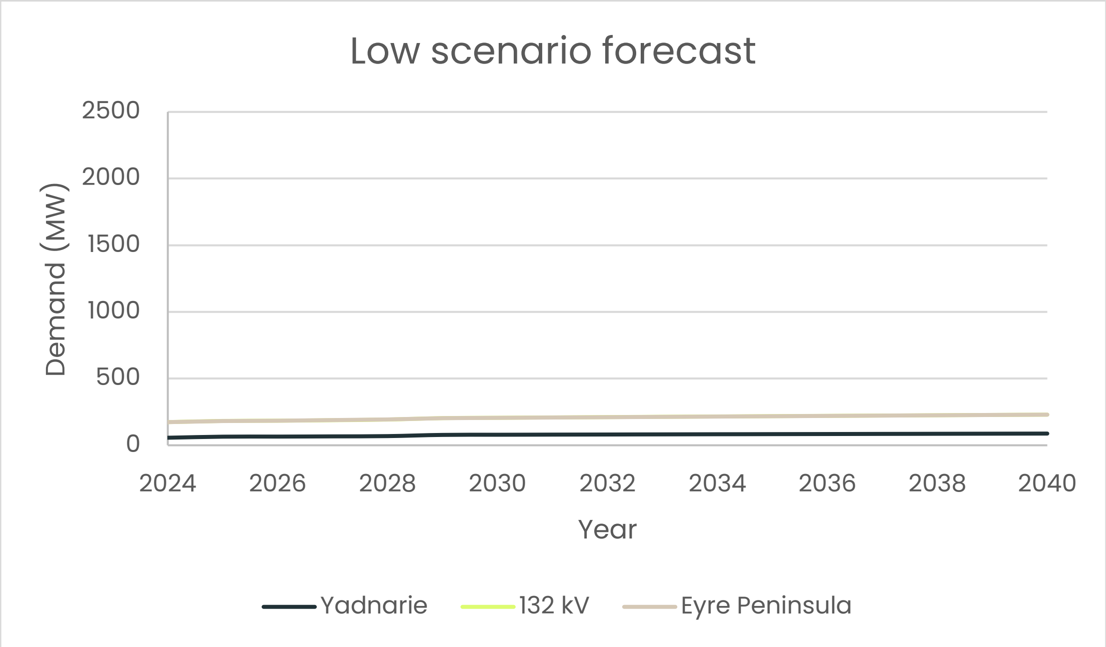


Figure 4 - Central scenario load forecast

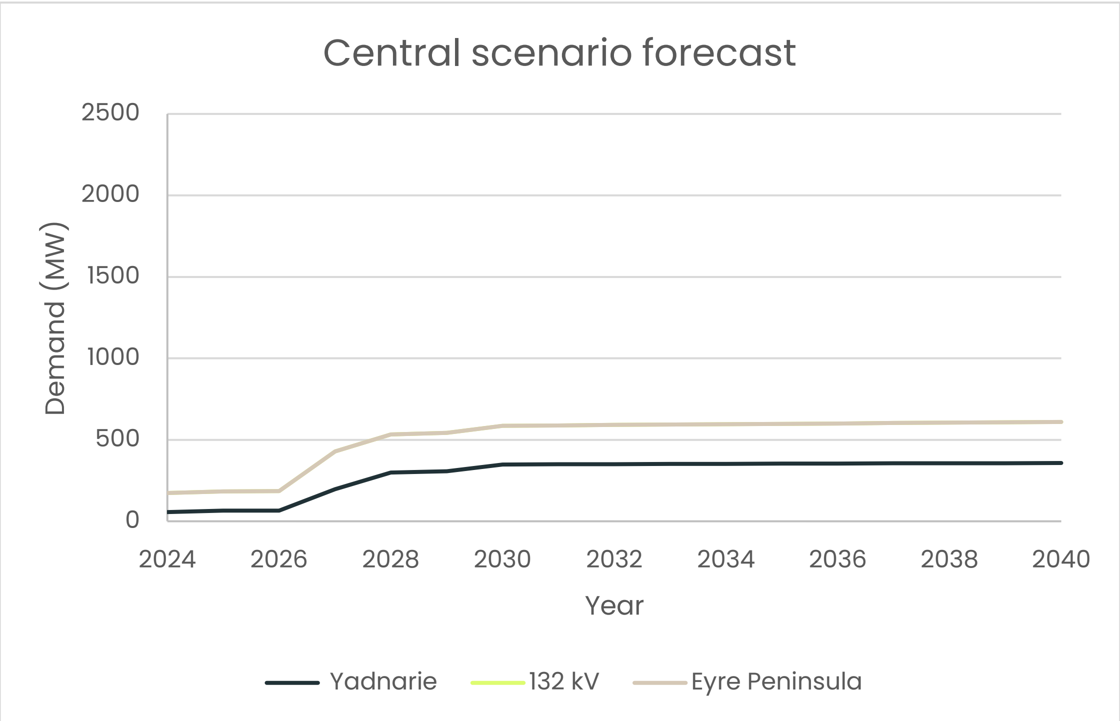
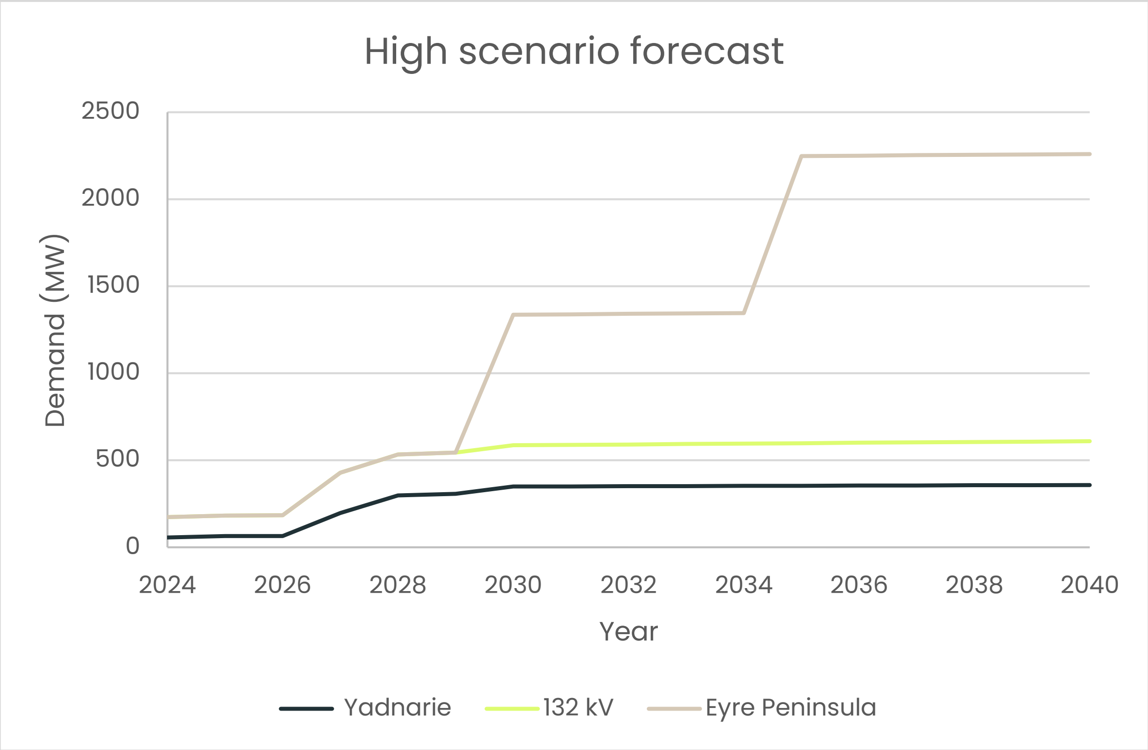


Figure 5 - High scenario load forecast



3 Submissions to the PSCR

ElectraNet received three submissions to the PSCR, one representing a South Australian government's development agency, one an equipment distributor and another a non-identifiable industrial project developer.

3.1 The South Australian government development agency

The Office of Hydrogen Power SA facilitates collaboration with private sector developers as part of the Port Bonython Hydrogen Hub (PBHH) project, and in July 2024 it presented a submission on behalf of the Port Bonython Hydrogen Hub, Power and Transmission Precinct Working group.

The submission provided information relating to the expected capacity of the aggregated PBHH new loads. The information reflects that projects are anticipated to be developed in stages:

- Initial project stages have the ambition to produce and export green hydrogen by 2030 with a forecast load of up to 750 MW.
- Subsequent stages involve the scale up of green hydrogen production capacity in the mid-2030 with total forecast load increasing to up to about 1650 MW.

It is expected that any developments at Port Bonython will connect to Cultana 275 kV.

This information has been used to incorporate the two stages of this project in the high scenario forecast, as a proposed project.

3.2 Xatech International – commercial representative

Xatech International is the representative for Epsilon Composite Cables. Epsilon offers a low-sag/high-temperature conductor, the HVCRC© composite core conductor which can be used to reconductor existing transmission lines or for new transmission lines.

The main advantage is the increase in the transmission line's thermal limit, when compared to equivalent size traditional conductors. For new transmission lines, because the lighter weight of the composite conductors, there will be a small reduction of required towers or the line's design could be modified to reduce the right of way.

The submission presents the possibility of using HVCRC© conductor as alternative to traditional conductors for:

- Option 4 from the PSCR – Duplicate Davenport to Cultana 275 kV. Use composite conductor for the proposed new 275 kV double-circuit transmission line, allowing for a larger thermal rating.
- Option 5 from the PSCR – Duplicate Cultana to Yadnarie 275 kV.
  - Alternative 1. Use composite conductor for the proposed new 275 kV double-circuit transmission line. Allows for a larger thermal rating.
  - Alternative 2. Reconductor the existing 275 kV double-circuit transmission line with a composite conductor. Reduce the required investment and it will allow for a thermal rating comparable to the parallel of the two double-circuit lines proposed.

- Additional option – Upgrade Yadnarie to Port Lincoln 132 kV.[29] Xatech includes this option as a possible solution to consider when the capacity increase could be required. Upgrade the existing 132 kV double-circuit transmission line by reconductoring the line with a composite conductor. As alternative 2 above, it will reduce the required investment to upgrade, and it will allow for a thermal rating comparable to twice of the existing double-circuit line.

The possibility of using this type of conductor is not considered in this report as this is part of the conductor selection process, which will look to optimise the conductor during the design phase of any new transmission lines and follows the RIT-T process[30].

3.3 Confidential industrial project developer

The developer has requested confidentiality on its submission.

Based on their analysis and studies the developer supports Option 1 – Upgrade the Cultana to Yadnarie section to 275 kV. This option aligns with its strategic vision of converting Yadnarie into a renewable energy and long-duration storage hub on the Eyre Peninsula.

[29] The PSCR did not include any option to increase capacity on the 132 kV double-circuit transmission line between Yadnarie and Port Lincoln. With the information available to ElectraNet at October 2024, we do not see the need to increase this transmission line capacity.
[30] Xatech has not provide any cost for their Epsilon Composite Cable, however AEMO's costing tool shows a composite conductor might be competitive in terms of construction cost.

4 Four credible options have been assessed

We have identified four credible network options to meet the identified need, depending on the location of load growth on the Eyre Peninsula. Specifically:

- Three of these options (Options 1, 2 and 3) are alternatives to each other to provide additional capacity between Cultana and Yadnarie; while
- Option 4 can be implemented in combination with Options 1, 2 or 3 to accommodate further additional load on the peninsula.

While these four options were proposed in the PSCR, we have updated our assessment of all the options after conducting power system studies and a more detail scoping of the options and their costings.

In summary:

- Options 1, 2 and 3 would address the possible overloading of the transformers at Cultana and augment the transmission capacity between Cultana and Yadnarie; while
- Option 4 would address the possible future overload of the link between Davenport and Cultana.

The four options are summarised in the table below. The capital costs for the network options have been revised since the PSCR to reflect more detailed scope of works and current market trends and risks, drawing on the experience of recent projects.

While the PSCR also included a further option – Option 5 – which was designed to address large load increases on the Eyre Peninsula south of Whyalla, additional studies undertaken since then have deemed this not necessary at this point in time. We have therefore discontinued the consideration of this option, as outlined in section 4.5 below.

Table 7 - Summary of the credible options assessed

Option	Capacity increases, MVA		Estimated capital cost, $million 2024-25[31]
	Cultana	Yadnarie[32]	
Alternatives to each other to provide additional capacity between Cultana and Yadnarie			
Option 1 – Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation[33]	79*	480	179
Option 2 (Stage 1) – Add a third 200 MVA transformer at Cultana	200	-	33
and a capacitor bank at Yadnarie North	-	90	75
Option 2 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	79*	480	139.5
Option 3 (Stage 1) – Replace the transformers at Cultana with 300 MVA rated transformers	100	-	27
and a capacitor bank at Yadnarie North	-	90	75
Option 3 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	79*	480	139.5
Option to accommodate further additional load on the peninsula			
Option 4: Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits	1,200	-	484

* This option does not increase the capacity at Cultana, but it releases existing capacity as it transfers loads to the 275 kV network, via the new 275/132 kV Yadnarie North substation. This value is based on the present load connected to Yadnarie.

