Maintaining supply reliability in the Shepparton and Goulburn-Murray area

Project Specification Consultation Report

Regulatory Investment Test - Transmission

December 2020

Important notice

Purpose

AusNet Services has prepared this document to provide information about potential limitations in the Victoria transmission network and options that could address these limitations.

Disclaimer

This document may or may not contain all available information on the subject matter this document purports to address. The information contained in this document is subject to review and may be amended any time.

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Executive summary

AusNet Services is initiating this Regulatory Investment Test for Transmission (RIT-T) to evaluate options to maintain supply reliability in the Shepparton and Goulburn-Murray area. Options investigated in this RIT-T will mitigate the risk of an asset failure at Shepparton Terminal Station.

Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process in accordance with clause 5.16 of the National Electricity Rules (NER)[1] and section 4.2 of the RIT-T Application Guidelines[2]. AusNet Services is also exploring opportunities to accelerate the RIT-T process for this project as allowed by NER clause 5.16.4(z1).

Shepparton Terminal Station is owned and operated by AusNet Services and is located in Shepparton in northern Victoria. It was commissioned in the late 1960's and serves as the main transmission connection point for distribution of electricity to approximately 72,525 customers. Peak demand at the station during the summer of 2019/20 reached 284.3 MW.

Identified need

As expected of assets that have been in service for an extended time, the condition of the transformers and circuit breakers at Shepparton Terminal Station has deteriorated to a level where there is a material risk of asset failure, which could have an impact on electricity supply reliability, safety, environment, and potential costs of emergency replacements. Therefore, the 'identified need' this RIT-T intends to address is to maintain supply reliability in the Shepparton and Goulburn-Murray area and mitigate risks from asset failures.

The present value of the baseline risk costs associated with maintaining the existing assets in service is more than $57 million. Supply risk is the biggest component of the baseline risk and is borne by electricity consumers. AusNet Services is therefore investigating options that could allow continued delivery of safe and reliable electricity supply.

Credible options

Network or non-network investments are likely to deliver more economical and reliable solutions to maintain supply reliability in the Shepparton and Goulburn-Murray area, compared with keeping the existing assets in service. AusNet Services has identified the following credible network solutions that could meet the identified need:

- Option 1 – Replace B2 transformer, B3 transformer and switchgear in an integrated project; or
- Option 2 – Staged replacement, with one transformer replacement deferred

AusNet Services also welcomes proposals from proponents of non-network options (stand-alone or in conjunction with a network solution), that may meet the identified need, such as:

- options that avoid the need for a 220/66 kV Shepparton Terminal Station and which are of sufficient scale and flexibility to supply 300 MW or more;
- options that defer the need to replace at least one 220/66 kV transformer, by addressing short-term supply shortfalls in an event of a simultaneous outage of two transformers at the terminal station; and
- options that allow for one or more of the 66 kV distribution feeders to become self-sufficient in islanded operation by providing local supply or demand curtailment in conjunction with local supply options.

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[1] Australian Energy Market Commission, *"National Electricity Rules"*

[2] Australian Energy Regulator, *"Application guidelines Regulatory investment test for transmission"*

Assessment approach

AusNet Services will investigate the costs, economic benefits, and ranking of options in this RIT-T. The robustness of the ranking and optimal timing of options will be investigated through sensitivity analysis which involves variation of assumptions around the base case values.

Options assessment and draft conclusion

AusNet Services' cost-benefit assessment confirms that an integrated replacement project that includes replacement of selected switchgear and both transformers that are in poor condition (Option 1) is the most economic option and provides the highest present value of net economic benefits. This option will not only maintain supply reliability, but also mitigates safety, environmental, and emergency replacement risk costs from deteriorating assets at Shepparton Terminal Station.

The optimal timing of the preferred option is 2024/25 based on an estimated capital cost of $38.5 million.

Submissions

AusNet Services welcomes written submissions on the topics and the credible options presented in this PSCR and invites proposals from proponents of potential non-network options.

Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before 18 March 2021. In the subject field, please reference 'RIT-T PSCR Shepparton Terminal Station.'

Submissions will be published on AusNet Services' and AEMO's websites. If you do not wish for your submission to be made public, please clearly stipulate this at the time of lodgment.

Next steps

AusNet Services intends to invoke an exemption from publication of a Project Assessment Draft Report (PADR) as per NER clause 5.16.4(z1) and produce a Project Assessment Conclusions Report (PACR) before 18 June 2021 should no additional credible options that could deliver a material market benefit be identified during the 12-week consultation period. Otherwise, in accordance with NER clause 5.16.4(z1)(4), this exemption will no longer apply and AusNet Services will aim to produce a PADR before 18 June 2021 Date.