ElectraNet has not identified any non-network solution that could help address the identified need for this RIT-T and the PSCR outlined why these solutions were not expected to be able to assist. No submissions relating to non-network proposals were received in response to the PSCR.

[31] All costs and benefits quoted in this PADR are in 2023-24 dollars unless stated otherwise.
[32] The increase is based on the transmission line voltage constraint of 120 MVA.
[33] The completion of the Eyre Peninsula Link project in 2023, retained the availability to upgrade the transmission line with the construction of a double-circuit transmission line between Cultana and Yadnarie designed for 275 kV, but operated initially at 132 kV.

4.1 Option 1 – Upgrade the Cultana to Yadnarie section to 275 kV

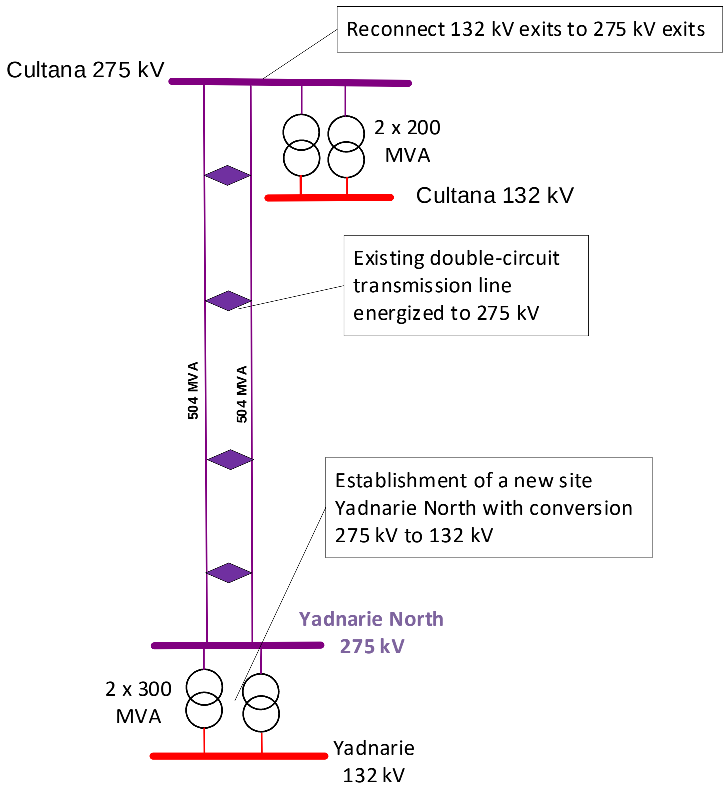
Option 1 is to upgrade the Cultana to Yadnarie section of the Eyre Peninsula Link from its current operation at 132 kV to 275 kV.[34]

Specifically, Option 1 involves:

- Constructing a new Yadnarie North substation with the following main characteristics:
  - connecting the Cultana-Yadnarie line to 275 kV[35]
  - transformation 275/132 kV
  - connecting Yadnarie and Port Lincoln lines to 132 kV
- Reconnecting the 132 kV exits at the existing Cultana substation on the 275 kV side.

Figure 6 presents a simplified network diagram for the substation works under Option 1.

Figure 6 - Network diagram for the works under Option 1



This option increases the secure (N-1) transfer capacity to Yadnarie to 600 MVA and release 79 MVA at Cultana 132 kV. This is the only option that increases capacity at Yadnarie and Cultana 132 kV.

[34] This is the second stage of the preferred option from the 2017-18 RIT-T. It was referred to as 'option 4D' in the PACR for that earlier RIT-T

[35] In the approach to Yadnarie the last two spans use Golf conductor. They will have to be removed or replaced on the new approach to Yadnarie North to achieve the full rating of 607 MVA per circuit. All the other spans between Cultana and Yadnarie use Hurdles conductor @ 100C.

The capital works associated with moving from 132 kV operation to 275 kV operation are expected to cost approximately $179 million and take two years to complete. This is more than expected when the previous PSCR was prepared reflecting conditions across the NEM where capital prices have increased due to a range of factors such as higher input costs (such as wages and materials) and supply chain bottle necks.

The estimated capital cost comprises:

- $13 million in labour costs;
- $34 million materials costs; and
- $132 million in expenses (which includes expenses in relation to contractors, design consultants, etc).

The estimated capital cost can be further broken down into the option's main components:

- $132.5 million to establish Yadnarie North substation;
- $40 million to extend Cultana 275 kV; and
- $6.5 million to allow for realignment of the transmission line at both ends.

The assumed timing of this option under the three different demand scenarios is as follows:

- 2029/30 under the low scenario;
- 2026/27 under the central scenario; and
- 2026/27 under the high scenario.

4.2 Option 2 – Install a third transformer at Cultana and defer the upgrade of the lines between Yadnarie and Cultana

Option 2 involves two potential stages – namely:

- Option 2 (Stage 1) – Add a third 200 MVA transformer at Cultana
- Option 2 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line.

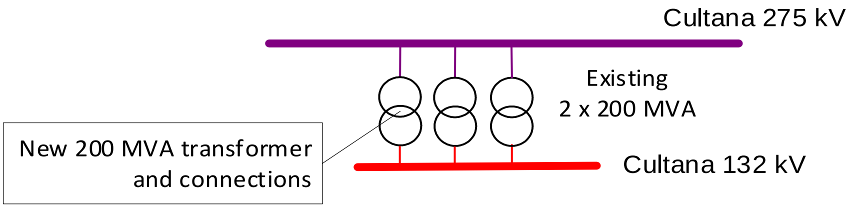
Specifically, the scope of Option 2 involves, in the immediate term:

- a third transformer in one of the existing 275 kV exits at the Cultana substation
- a new 132 kV cable from the new transformer to the 132 kV Cultana bus; and
- establishment of 132 kV Yadnarie North to install a capacitor bank required to remove a voltage constraint at Yadnarie[36]

Figure 7 presents a simplified network diagram for the substation works under Option 2.

[36] During outage of one of the Cultana-Yadnarie 132 kV circuits, the maximum load allowed to connect to Yadnarie will be 120 MW due to voltage collapse. A 60 MVArs capacitor bank (4 x 15 MVArs) will resolve the issue, allowing loads up to 210 MW.

Figure 7 - Network diagram for substation works under Option 2



This will increase the 132 kV secure (N-1) capacity at Cultana to 400 MVA. The capital works associated with the installation of the third transformer and the capacitor bank is estimated to cost $108 million and to take 12 months to complete (after the transformer and capacitor bank have been procured). It is expected that this will provide an additional 200 MVA of network transformation capacity at Cultana.

The estimated capital cost for stage 1 comprises:

- Stage 1
  - $12 million in labour costs;
  - $13 million materials costs; and
  - $83 million in expenses (which includes expenses in relation to contractors, design consultants, etc).

The estimated capital cost can be further broken down into the option's main components:

- Stage 1
  - $33 million to add a third 200 MVA transformer at Cultana; and
  - $75 million to establish Yadnarie North 132 kV and install capacitor bank.

Option 2 (stage 1) is expected to take as long as Option 1 (and Option 3) to commission and so is not expected to deliver benefits any sooner.

As discussed above, a third transformer at Cultana and the capacitor bank at Yadnarie North will defer the need to upgrade the Cultana to Yadnarie section of the Eyre Peninsula Link to 275 kV. This will only be possible if most of the additional load at 132 kV is connecting to Cultana and not south of it. However, ElectraNet expects several large industrial loads connecting south of Yadnarie within a time span of 1 or 2 years. This will require upgrading the transmission line (Option 2 - stage 2) in close succession to the time the additional transformer is installed.

One drawback of this option is that it would use one of the remaining exits at the Cultana substation. It is already likely that all the current available exits may be needed to accommodate future network expansion, including the upgrade of the Cultana-Yadnarie line. This might be required to meet load growth in the broader area (including potentially to accommodate future projects such as Port Bonython hydrogen export hub near Whyalla) increasing the costs of those future developments.

Option 2 (stage 2) includes the upgrade of the Cultana-Yadnarie transmission line when required. This includes the completion of the Yadnarie North with the installation of transformers and the connection to 275 kV. This will increase the secure (N-1) transfer capacity to Yadnarie to 600 MVA. The total cost of the upgrading is $139.5 million. Analysis of this variation includes an analysis of the value of the deferment made possible by installing a third transformer and the estimated value of higher losses on the 132 kV network. To the extent that this variation also involves the upgrade of the line itself the analysis will be based on the same assumptions made for Option 1.

The estimated capital cost for stage 2 comprises:

- Stage 2
  - $15 million in labour costs;
  - $33.5 million materials costs; and
  - $91 million in expenses (which includes expenses in relation to contractors, design consultants, etc).

The estimated capital cost can be further broken down into the option's main components:

- Stage 2
  - $93 million to complete Yadnarie North transformation substation;
  - $40 million to extend Cultana 275 kV; and
  - $6.5 million to allow for realignment of the transmission line at both ends.

We expect to also assume that the third transformer would remain at Cultana even after the Cultana to Yadnarie section is upgraded to 275 kV, as the cost of removing/relocating it is expected to be prohibitively high. The third transformer would have no impact on the capacity of the line south of Cultana after the upgrade, but it would increase the 132 kV capacity at Cultana.

Depending on the location of new loads and generation, there is a possibility the third transformer will become a stranded asset with no used capacity after the upgrade.

The assumed timing of this option under the three different demand scenarios is as follows:

- 2029/30 under the low scenario for stage 1;
- 2026/27 under the central scenario for stage 1 and 2027/28 for stage 2; and
- 2026/27 under the high scenario for stage 1 and 2027/28 for stage 2.

4.3 Option 3 – Replace the Cultana transformers and defer the upgrade of the lines between Yadnarie and Cultana

Similar to Option 2, Option 3 is a staged option and involves two potential stages – namely:

- Option 3 (Stage 1) – Replace the transformers at Cultana with 300 MVA rated transformers; and
- Option 3 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line

Option 3 is similar to Option 2 in that additional transformer capacity is used in the first instance to defer the ultimate upgrade of the Cultana to Yadnarie section of the Eyre Peninsula Link from 132 kV to 275 kV. The difference is that Option 3 involves replacing the two existing 200 MVA transformers at Cultana with two 300 MVA transformers, rather than adding a third transformer.

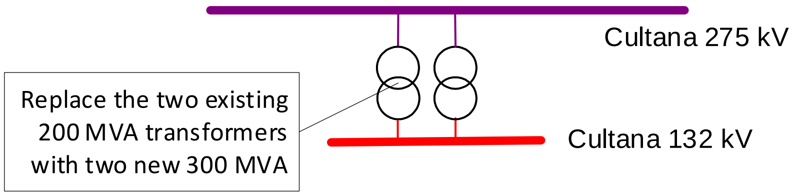
Figure 8 presents a simplified network diagram for the substation works under Option 3.

Specifically, the scope of Option 3 involves, in the immediate term:

- Replacing the existing Cultana 200 MVA transformers with 300 MVA transformers

- Replace connecting equipment for these transformers to accommodate the higher capacity transformers
- Establishment of 132 kV Yadnarie North to install capacitor banks required to remove a voltage constraint at Yadnarie[37]

Figure 8 - Network diagram for the substation works under Option 3



The capital works associated with replacing the two existing transformers and installing the capacitor bank are estimated to cost $102 million and to take 12 months to complete (after the transformers and capacitor bank have been procured). This will increase the 132 kV secure (N-1) capacity at Cultana to 300 MVA.

The estimated capital cost for stage 1 comprises:

- Stage 1
  - $13 million in labour costs;
  - $18.5 million materials costs; and
  - $70.5 million in expenses (which includes expenses in relation to contractors, design consultants, etc).

The estimated capital cost can be further broken down into the option's main components:

- Stage 1
  - $27 million to upgrade/replace transformers at Cultana; and
  - $75 million to establish North Yadnarie 132 kV and install capacitor bank.

As with Option 2, given current procurement lead-times we expect that the total time to procure and commission the two new transformers and the capacitor bank would be similar as for upgrading the line under Option 1. Therefore, we do not expect that Option 3 would deliver benefits sooner than either Option 1 or Option 2.

Option 3 (stage 1) involves replacing the transformers at Cultana and could defer the need to upgrade of the Cultana to Yadnarie section of the Eyre Peninsula Link to 275 kV, but not prevent it entirely. This will only be possible if most of the additional load at 132 kV is connecting to Cultana and not south of it. However, large industrial loads are expected to connect south of Yadnarie within a time span of 1 or 2 years. This will require upgrading the transmission line in close succession to the time the two transformers are replaced.

[37] During outage of one of the Cultana-Yadnarie 132 kV, the maximum load allowed to connect to Yadnarie will be 120 MW due to voltage collapse. A 60 MVArs capacitor bank (4 x 15 MVArs) will resolve the issue, allowing loads up to 210 MW.

Hence, the variation Option 3 (stage 2) would be required to upgrade the Cultana-Yadnarie transmission line at a later day. This variation is the same as Option 2 (stage 2), with the same scope of works, transfer capacity and estimated costs of $139.5 million.

Therefore, as with Option 2, analysis of this variation amounts to study the value of the deferment made possible by upgrading the two existing transformers at Cultana. To the extent that this option also involves the (later) upgrade of the line itself, the analysis will be based on the same assumptions made for Option 1. Once the line is upgraded there will be a surplus of transformation capacity at Cultana, as the load at Cultana 132 kV will be reduced.

Option 3 has the advantage of keeping all the current spare exits at the Cultana substation available for future network developments.

The assumed timing of this option under the three different demand scenarios is as follows:

- 2029/30 under the low scenario for stage 1;
- 2026/27 under the central scenario for stage 1 and 2027/28 for stage 2; and
- 2026/27 under the high scenario for stage 1 and 2027/28 for stage 2.

4.4 Option 4 – Duplicate Davenport to Cultana 275 kV

Option 4 is to upgrade the Davenport to Cultana section of the Eyre Peninsula Link to deliver more power from Davenport to Cultana. This option may be required in conjunction with others or by itself depending on the location of new load.

Connectivity to Davenport is restricted as only one exit is available and it is not possible to extent the site. In the past a new Davenport South future site has been considered. However, a new site south of Davenport would have some complications:

- Connecting to Cultana would require
    - Crossing the Spencer Gulf, which represents a transmission line section with more stringent design requirements, high exposure to sea environment and a higher risk of loss of load because of longer times to repair or,
    - A long transmission line around the gulf, avoiding the crossing.
- It does not provide geographic diversity, as it will be close to Davenport.
- It will be difficult to establish new transmission corridors north due to the localities of Port Augusta and Stirling North and any new transmission line most probably will have to cross existing transmission lines. Similarly, transmission corridors in the east direction will be restricted by existing and emerging solar farms. This will reduce the alternatives to connect to the network.
- A south location, closer to shore increases the future risks due to climate change, rising sea levels and coastal inundation[38].

ElectraNet considers a new site north of Davenport could be a better choice. This new site connection could be located around 30 km North-West of Davenport, in the vicinity of

[38] By mid-century sea levels are projected to rise around 24 cm along the South Australia coast. Department of Environment and Water SA. Guide to climate projections for risk assessment and planning in South Australia 2022.

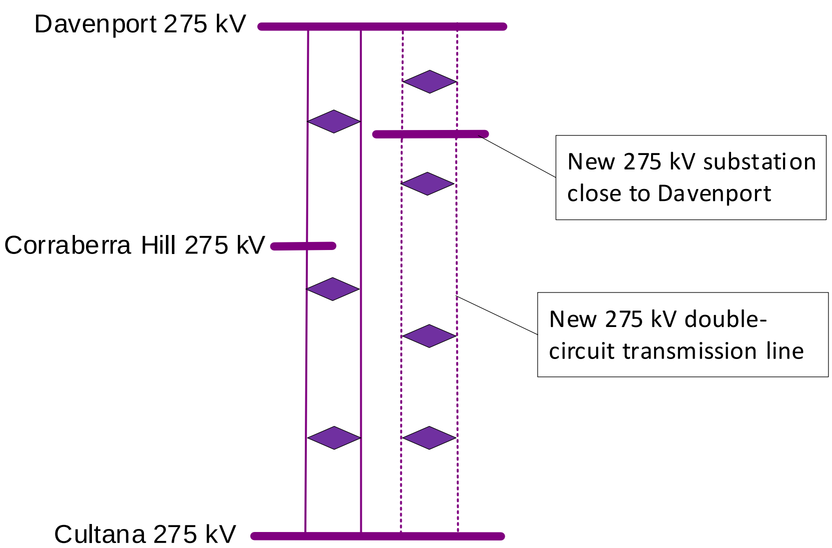
Carriewerloo. A site at this location could become a switching hub, facilitating the connection to Davenport, BHP, the Eyre Peninsula and the Mid-North.

Specifically, the scope of Option 4 involves, in the immediate term:

- Establishing a new site called Carriewerloo approximately 30 km north of Davenport;
- Expansion of Cultana at 275 kV;
- Build a 275 kV double circuit transmission line between Davenport to Carriewerloo, with an approximated length of 30 km and rated around 600 MVA per circuit or higher. We plan to make use of an existing 275 kV circuit leaving Davenport, that partially follows the same path and that for a few kilometres is installed on double circuit transmission towers. This will reduce the length of conductor and number of structures required for the new transmission line.
- A new double circuit 275 kV overhead transmission line between Carriewerloo and Cultana, of approximately 70 km and rated at around 600 MVA[39] per circuit or higher.

Figure 9 presents a simplified network diagram for the substation works under Option 4.

Figure 9 - Network diagram for the works under Option 4



The capital works associated with this option are around $484m and this project would have a lead time of around 4 years from the time the RIT-T is concluded, and Final Investment Decision (FID) is made. This project would increase the secure (N-1) transfer capacity from Davenport to Cultana from estimated 600 MW to around 1,800 MW.

The estimated capital cost comprises[40]:

- $41 million in labour costs;
- $88 million materials costs; and

[39] Capacity is limited to the rating of the existing Davenport - Cultana circuits.
[40] The establishment of the new Carriewerloo substation will require land acquisition. Its cost is not included here because it is expected it will represent a small percentage of the total option cost.

- $355 million in expenses (which includes expenses in relation to contractors, design consultants, etc).

The estimated capital cost can be further broken down into the option's main components:

- $89.5 million to establish new 275 kV Carriewerloo substation;
- $99 million for new double circuit 275 kV transmission line between Davenport and Carriewerloo;
- $16 million for existing 275 kV transmission line reconfiguration leaving Davenport;
- $231 million for new double circuit 275 kV transmission line between Carriewerloo and Cultana; and
- $48.5 million to extend Cultana 275 kV

The assumed timing of this option under the three different demand scenarios is as follows:

- It is not required over the assessment period under the low scenario;
- 2034/35 under the central scenario; and
- 2028/29 under the high scenario.

4.5 Options considered but not progressed

We have also considered a range of other options but have not progressed these on the grounds that they are not considered feasible and therefore are not credible options. These options cannot resolve the identified need satisfactorily.

A summary of these options is provided in the table below.

Table 8 - Summary of options considered but not progressed

Option	Overview	Reason(s) it has not been progressed
Only install the third transformer at Cultana	Option 2 but without the ultimate line upgrade to 275 kV.	A third transformer alone would not provide sufficient capacity to meet the identified need for most new connections. It would therefore involve additional costs without commensurately reducing expected unserved energy base case and losses for Eyre Peninsula generators and so is not considered economically feasible.
Only upgrading the Cultana transformers	Option 3 but without the ultimate line upgrade to 275 kV.	Upgrading the Cultana transformers alone would not provide sufficient capacity to meet the identified need for most new connections. It would therefore involve additional costs without commensurately reducing expected connection costs in the base case and losses for Eyre Peninsula generators and so is not considered economically feasible.
Commission a new 132 kV double-circuit line between Cultana and Yadnarie	Duplicate the existing 132 kV line, or parts of it.	This would cost considerably more than any of the credible options outlined above but would not provide any additional market benefits. This option is therefore not considered economically feasible. Additionally, it will require the addition of more transformer capacity at Cultana.
'Option 5' from the PSCR – duplicate the Cultana to Yadnarie North 275 kV circuits	Duplicate the existing transmission line	This would represent a considerable cost and with the information we have at the moment, there are not proposed future loads that could require this duplication. None of the load forecasts included in this report supports this capacity increase in the studied time period.

5 Estimating market benefits

This section outlines the two categories of market benefit we expect to be material for this RIT-T, as well as how they have been estimated.

5.1 Two RIT-T 'market benefits' are expected to be material

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 NSP can demonstrate that they are unlikely to be material in relation to the RIT-T assessment for a specific option.

The only two categories of market benefit under the RIT-T that are expected to be material are:

- changes in involuntary load shedding – due to each option being able to avoid different levels of unserved energy under the base case; and
- changes in network losses – due to the different capacity options resulting in different levels of electrical losses on the peninsula.

Both of these have been modelled using PLEXOS and included in the PADR assessment.

While all options are also expected to deliver significant other market benefits compared to the base case [41] (e.g. through improving the efficiency of wider wholesale market build and operational decisions), these impacts are not expected to be materially *different* across the options and so have not been estimated.

In addition, while Options 2-3 exhibit flexibility in terms of their ability to defer the upgrade of the Cultana to Yadnarie line until a time that sufficient future load becomes committed, we have captured the option value of this flexibility implicitly through considering scenarios in which the line upgrade is not required initially. This approach is consistent with the AER guidance on the treatment of option value. We consider that a wider option value modelling exercise would be disproportionate to any option value that may be identified for this specific RIT-T assessment.

While involuntary load shedding and losses have been estimated, analysis has shown differences between all the options are actually small for the central and high demand scenarios. This is because Option 2 and 3 require upgrading the transmission line just one year after the transformer upgrades, which corresponds to one year after the upgrade of the line for Option 1. Hence, all options operate for most years with the upgraded transmission line making the involuntary load shedding and losses amounts effectively the same between the options, for most of the analysis period, except for a couple of years.

The low demand scenario shows similar small quantities of involuntary load shedding for all options at the end of the analysis period. For this scenario the main difference is between Option 1 and Options 2 and 3. Option 1 is the only one upgrading the transmission line and therefore its losses are small compared to the other options.

[41] See Section 6.1.

All avoided involuntary load shedding has been valued at a weighted VCR of $20,970 per MWh. This VCR was calculated using the South Australian residential VCR and the VCRs for industrial, mining and services determined by the AER[42].

Our PLEXOS model is based on a detailed representation of our network, which includes the individual transmission lines and their respective parameters, such as resistance. This allows for a direct calculation of the losses for each transmission line. For each demand scenario and option, a PLEXOS simulation was carried out and losses were calculated for the relevant assets. Then the cost of the losses was calculated assuming a value of $62/MWh, which represents the marginal fuel cost, based on approximated future contract pricing[43].

5.2 PLEXOS has been used to estimate market benefits categories

At ElectraNet, we have developed an internal PLEXOS market model to assess the market benefits expected to arise for each of the options.

This market modelling has been conducted using a detailed model of ElectraNet's transmission network, which allows for more granular analysis and produces results more directly related to the real network.

For the purposes of the market modelling, ElectraNet defines two sets of market modelling inputs – namely:

- 'Common' assumptions – these are assumptions that apply across all scenarios and model runs, e.g., generator technical and financial parameters, the stringency of jurisdictional Renewable Energy Targets and capital costs of new entrant generators; changes in involuntary load shedding – due to each option being able to avoid different levels of unserved energy under the base case; and
- 'State of the world' assumptions – these are the assumptions that define each 'state of the world' modelled in the option value analysis, i.e., 'a low demand world' vs. a 'high demand world' and a specific option.

For the purposes of this RIT-T, ElectraNet has only modelled outcomes under the ISP Step Change scenario.

Other ISP scenarios differ across a range of parameters, including forecast demand and the approach to decarbonisation. However, these differences principally affect the estimation of wholesale market benefits and, since no categories of wholesale market benefit are material to the NPV assessment of the two credible network options included in this PADR, adopting a single scenario approach is considered appropriate.

[42] AER Australian Energy Regulator, Values of customer reliability – final report on VCR values, Dec. 2024.
[43] AEMO's 2023 Inputs, Assumptions and Scenarios Report (IASR)

6 Overview of the assessment approach

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

6.1 The base case 'do nothing' option

Consistent with the RIT-T requirements, the assessment undertaken in the PADR 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, i.e.:[44]

> *"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, the existing shared transmission infrastructure on the Eyre Peninsula is assumed not to change going forward. While this RIT-T has been initiated to be able to accommodate future load increases, the assessment is required to use a "do nothing" base case as a common point of reference when estimating the net benefits of each credible option.

The connection of new loads under the base case would be constrained by the existing ratings in the network. These restrictions would limit the loads that can connect and the operation of those that are able to connect, which would result in increasingly frequent unserved energy.

These are not situations ElectraNet plans to encounter, and the NER obligations and this RIT-T have been initiated specifically to avoid them.

6.2 General cost benefit analysis parameters adopted

The RIT-T analysis considers a 20-year assessment period from 2024-25 to 2043-44. A 20-year period considers the size, complexity and expected lives of the options and provides for 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.

A real, pre-tax discount rate of 7.0 per cent has been adopted as the central assumption for the NPV analysis presented in this PADR, consistent with the assumptions adopted in the latest IASR and AEMO ISP Step Change scenario. The RIT-T also 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. ElectraNet has therefore tested the sensitivity of the results

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44 AER, *Regulatory Investment Test for Transmission Application Guidelines,* August 2020, p. 21.

to a lower bound discount rate of 3.63 per cent,[45] and an upper bound discount rate of 10.50 per cent (being the upper bound in the latest IASR).

6.3 Approach to estimating costs

ElectraNet has prepared cost estimates reflecting the AACE cost estimate classification system, level AACE class 4 for the credible network options in this RIT-T. The class 4 estimates are of an expected accuracy of +50%/-30%.

Cost estimates have been derived from high level desktop review of required scope prepared by asset engineering team and/or single line diagrams prepared by network planning team.