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1. Introduction

AusNet Services is initiating this Regulatory Investment Test for Transmission (RIT-T) to evaluate options to maintain supply reliability in the Shepparton and Goulburn-Murray area given the poor condition of some of the assets at Shepparton Terminal Station.

Publication of this Project Specification Consultation Report (PSCR) represents the first step in the RIT-T process[3] in accordance with clause 5.16 of the National Electricity Rules (NER)[4] and section 4.2 of the RIT-T Application Guidelines.[5]

This document describes:

- the identified need that AusNet Services is seeking to address, together with the assumptions used in identifying this need;
- credible network options that may address the identified need;
- the technical characteristics that would be required of a non-network option to address the identified need;
- the assessment approach and scenarios AusNet Services is intending to employ for this RIT-T assessment; and
- the specific categories of market benefits that are unlikely to be material in this RIT-T.

The need for investment to address risks from the deteriorating assets is presented in AusNet Services Asset Renewal Plan that is published as part of AEMO's 2020 Victorian Transmission Annual Planning Report (VAPR).

[3] A RIT-T process will assess the economic efficiency and technical feasibility of proposed network and non-network options

[4] Australian Energy Market Commission, *"National Electricity Rules"*

[5] Australian Energy Regulator, *"Application guidelines Regulatory investment test for transmission"*

2. Identified need

The role of Shepparton Terminal Station in providing electricity supply services and the condition of key assets is discussed below. Quantification of the risk costs associated with the deterioration of these assets, and the need for the investments is also presented.

2.1. Supply to the Shepparton and Goulburn-Murray area

The 220/66 kV Shepparton Terminal Station is owned and operated by AusNet Services and is in Shepparton, in northern Victoria. Since it was commissioned in the late 1960’s, Shepparton Terminal Station has served as the main transmission service connection point for distribution of electricity to communities in the towns of Shepparton, Echuca, Mooroopna, Yarrawonga, Kyabram, Cobram, Numurkah, Tatura, Rochester, Nathalia, Tongala, and Rushworth.[6]