The estimates have been obtained following ElectraNet's standard procedure, using data from our estimating database in conjunction with latest costs from recent projects. No explicit contingency allowance has been added to the estimates, though we note that estimates are accurately interpreted as ranges rather than the point estimates used in the analysis presented in this PADR.

The estimates do not Include any costs related to the acquisition of land nor easements. Based on the present option scopes and their respective costing estimates, we have concluded that the expected costs of these items will not be material when compared with the total option cost and so they do not need to be considered at this stage.

All cost estimates were prepared in real, 2024/25 dollars based on the information and pricing history available to ElectraNet at the time that they were estimated.

There are differences between the costings in our previous PSCR and this PADR. The main reasons for them are:

- power system studies provided new information around the options, there requirements and capabilities;
- costs in general have increased considerably due to reduced labour markets and increased price of raw materials and manufacturing; and
- more detail on the scope of works for the options.

The resulting cost estimates are presented in the next section.

Additionally, for the NPV analysis ElectraNet has assumed for each option that 0.5% of its initial capital cost represents the yearly cost incurred to operate and maintain the assets across their lifespan.

[45] A discount rate of 3.63% pre-tax Weighted Average Cost of Capital is based on AER, TasNetworks (Transmission) 2024–29 Final Determination, April 2024.

6.4 Costs estimates for credible options

Table 9 - Estimated costs for credible options (Class 4, +50%/-30%)

Option	Estimated capital cost, $million 2024-25[46]
Alternatives to each other to provide additional capacity between Cultana and Yadnarie	
Option 1 – Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation[47]	
Establish Yadnarie North substation (275/132 kV)	132.5
Extend 275 kV switchyard at Cultana	40
Realignment of the transmission line at both ends	6.5
Option 1 - Total	**179**
Option 2 (Stage 1) – Add a third 200 MVA transformer at Cultana and a capacitor bank at Yadnarie North	
Add a third 200 MVA 275/132 kV transformer at Cultana	33
Establish the 132 kV switchyard at Yadnarie North and install capacitor bank	75
Option 2 (Stage 1) - Total	**108**
Option 2 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line to 275 kV	
Complete establishment of Yadnarie North 275/132 kV	93
Extend Cultana 275 kV switchyard	40
Realignment of the transmission line at both ends	6.5
Option 2 (Stage 2) - Total	**139.5**

[46] All costs and benefits quoted in this PADR are in 2023-24 dollars unless stated otherwise.
[47] The completion of the Eyre Peninsula Link project in 2023, retained the availability to upgrade the transmission line with the construction of a double-circuit transmission line between Cultana and Yadnarie designed for 275 kV, but operated initially at 132 kV.

Option 3 (Stage 1) – Replace the transformers at Cultana with 300 MVA rated transformers	
Replace the 275/132 kV transformers at Cultana with 300 MVA transformers	27
Establish the 132 kV switchyard at Yadnarie North and install capacitor bank	75
Option 3 (Stage 1) - Total	**102**
Option 3 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line to 275 kV	
Complete establishment of Yadnarie North 275/132 kV	93
Extend Cultana 275 kV switchyard	40
Realignment of the transmission line at both ends	6.5
Option 3 (Stage 2) - Total	**139.5**
Options to accommodate further additional load on the peninsula	
Option 4 – Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits	
Establish a new 275 kV substation close to Carriewerloo	89.5
Construct a new double circuit 275 kV transmission line between Davenport and Carriewerloo	99
Reconfigure existing 275 kV circuit leaving Davenport	16
Construct a new double circuit 275 kV transmission line between Carriewerloo and Cultana	231
Extend the 275 kV switchyard at Cultana	48.5
Option 4 - Total	**484**

7 Net present value analysis

This section outlines the results of the economic assessment we have undertaken of the credible options.

Our analysis has shown that using the three demand scenarios described in this PADR, the delivering time of the options is as shown in Table 10.

Table 10. Delivering times for the options based on the load scenario

Option	Low	Central	High
Alternatives to each other to provide additional capacity between Cultana and Yadnarie			
Option 1 – Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation	2029/30	2026/27	2026/27
Option 2 (Stage 1) – Add a third 200 MVA transformer at Cultana	2029/30	2026/27	2026/27
Option 2 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	-	2027/28	2027/28
Option 3 (Stage 1) – Replace the transformers at Cultana with 300 MVA rated transformers	2029/30	2026/27	2026/27
Option 3 (Stage 2) – Upgrading the Cultana-Yadnarie transmission line	-	2027/28	2027/28
Option to accommodate further additional load on the peninsula			
Option 4: Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits	-	2035/36	2029/30

7.1 Low demand scenario

This scenario assumes all existing and committed loads. This includes all existing SA Power Networks connected loads and all existing directly connected customers.

Under this scenario Options 2-3 only require stage 1, as the only constraint binding would be the transformers at Cultana. Option 4 is also not needed under the low demand scenario.

Figure 10 shows the NPV for the three options and indicates that the options upgrading the transformers at Cultana are more competitive than the upgrading of the transmission line. The respective NPVs are Option 1: -$110.73 m, Option 2: -$65.11 m and Option 3: -$60.48 m.

Figure 10. NPV for the low demand scenario

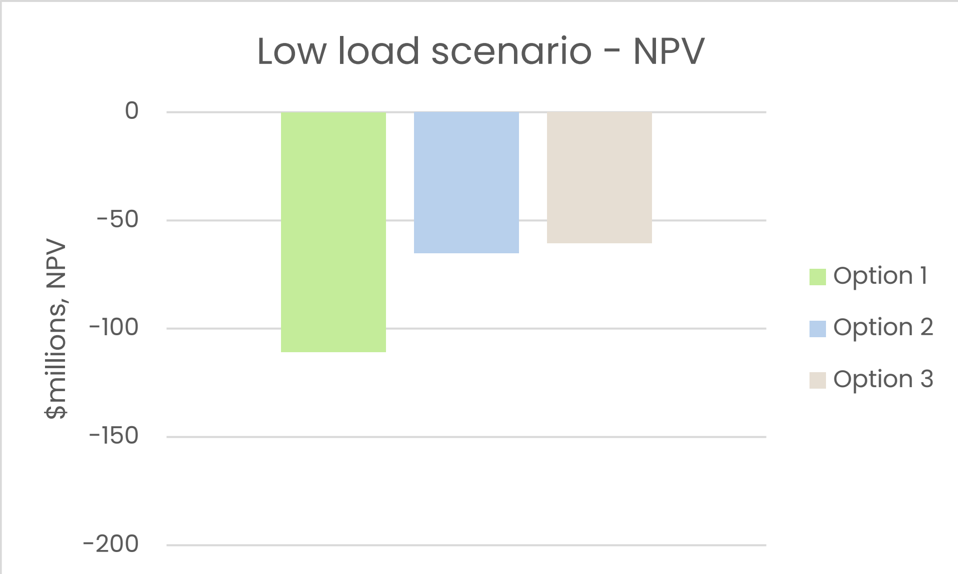
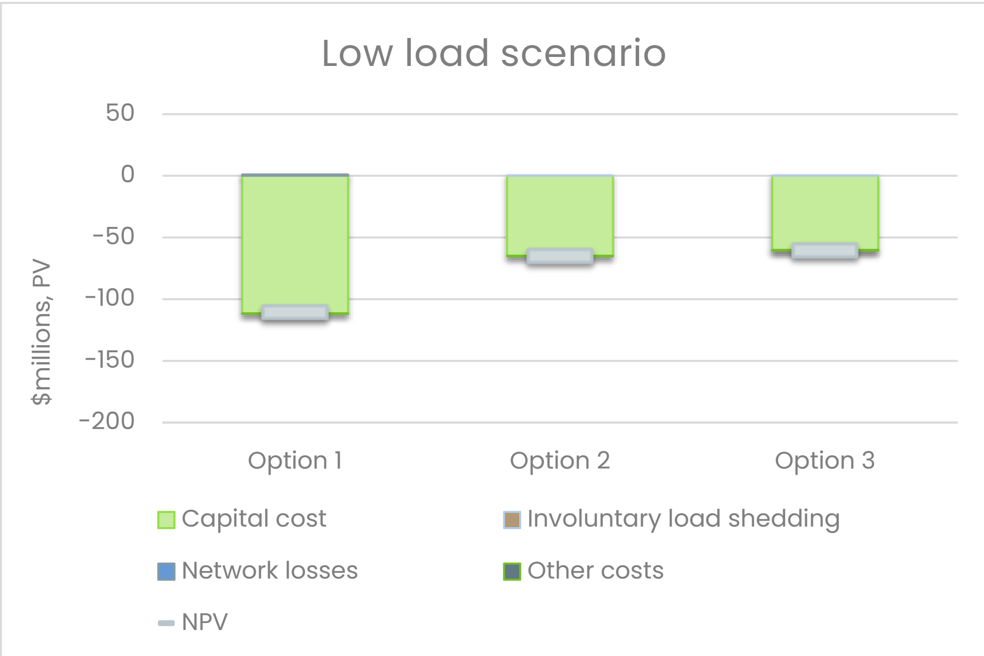


Figure 11 presents a breakdown of costs and benefits under the low demand scenario calculated in present value terms.

Figure 11. Breakdown costs and benefits for the low load scenario



7.2 Central demand scenario

This scenario consists of all the loads in the low scenario plus the "anticipated" large industrial loads. Figure 12 shows the NPV for the three options and indicates Option 1 is more competitive than the other two.

Figure 12. NPV for central demand scenario

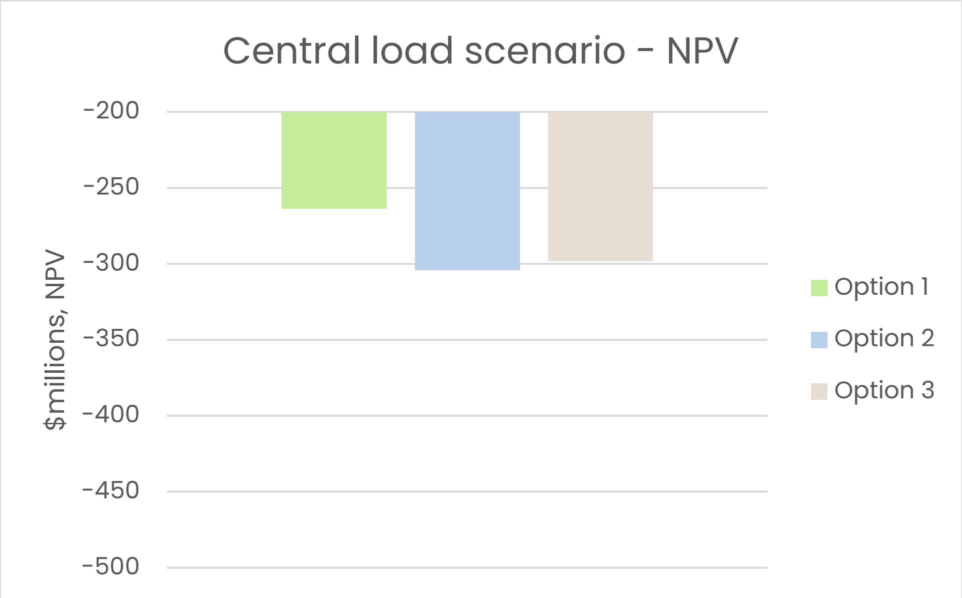
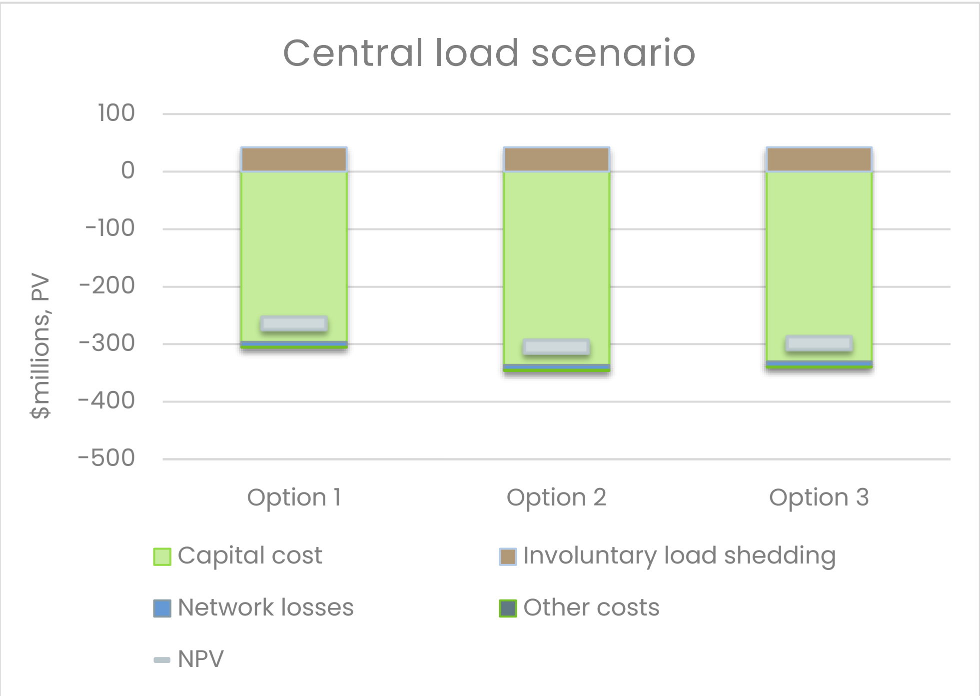


Figure 13 presents a breakdown of costs and benefits under the central demand scenario calculated in present value terms.

Figure 13. Breakdown costs and benefits for the central load scenario



Under this scenario Options 2-3 require implementing both stages of their construction. Also, because the high demand increases at Yadnarie, both options must upgrade the transmission line between Cultana and Yadnarie one year after the transformer upgrading.

Furthermore, because the demand increases across all the Eyre Peninsula, it is required to upgrade its connection to the rest of the network, Option 4 must be implemented on all three options by 2035. The inclusion of Option 4 on all the other options explains the large difference between the NPV for the low demand scenario and this scenario.

Figure 12 shows the NPVs for the three options, with Option 1 been the most competitive. The respective NPVs are Option 1: -$263.74 m, Option 2: -$304.10 m and Option 3: -$298.07 m.

7.3 High demand scenario

This scenario consists of all the loads in the Central Scenario plus the "proposed" large industrial loads that are aligned with government policy. Figure 14 shows the NPV for the three options and indicates Option 1 is more competitive than the other two.

Figure 14. NPV for the high demand scenario

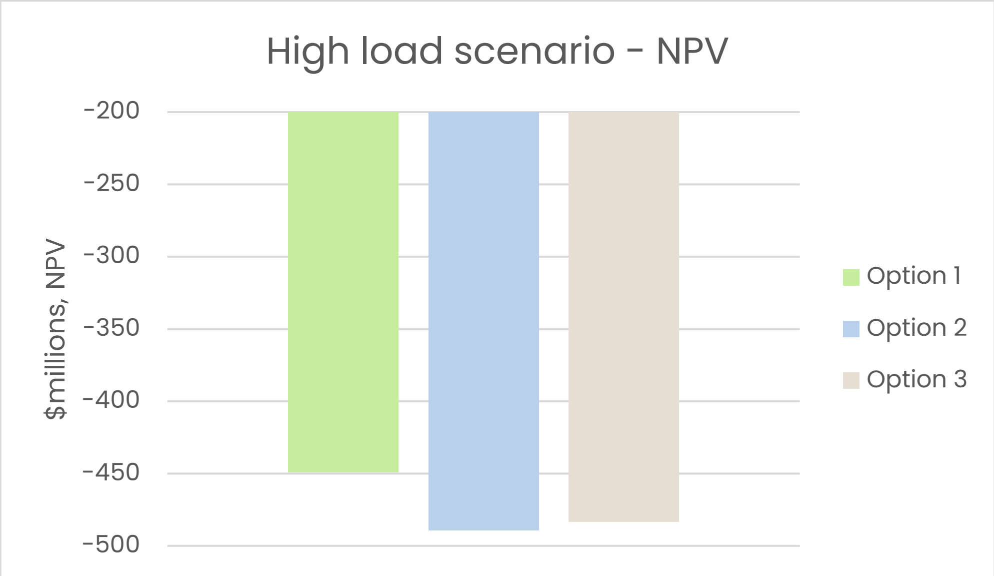
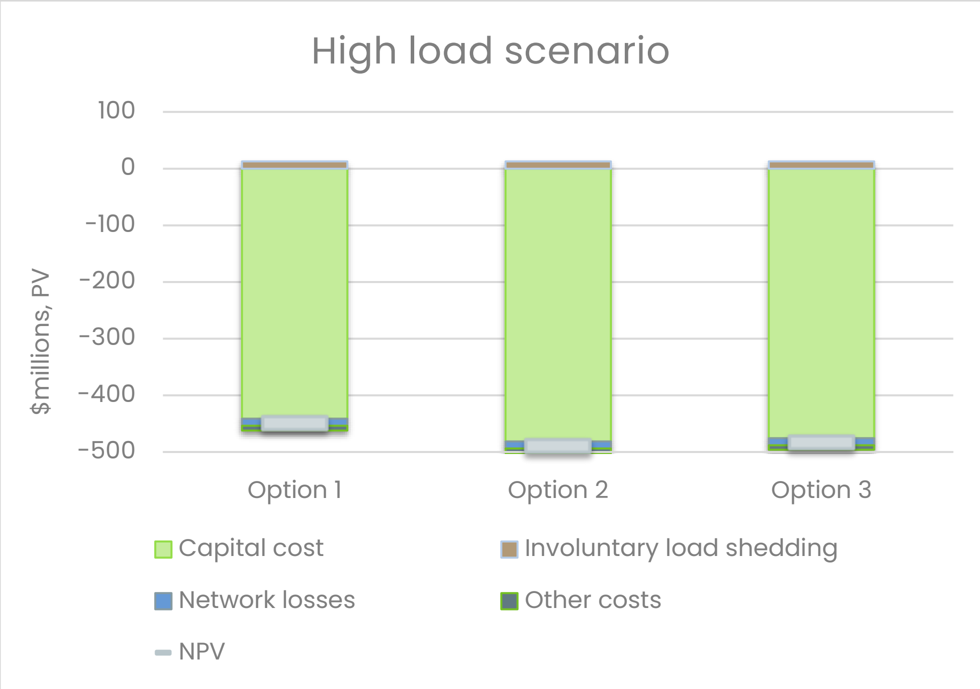


Figure 15 presents a breakdown of costs and benefits under the high demand scenario calculated in present value terms.

As with the central demand scenario, options 2-3 require implementing both stages of their construction. Also, because the high demand increases at Yadnarie, both options must upgrade the transmission line between Cultana and Yadnarie one year after the transformer upgrading.

Figure 15. Breakdown costs and benefits for the high load scenario



Furthermore, because of the high demand across all the Eyre Peninsula, it is required to upgrade its connection to the rest of the network. Option 4 must therefore be implemented on all three options by 2029. The inclusion of Option 4 on all the other options explains the large difference between the NPV for the low demand scenario and this scenario.

Figure 14 shows the NPVs for the three options, with Option 1 been the most competitive. The respective NPVs are Option 1: -$449.16 m, Option 2: -$489.26 m and Option 3: -$483.26 m.

7.4 Weighted net benefits

Given the difficulty on determining the most probable demand scenario, to evaluate the net benefit, ElectraNet has considered a balance by estimating the NPV for a weighted scenario, where each of the previous NPV calculated for each of the demand scenarios has a weight of a third.

Figure 16 shows the results for the weighted scenario for the three options, with Option 1 been the most competitive. The respective NPVs are Option 1: -$274.54 m, Option 2: -$286.16 m and Option 3: -$280.6 m.

Figure 16. NPV for weighted demand scenario

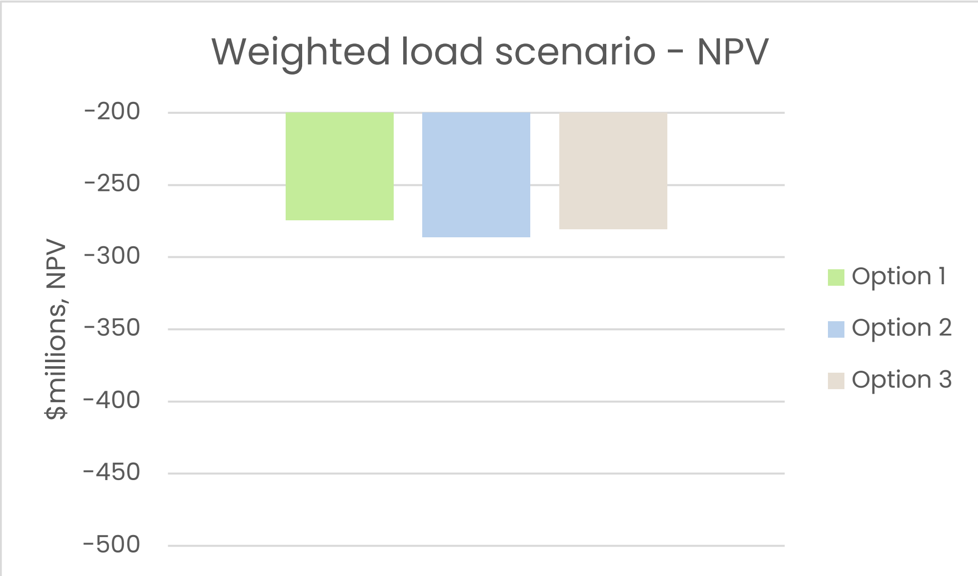
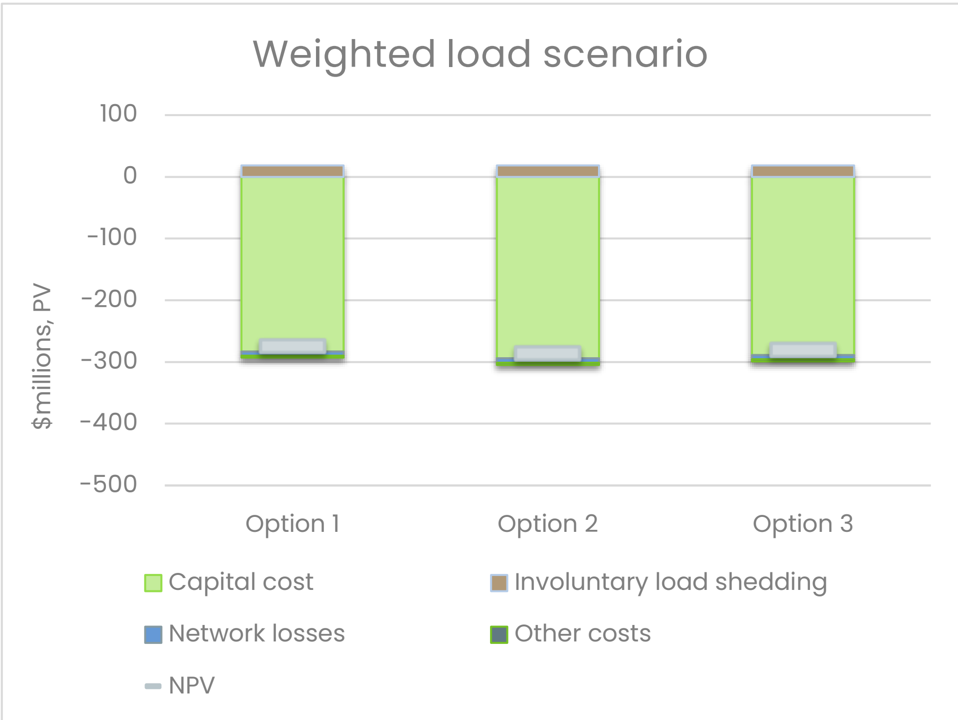


Figure 17 presents a breakdown of costs and benefits under the weighted demand scenario calculated in present value terms.

Figure 17. Breakdown costs and benefits for the weighted load scenario



7.5 Sensitivity testing

ElectraNet has undertaken sensitivity testing to examine how the net market benefit of the credible options change with respect to changes in key modelling assumptions. The factors tested as part of the sensitivity analysis in this PADR are:

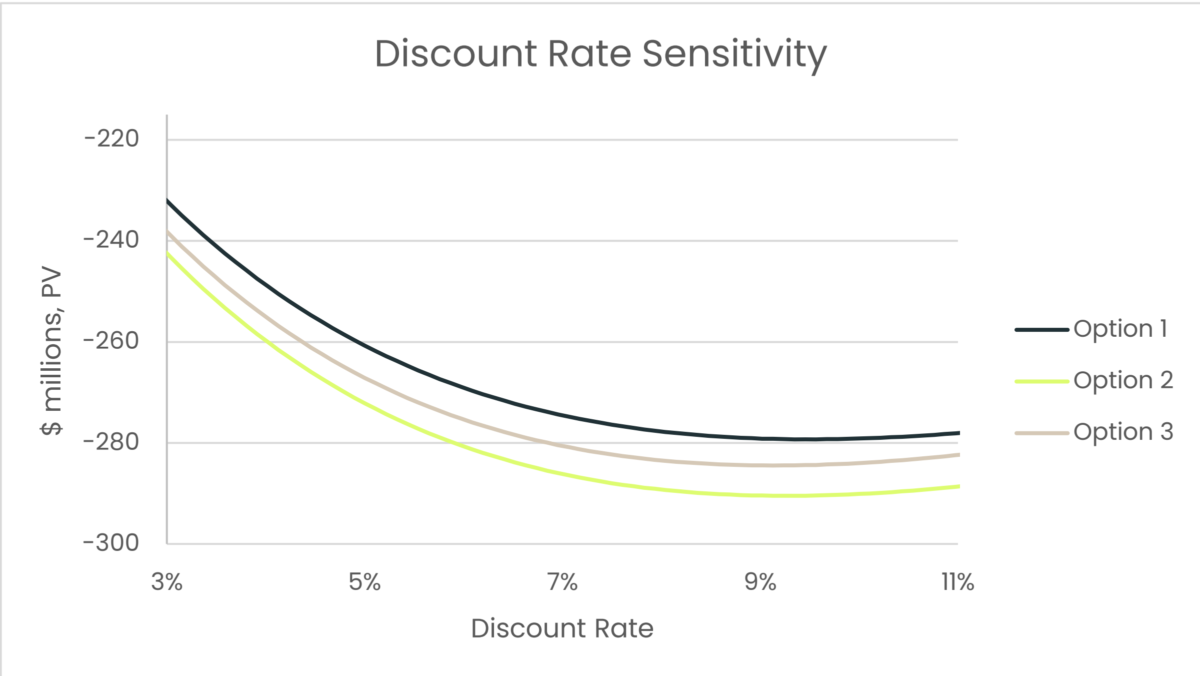
- Alternate commercial discount rate assumptions (3.63% to 10.50%)
- Higher or lower capital costs of the credible options (+50% to -30%); and
- Variations in the estimated VCR (+30% to -30%)

7.5.1 Sensitivity analysis on the discount rate

ElectraNet has examined possible variations on the discount rate and look at the range between 3.63% and 10.50%. Analysis within this range shows that Option 1 is the preferred one across the interval.