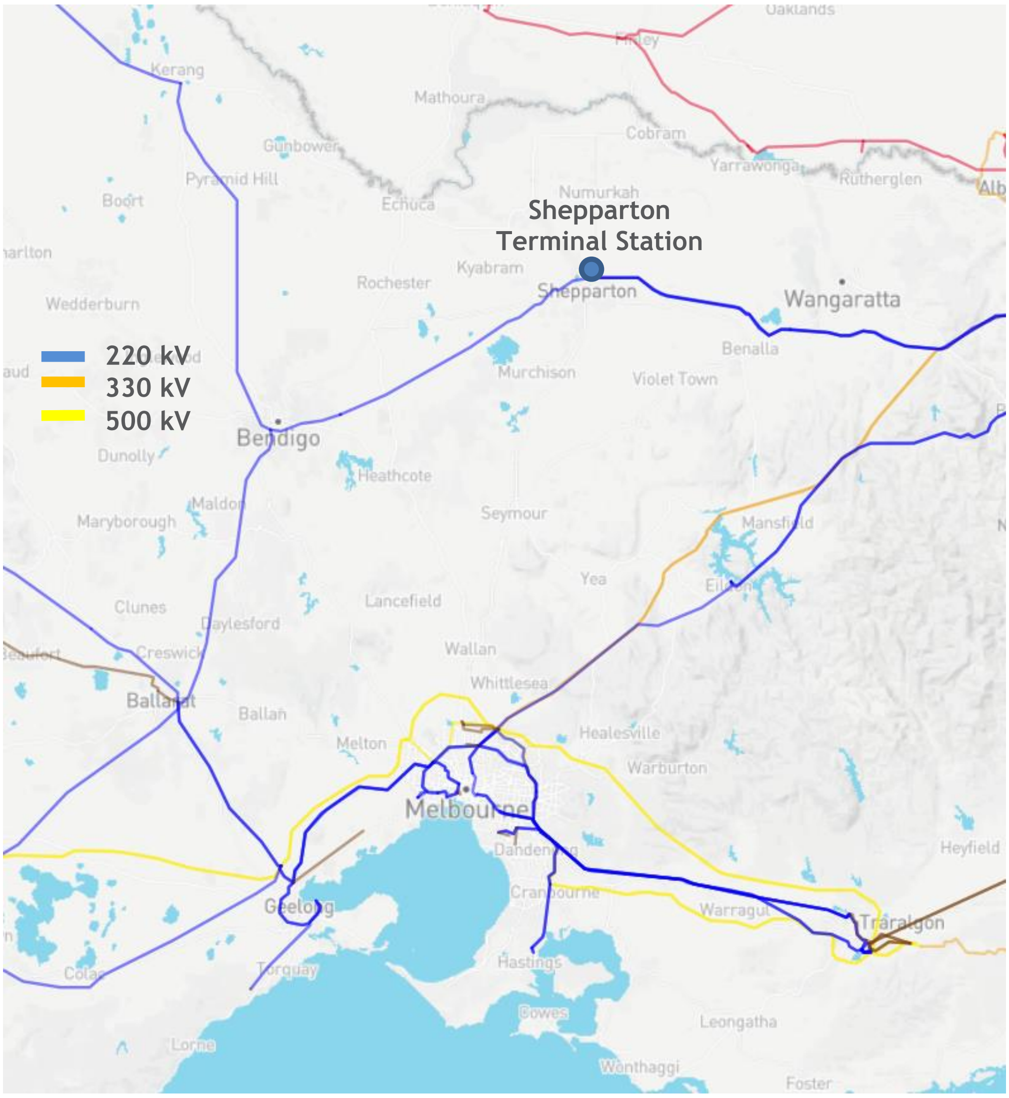

Figure 1 – Transmission network supplying Shepparton Terminal Station

[6] Powercor is responsible for distribution of electricity to relevant communities.

Electricity demand

Approximately 72,525 customers depend on Shepparton Terminal Station for their electricity supply. Commercial customers consume 56% and residential customers consume 27% of the total annual energy supplied at Shepparton Terminal Station as illustrated in Table 1.

Customer type	Share of consumption (%)
Commercial	56%
Residential	27%
Industrial	9%
Agricultural	9%
Total	100%

Table 1 - Customer number and demand composition

Peak demand during the summer of 2019/20 at Shepparton Terminal Station reached 284.3 MW. The Australian Energy Market Operator (AEMO) forecasts[7] that peak demand at Shepparton Terminal Station will remain at present levels. Figure 2 shows the 10% probability of exceedance (POE10)[8] and the 50% probability of exceedance (POE50)[9] forecasts for peak demand during summer and winter periods over the next 10 years.[10]