In addition, we do not find a realistic 'boundary value' for Option 1 no longer being preferred. That is, there is no realistic alternate discount rate that would result in Option 2 or Option 3 being preferred over Option 1 on a weighted basis.

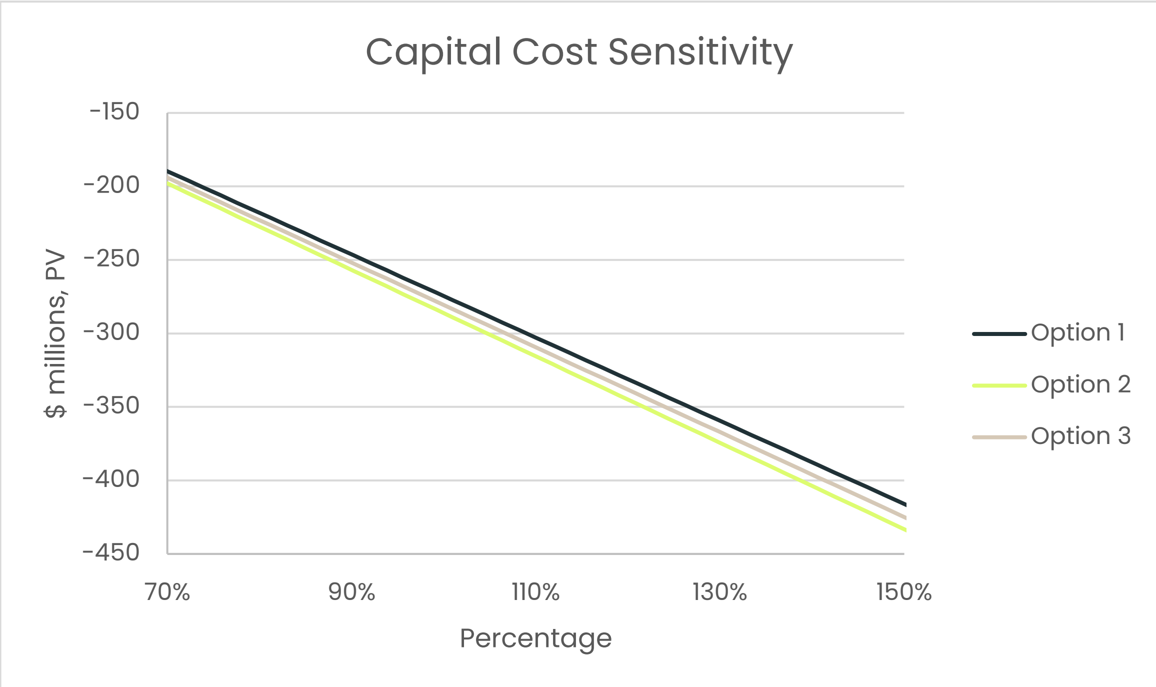
Figure 18. Sensitivity analysis - Discount Rate



7.5.2 Sensitivity analysis on network capital costs

Figure 19 shows how the net benefits behave in terms of changes of the capital costs. The costing for this report is a class 4, which represents a range between +50% and -30%. Analysis within this rate shows the costs for the three options are relatively close to each other. With the difference between them increasing as the capital costs get higher. However, the ranking of the options is the same and Option 1 shows as the preferred one across the range.

Figure 19. Sensitivity analysis - Capital costs



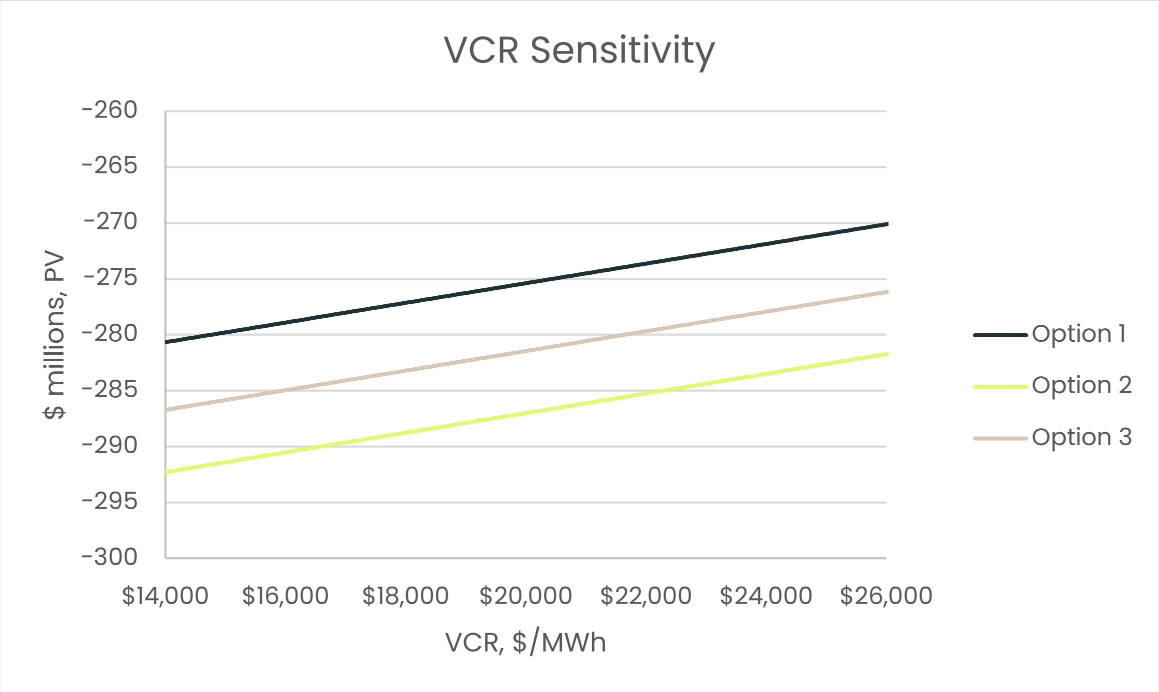
In addition, we do not find a realistic 'boundary value' for Option 1 no longer being preferred. That is, there is no realistic increase (or decrease) in assumed network capital costs that would result in Option 2 or Option 3 being preferred over Option 1 on a weighted basis.

7.5.3 Sensitivity analysis on Value Customer Reliability (VCR)

Because of the variety of customers in the Eyre Peninsula ElectraNet examined the sensitivity of the results to changes in the VCR in the range +30% to -30%. Figure 20 shows Option 1 is the preferred option across the interval. The difference between the options appears not to change, as the three options have very similar benefits from involuntary load shedding and losses.

In addition, we do not find a realistic 'boundary value' for Option 1 no longer being preferred. That is, there is no realistic increase (or decrease) in the assumed VCR that would result in Option 2 or Option 3 being preferred over Option 1 on a weighted basis.

Figure 20. Sensitivity analysis - VCR



7.5.4 Sensitivity analysis on scenario weights

While Option 1 ranks behind Option 2 and Option 3 under the low scenario, we have investigated what weight this scenario would need to be given, with the other two scenarios continued to be weighted equally, in order for Option 1 to no longer be preferred on a weighted basis. This analysis finds that the low scenario would need to be given a weight of at least:

- 41% for Option 3 (the second ranked option) to have the same expected net benefits as Option 1; and
- 64% for Option 3 to have the expected net benefits that are at least 10% greater than Option 1.

We consider both weights as unreasonably high given the information we have through our close communication with load proponents as part of the formal connection process.

Moreover, ElectraNet expects that the more granular classification of large industrial future load currently being consulted on by AEMO as part of its Electricity Demand Forecasting Methodology document will be upheld in the final determination (expected to be published in March 2025), which would further support the use of load forecasts in-line with our central and high demand scenarios.

8 Proposed preferred option at this draft stage

The proposed preferred option identified in this PADR is the combination of two of the options:

- **Option 1** - Develop the Yadnarie North substation now to enable upgrading of the transmission lines between Yadnarie and Cultana to 275 kV operation; and
- **Option 4** - Establish a new site close to Davenport and duplicate the Davenport to Cultana 275 kV circuits, subject to commitment of a further around 400 MW of electrical load by 2030 on the Eyre Peninsula network, supplied out of Davenport.

Table 11 shows this combination has the greatest net benefit, when weighted across three different demand scenarios, based on AEMO's 2024 ISP Step Change. The analysis adopts a 20-year assessment period and draws on the central discount rate in AEMO's 2023 Inputs, Assumptions and Scenarios Report (IASR).

While net benefits are negative, this is acceptable under the RIT-T because the identified need is a reliability corrective action. Sensitivity analysis with respect to capital costs and other assumptions further support Option 1 + Option 4 as the preferred option.

Table 11. Net benefits relative to the base case ($m 2024-25)

Option	Weighted NPV ($m)	Ranking
Option 1 + Option 4	-274.54	1
Option 2 + Option 4	-286.16	3
Option 3 + Option 4	-280.6	2

The proposed preferred Option 1 has a capital cost of approximately $179 million, while the proposed preferred Option 4 has a capital cost of approximately $484 million

ElectraNet proposes a key re-opening trigger for this RIT-T which is the load required to justify Option 4 (establishing a new site close to Davenport and duplicating the Davenport to Cultana 275 kV circuits) not eventuating. Specifically, based on the assessment included in this PADR, we consider that the following is expected to form a re-opening trigger for Option 4 under this RIT-T:

- A central demand forecast published before 1 January 2030, with a total load forecast for the Eyre Peninsula below 570 MW.

Based on the sensitivity assessment included in this PADR, we do not consider there to be any other relevant re-opening triggers for this RIT-T. Specifically, the finding that Option 1 (plus Option 4) is the preferred option is found to be robust to all other key assumptions (e.g., assumed capital costs, discount rates etc).

Should a re-opening trigger occur (e.g., outturn demand not being sufficient to justify Option 4), ElectraNet would prepare a letter to the AER outlining how, as a consequence, the preferred option for this RIT-T would change. A new RIT-T would not be commenced (which would require significant time to complete and would likely jeopardise ElectraNet's ability to meet its ETC reliability standards). Instead, we would refer back to this RIT-T to confirm that the action ElectraNet is proposing to take is considered optimal.

Appendix A Compliance Tables

This appendix sets out a checklist which demonstrates the compliance of this PADR with the requirements of the NER version 224.

Table 12: Compliance checklist of PADR with NER

Rules clause	Summary of requirements	Relevant section(s) in the PADR
5.16.4(k)	**A RIT-T proponent must prepare a report (the assessment draft report), which must include:**	
	(1) a description of each credible option assessed;	Chapter 4
	(2) a summary of, and commentary on, the submissions to the project specification consultation report;	Chapter 3
	(3) a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefit for each credible option;	Chapter 5 and 6
	(4) a detailed description of the methodologies used in quantifying each class of material market benefit and cost;	Chapter 5
	5) reasons why the RIT-T proponent has determined that a class or classes of market benefit are not material;	Section 5.1
	6) the identification of any class of market benefit estimated to arise outside the region of the Transmission Network Service Provider affected by the RIT-T project, and quantification of the value of such market benefits (in aggregate across all regions);	N/A
	(7) the results of a net present value analysis of each credible option and accompanying explanatory statements regarding the results;	Chapter 7
	(8) the identification of the proposed preferred option;	Chapter 8
	(9) for the proposed preferred option identified under subparagraph (8), the RIT-T proponent must provide: (a) details of the technical characteristics; (b) the estimated construction timetable and commissioning date; (c) if the proposed preferred option is likely to have a material inter-network impact and if the Transmission Network Service Provider affected by the RIT-T project has received an augmentation technical report, that report; and (d) a statement and the accompanying detailed analysis that the preferred option satisfies the regulatory investment test for transmission.	Sections 4.1 and 4.4

In addition, the table below outlines a separate compliance checklist demonstrating compliance with the binding guidance in the latest AER RIT-T guidelines.

Table 13: Compliance checklist of PADR with AER RIT-T Guidelines

Guidelines section	Summary of the requirements	Section in the PADR
3.2.5	A RIT-T proponent must consider social licence issues in the identification of credible options. A RIT proponent should include information in its RIT reports about when and how social licence considerations have affected the identification and selection of credible options.	N/A[48]
3.4.3	The value of emissions reduction (VER), reported in dollars per tonne of emissions (CO_2 equivalent), is used to value emissions within a state of the world. A RIT-T proponent is required to use the then prevailing VER under relevant legislation or, otherwise, in any administrative guidance.	N/A[49]
3.5A.1	Where the estimated capital costs of the preferred option exceed $103 million (as varied in accordance with a cost threshold determination), a RIT-T proponent must, in a RIT-T application: – outline the process it has applied, or intends to apply, to ensure that the estimated costs are accurate to the extent practicable having regard to the purpose of that stage of the RIT-T – for all credible options (including the preferred option), either apply the cost estimate classification system published by the AACE, or if it does not apply the AACE cost estimate classification system, identify the alternative cost estimation system or cost estimation arrangements it intends to apply, and provide reasons to explain why applying that alternative system or arrangements is more appropriate or suitable than applying the AACE cost estimate classification system in producing an accurate cost estimate	Sections 6.3 and 6.4
3.5A.2	For each credible option, a RIT-T proponent must specify, to the extent practicable and in a manner which is fit for purpose for that stage of the RIT-T: – all key inputs and assumptions adopted in deriving the cost estimate – a breakdown of the main components of the cost estimate – the methodologies and processes applied in deriving the cost estimate (e.g. market testing, unit costs from recent projects, and engineering-based cost estimates)	Sections 6.3 and 6.4

[48] These are new requirements stipulated in revised RIT-T Application Guidelines released by the AER, which came into effect on 21 November 2024. For compliance purposes, the AER only have regard to the guidance that was in effect when ElectraNet initiated the RIT-T in question. In this context, initiated means from the publication of a PSCR. As the PSCR was published prior to 21 November 2024, these new requirements are not applicable to this RIT-T.

[49] Please footnote above regarding this being a new requirement in the latest AER RIT-T Application Guidelines and not being relevant to this PADR.

	– the reasons in support of the key inputs and assumptions adopted and methodologies and processes applied – the level of any contingency allowance that have been included in the cost estimate, and the reasons for that level of contingency allowance	
3.5	In the RIT-T, costs must include the following classes: – Costs incurred in constructing or providing the credible option – Operating and maintenance costs over the credible option's operating life – Costs of complying with relevant laws, regulations and administrative requirements For, asset replacement projects or programs, there are costs resulting from removing and disposing of existing assets, which a RIT-T assessment should recognise. RIT-T proponents should include these costs in the costs of all credible options that require removing and disposing of retired assets. For completeness, the RIT-T proponent would exclude these costs from the 'BAU' base case.	Section 6.3 and 6.4
3.5.3	The RIT-T proponent is required to provide the basis for any social licence costs in its RIT-T reports and may choose to refer to best practice from a reputable, independent and verifiable source.	N/A[50]
3.6	RIT-T proponents are required to apply classes of market benefits consistently across all credible options.	Chapter 5
3.7.3	When calculating the benefit from changes in Australia's greenhouse gas emissions, a RIT-T proponent is required to: – include the following emissions scopes, unless the change relative to the base case can be demonstrated to be immaterial to the RIT outcome: – direct emissions from generation – direct emissions other than from generation – estimate the change in annual emissions (once identified in accordance with this Guideline) between the base case and the credible option, and multiplying this change by the annual VER to arrive at the annual benefit from changes in Australia's greenhouse gas emissions	N/A
3.8.2	Where the estimated capital cost of the preferred option exceeds $100 million (as varied in accordance with an applicable cost threshold determination), a RIT-T proponent must undertake sensitivity analysis on all credible options, by varying one or more inputs and/or assumptions.	Section 7.5

[50] Please footnote above regarding these being new requirements in the latest AER RIT-T Application Guidelines and not being relevant to this PADR.

3.9.4	If a contingency allowance is included in a cost estimate for a credible option, the RIT-T proponent must explain: – the reasons and basis for the contingency allowance, including the particular costs that the contingency allowance may relate to, and – how the level or quantum of the contingency allowance was determined.	N/A
3.11.2	Where a concessional finance agreement is included, the RIT-T proponent is required to provide sufficient detail about the concessional finance agreement to justify an agreement's inclusion and such that it can articulate how the value of the concession is to or would be shared with consumers. If a proponent seeks to include an unexecuted concessional finance agreement in the RIT-T, they must undertake sensitivity testing for the scenario the agreement doesn't eventuate.	N/A[51]
4.1	RIT-T proponents are required to describe in each RIT-T report – how they have engaged with local landowners, local council, local community members, local environmental groups or traditional owners and sought to address any relevant concerns identified through this engagement – how they plan to engage with these stakeholder groups, or – why this project does not require community engagement.	N/A[51]

[51] Please footnote above regarding these being new requirements in the latest AER RIT-T Application Guidelines and not being relevant to this PADR.

Appendix B Definitions

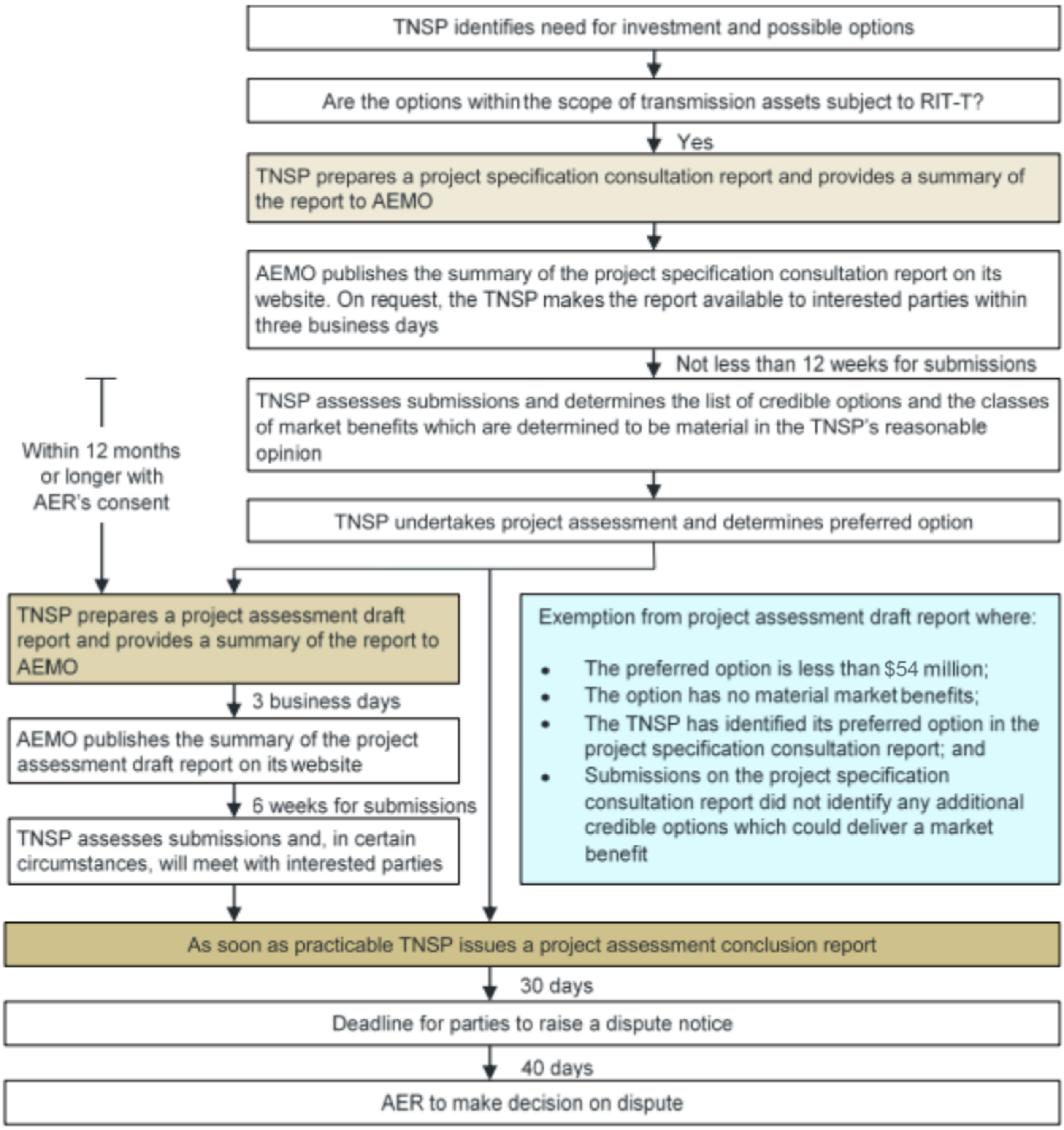
All laws, regulations, orders, licences, codes, determinations and other regulatory instruments (other than the Rules) which apply to Registered Participants from time to time, including those applicable in each participating jurisdiction as listed below, to the extent that they regulate or contain terms and conditions relating to access to a network, connection to a network, the provision of network services, network service price or augmentation of a network.
A comprehensive list of applicable regulatory instruments is provided in the Rules.

Applicable regulatory instruments	
AEMO	Australian Energy Market Operator
Base case	A situation in which no option is implemented by, or on behalf of the transmission network service provider.
Commercially feasible	An option is commercially feasible if a reasonable and objective operator, acting rationally in accordance with the requirements of the RIT-T, would be prepared to develop or provide the option in isolation of any substitute options. This is taken to be synonymous with 'economically feasible'.
Costs	Costs are the present value of the direct costs of a credible option
Credible option	A credible option is an option (or group of options) that: address the identified need; is (or are) commercially and technically feasible; and can be implemented in sufficient time to meet the identified need.
Economically feasible	An option is likely to be economically feasible where its estimated costs are comparable to other credible options which address the identified need. One important exception to this Rules guidance applies where it is expected that a credible option or options are likely to deliver materially higher market benefits. In these circumstances the option may be "economically feasible" despite the higher expected cost. This is taken to be synonymous with 'commercially feasible'
Identified need	The reason why the Transmission Network Service Provider proposes that a particular investment be undertaken in respect of its transmission network.

Applicable regulatory instruments	
Market benefit	Market benefit must be: the present value of the benefits of a credible option calculated by: a) comparing, for each relevant reasonable scenario: i. the state of the world with the credible option in place to ii. the state of the world in the base case, And b) weighting the benefits derived in sub-paragraph (i) by the probability of each relevant reasonable scenario occurring. a benefit to those who consume, produce and transport electricity in the market, that is, the change in producer plus consumer surplus.
Net market benefit	Net market benefit equals the market benefit less costs.
Preferred option	The preferred option is the credible option that maximises the net economic benefit to all those who produce, consume and transport electricity in the market compared to all other credible options. Where the identified need is for reliability corrective action, a preferred option may have a negative net economic benefit (that is, a net economic cost).
Reasonable Scenario	Reasonable scenario means a set of variables or parameters that are not expected to change across each of the credible options or the base case.

Appendix C Process for implementing the RIT-T

For the purposes of applying the RIT-T, the NER establishes a typically three stage process, ie: (1) the PSCR; (2) the PADR; and (3) the PACR. This process is summarised in the figure below (in gold).



Appendix D Context and assumptions

This appendix provides additional information around some of the assumptions used in this PADR.

D.1 Reliability supply requirements

Existing loads on the Eyre Peninsula are connected to exit points ranging between Category 1 – 4 under the South Australian Electricity Transmission Code (ETC). Table 14 below summarises the level of line and transformer reliability for each category.

Table 14. Reliability levels in Eyre Peninsula

Category	Transmission line >= 100% AMD	Transformer >= 100% AMD	Exit Points
1	"N"	"N"	Middleback, Whyalla Terminal and Stony Point
2	"N"	"N-1"	Wudinna and Yadnarie
3 and 4	"N-1"	"N-1"	Port Lincoln and Whyalla Central

All new LIL discussed below in this PADR are assumed to be 'Category 1'.

This means that ElectraNet must provide equivalent line capacity for at least 100 percent of each load's agreed maximum demand for the exit point without redundancy. Put another way, should any critical network element be out of service the agreed maximum demand may not be able to be fully served[52].

D.2 Spencer Gulf Crossing

Eyre Peninsula is supplied via Davenport by a double-circuit transmission line, which crosses a portion of the upper Spencer Gulf. For the crossing, six of its towers are on specially designed piled footings within the tidal zone, with two directly in the water and four in dense mangrove, part of the tidal channel. Typically, these towers are more costly to build and maintain that on-land towers providing a similar level of reliability.