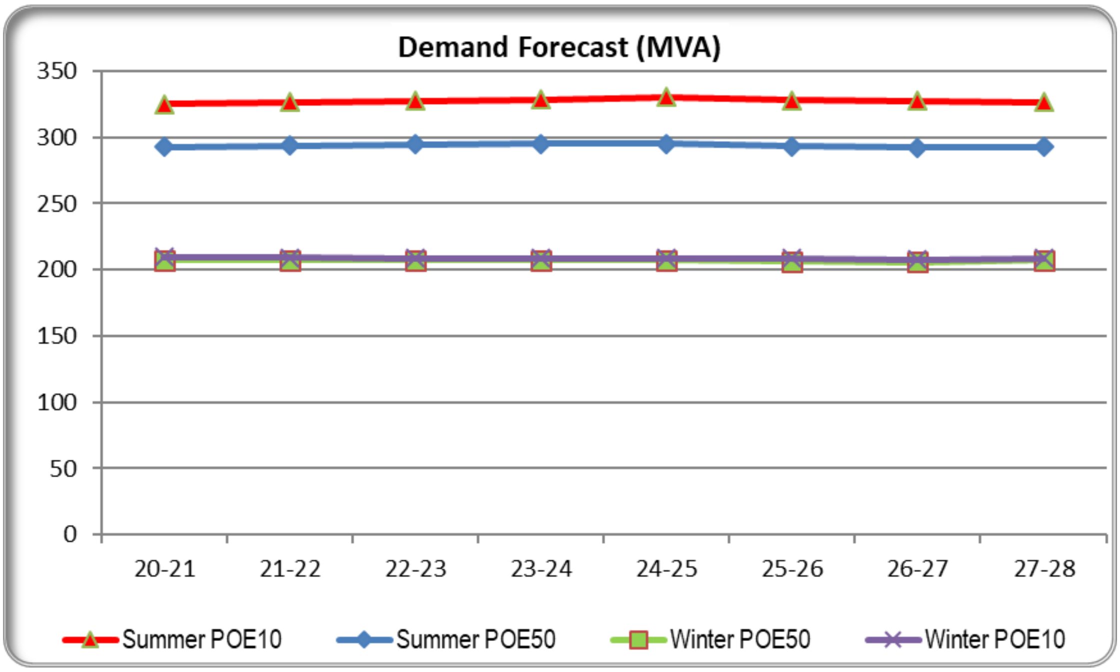

Figure 2 - Demand forecasts for Shepparton Terminal Station

[7] Australian Energy Market Operator (AEMO), *"2019 Transmission Connection Point Forecast for Victoria"*.
[8] A POE10 forecast indicates a level where there is 10 % likelihood that actual peak demand will be greater.
[9] A POE50 forecast indicates a level where there is 50 % likelihood that actual peak demand will be greater.
[10] Victorian electricity demand is sensitive to ambient temperature. Peak demand forecasts are therefore based on expected demand during extreme temperature that could occur once every ten years (POE10) and during average summer condition that could occur every second year (POE50).

AEMO and the relevant Distribution Network Service Providers (DNSPs) recognise there is an ongoing need for electricity supply services to communities in the Shepparton and Goulburn-Murray area as reflected in the demand forecast for Shepparton Terminal Station.

Embedded generation

There is one major embedded generator – the Numurkah Solar Farm - connected at Shepparton Terminal Station 66 kV.

Electricity network

Shepparton Terminal Station sources its electricity supply from the 220 kV transmission network in the northern part of Victoria, as shown in Figure 1. It supplies nine 66 kV feeders (owned by Powercor) that distribute electricity to customers, as shown in Figure 3. The zone substations supplied from Shepparton Terminal Station include Kyabram (KYM), Echuca (ECM), Stanhope (SHP), Mooroopna (MNA), Shepparton (STN), Shepparton North (SHN), Numurkah (NKA) and Cobram East (CME).

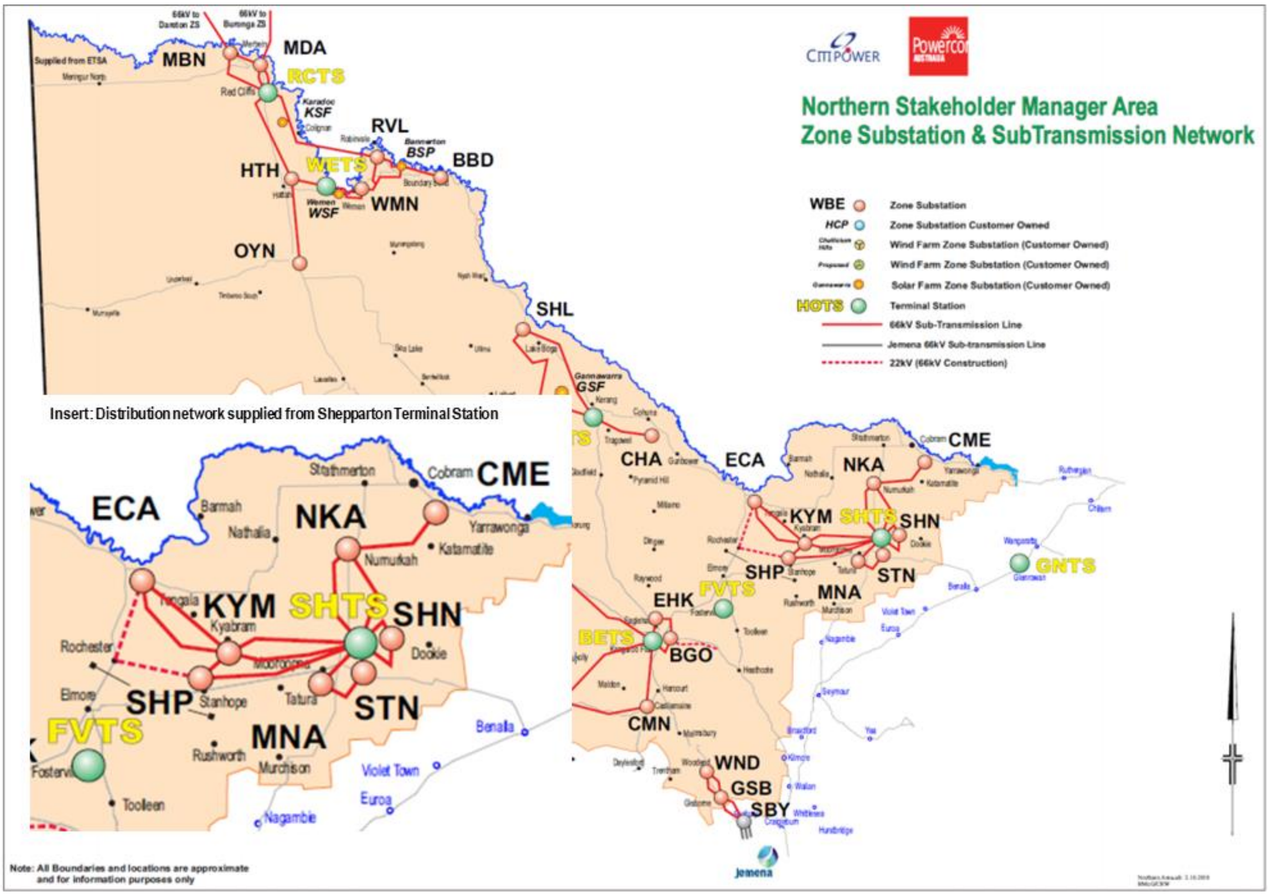

Figure 3 – Distribution network supplied from Shepparton Terminal Station

2.2. Asset condition

Several primary (power transformers and circuit breakers) and secondary (protection and control) assets at Shepparton Terminal Station are in poor or very poor condition as expected of assets that have been in service for a long time.

AusNet Services classifies asset conditions using scores that range from C1 (initial service condition) to C5 (very poor condition) – as set out in Appendix B. The latest asset condition assessment for Shepparton Terminal Station was conducted in 2019 and reveals some assets at the terminal station are in poor condition (C4) or very poor condition (C5). For the affected assets, the probability of failure is high, and is likely to increase further if no remedial action is taken. Table 2 provides a summary of the condition of relevant major equipment.

Asset class	Condition scores				
	C1	C2	C3	C4	C5
Power transformers	1			2	
66 kV circuit breakers	4	10	4	7	5
66 kV current transformers	3	10	26	7	0
66 kV voltage transformers	9	25	32	9	1

Table 2 - Summary of major equipment condition scores

Power transformers

There are three 150 MVA 220/66 kV transformers at Shepparton Terminal Station. The B2 and B3 transformers were commissioned in late 1960's and are of a specific make and type that has significant design issues observed in the fleet of similar assets in AusNet Services' network. The B2 and B3 transformers have deteriorated significantly and according to the recent asset condition assessment report, are in poor condition. Assets in this condition (C4) requires remedial action within the next 2 to 10 years.

An investigation of a failure of a similar transformer in March 2016 revealed that it was as result of previous buckling, which is also a concern for the B2 and B3 transformers.

The 'B4' transformer is in very good condition and has a very low risk of failure.

AusNet Services considers that there is a high probability that a winding failure, major tap changer failure or bushing failure of either the B2 or B3 transformer will result in an extended service interruption and a subsequent need for emergency repairs or replacement. The probability of a transformer failure is forecast to increase over time as the condition of these two transformers deteriorates further.

66 kV circuit breakers

Twelve of the thirty 66 kV circuit breakers, including three bus tie circuit breakers, are in poor or very poor condition or have suffered extreme deterioration and are approaching their end of economic and technical life[11]. This is expected of assets that have been in service for a long time.

With condition scores of C4 and C5, these circuit breakers present challenges due to duty-related deterioration including erosion of arc control devices, bushing oil leakages, and wear of operating mechanisms and drive systems; intensive maintenance; lack of spares and manufacturer support; and lack of oil containment bunding.

66 kV instrument transformers

Several instrument transformers at Shepparton Terminal Station are assessed to be in poor or very condition (C4 and C5). Management of safety risks from potential explosive failures[12] of instrument transformers of this type is costly due to the need for regular oil sampling and partial discharge condition monitoring.

[11] Australian Energy Regulator, *"Industry practice application note for asset replacement planning"*.
[12] Since 2002, two current transformers of this type have failed explosively in the Victorian network.

2.3. Description of the identified need

Shepparton Terminal Station provides electricity supply to the Shepparton and Goulburn-Murray area. AusNet Services expects that the services that the terminal station provides will continue to be required as the demand for electricity is forecast to remain at present levels over the next ten year period. However, the poor and deteriorating condition of some of the components at the terminal station has increased the likelihood of asset failures. Such failures would result in prolonged substation outages.