In the case of failure of one or more of these towers, an outage of the two 275 kV circuits supplying the Eyre Peninsula will occur, isolating the Peninsula from the rest of the South

[52] The ETC is made by the Essential Services Commission of South Australia (ESCOSA) and specifies required reliability standards at transmission network connection points, including on the Eyre Peninsula. The definition of Category 1 can be found at: Escosa Electricity Transmission Code

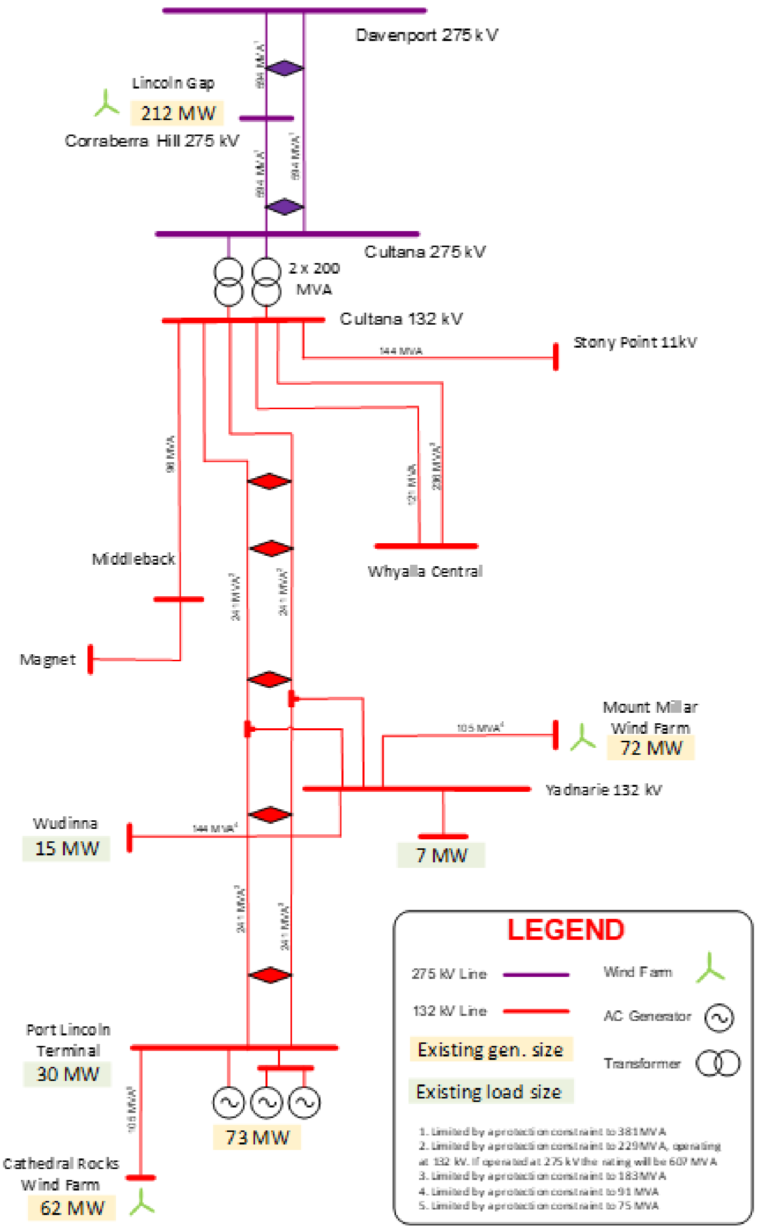
Australian network. Restoring the supply could take several days as it will be difficult to establish a temporary bypass across the gulf and setting up new structures will take a long time as it will require specialised equipment.

Additionally, these towers will be exposed to future higher tides and sea levels, due climate change, making more difficult their maintenance and repair or replacement.

D.3 Eyre Peninsula – Existing supply arrangements

Existing supply for the Eyre Peninsula is centred on Eyre Peninsula Link. Figure 21 shows a simplified single line diagram of the same electrical network. Figure 21 identifies more clearly the main assets mentioned in different sections of this RIT-T.

Figure 21 - Existing loads on Eyre Peninsula



There are three generation centers in the Eyre Peninsula region:

- Mount Milllar wind farm connected via a 110 kV transmission line to Yadnarie and a total installed capacity of 72 MW. Its capacity factor for the financial year 2023-24 was 23.5%.
- Three gas generators connected to Port Lincoln 110 kV, with a total installed capacity of 73 MW. These units are no longer operating since July 1, and they will fully close in 2028. These generators used to operate occasionally as they had a network backup support service agreement with ElectraNet, which expired last year.
- Cathedral Rocks wind farm connected via a 110 kV transmission line to Port Lincoln and a total installed capacity of 62 MW. Its capacity factor for the financial year 2023-24 was 23.5%.

There is one additional generation plant connected between Davenport and Cultana:

- Lincoln Gap wind farm, connected at Corraberra Hill 275 kV, with a total installed capacity of 212 MW. Its capacity factor for the financial year 2023-24 was 31.9%.

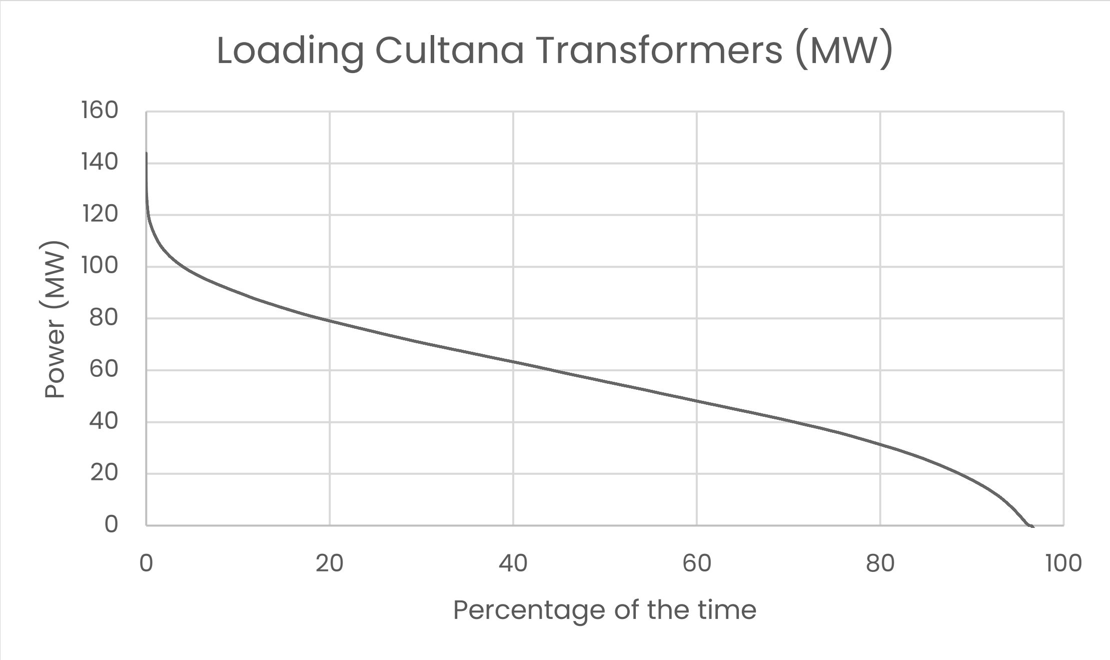
D.4 Eyre Peninsula - Existing load

The existing load on the Eyre Peninsula is all fed via the Cultana 275/132 kV transformers. It consists of:

- Around 110 MW in the Northern Eyre Peninsula (including SA Power Networks and direct connect loads in the vicinity of Whyalla), and
- Around 55 MW in the Southern Eyre Peninsula (including all loads in the vicinity of Yadnarie or connected from the south and west via Yadnarie).

Figure 22 shows the load duration curve for the Cultana transformers, during a one-year period between August 2023 to July 2024. It shows the load mainly varies between 30-90 MVA, with some instances just above 140 MVA. The Cultana transformers provide a useful measure of net load on Eyre Peninsula and demonstrates that at present, there is no excess supply on Eyre Peninsula being exported to the rest of the state.

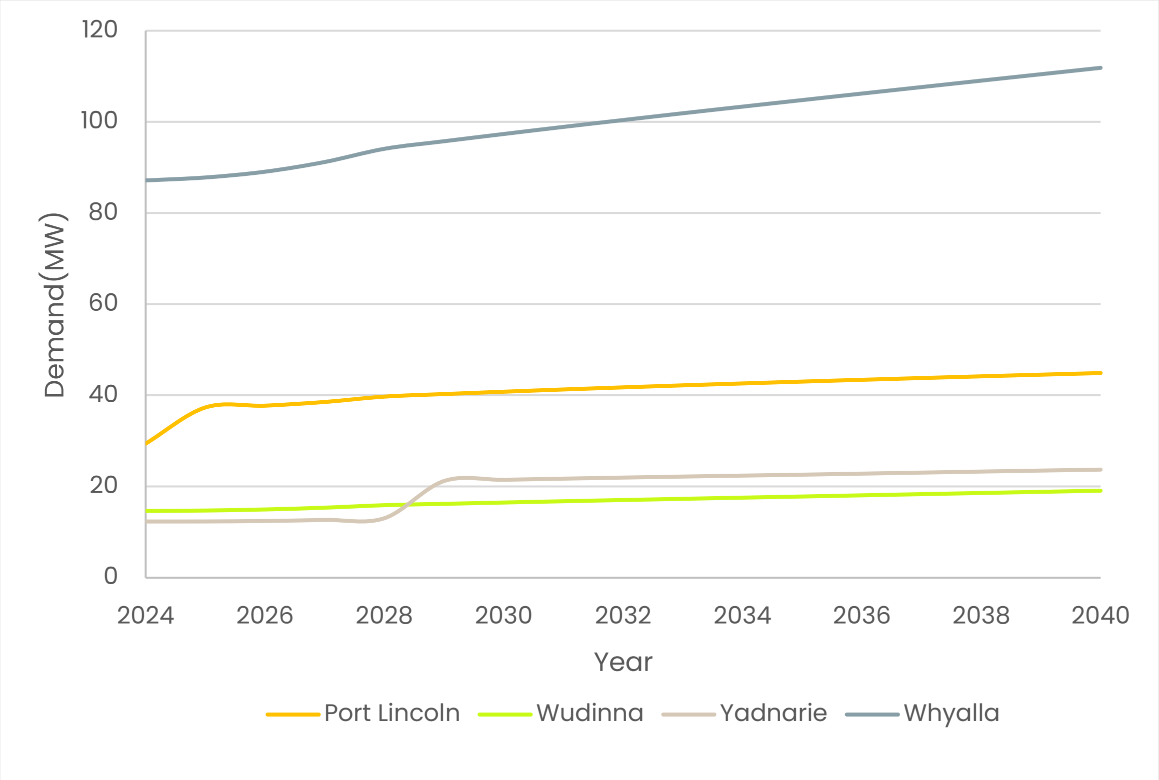
Figure 22 – Load duration curve for Cultana transformers



D.5 Forecast demand

Figure 23 shows the SA Power Networks demand forecasts for the connection points in the Eyre Peninsula. The traces show considerable increases in demand at Whyalla, Port Lincoln, and Yadnarie, with a slightly smaller expected increase at Wudinna. These increases are based mainly on the load underlying growth rates.

Figure 23 - SA Power Networks annual maximum demand forecast at 132 kV



The present AMD at SAPN point of connection is Port Lincoln – 32 MW, Wudinna – 18 MW and Yadnarie 12 MW, for a total of 62 MW south of Yadnarie and 107 MW for Whyalla.

The cumulative load on Eyre Peninsula will exceed the N-1 ratings of the Cultana transformers from 2030. SAPN has requested to increase the AMD to one of their industrial customers in the Eyre Peninsula. This could bring forward the Cultana overload to 2027.

Appendix E AEMO proposed categories for large industrial load projects

AEMO recently has published its 2024 draft Electricity Demand Forecasting Methodology document[53], in which it proposes three categories for future prospective loads: committed, anticipated and proposed. The status of the project will depend on:

- Current stage of the connection process (pre-feasibility, enquiry, application, contracts, construction and completion)
- Environment and planning approvals
- Financial and contract information
- Other information from load surveys, TNSP insights or others that provide information on the likelihood of the development progressing. ElectraNet believes the TNSP knowledge of the potential customer and its approach to the connection process can provide valuable information to help establish the project status.

Committed projects are those with a very high likelihood of being developed, based on information such as:

- The project is being commissioned or is under construction.
- The project has reached final investment decision and made public.
- The project is at least at the application stage (including final investment decision) in the connection process.
- Other information indicating the project has a very high likelihood of being developed. Information could come from AEMO's LIL survey process, TNSP information requests or similar.

Anticipated projects have a high likelihood of being developed, based on a combination of information such as:

- The project environmental and planning approvals are progressing.
- The project is at least at enquiry or a later stage in the connection process.
- Other information indicating the project has a high likelihood of being developed. Information could come from AEMO's LIL survey process, TNSP information requests or similar.

Proposed projects are other projects not classified by AEMO as committed or anticipated, identified explicitly based on the following information:

- The project is at pre-feasibility or a later stage in the connection process and
- The project aligns with government policy or is of state significance.
- Other information that explicitly identify the project as a potential development. Information could come from AEMO's LIL survey process, TNSP information requests or similar.

AEMO has proposed that for the short-term only committed projects should be used for the central scenario and committed plus anticipated projects for higher economic growth scenario. For the medium and long-term the committed and anticipated projects should be used for the central scenario and the proposed projects should be added for high economic growth.

[53] AEMO, 2024 Draft Electricity Demand Forecasting Methodology

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