Without remedial action, other than ongoing maintenance practice (business-as-usual), affected assets are expected to deteriorate further and more rapidly. This will increase the probability of failure, resulting in a higher likelihood of electricity supply interruptions, heightened safety risks due to potential explosive failure of the assets, environmental risks from possible oil spillage, collateral damage risks to adjacent plant, and the risk of increased costs resulting from the need for emergency asset replacements and reactive repairs.

Therefore, the 'identified need' this RIT-T intends to address is to maintain supply reliability in the Shepparton and Goulburn-Murray area and to mitigate risks from asset failures.

AusNet Services calculated the present value of the baseline risk costs to be more than $57 million over the forty-five year period from 2020/2021. The key elements of the baseline risk are shown in Figure 4, with the largest component being the supply interruption risk that is borne by electricity consumers.

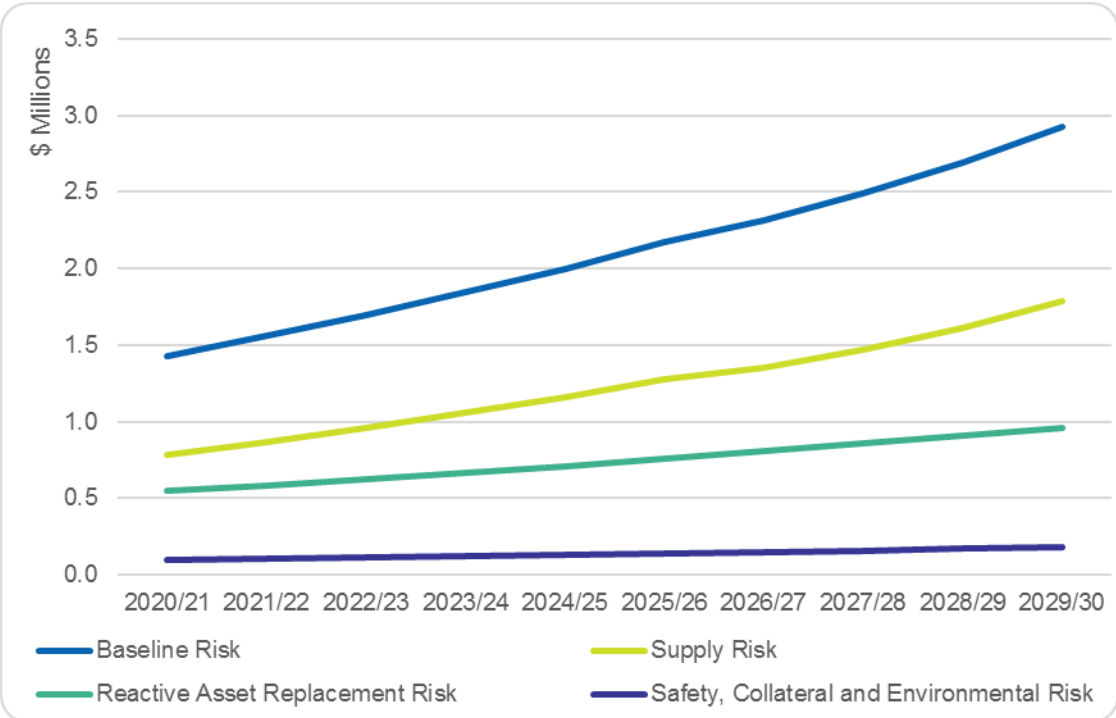

Figure 4 - Baseline risk costs

By undertaking the options identified in this RIT-T, AusNet Services will be able to maintain supply reliability in the Shepparton and Goulburn-Murray area and mitigate safety and environmental risks, as required by the NER and Electricity Safety Act 1998[13].

[13] Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Electricity Safety Act 1998,"* available at http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst9.nsf/DDE300B846EED9C7CA257616000A3571/1D9C11F63DEBA5E2CA257E70001687F4/%24FILE/98-25aa071%20authorised.pdf.

2.3.1. Assumptions

Aside from the failure rates (determined by the condition of the assets) and the likelihood of relevant consequences, AusNet Services has adopted further assumptions to quantify the risks associated with asset failure. These assumptions are detailed in the following subsections.

Supply risk costs

In calculating the supply risk costs, AusNet Services has calculated the unserved energy based on the most recent AEMO demand forecasts for Shepparton Terminal Station,[14] and has valued this expected unserved energy at an appropriate Value of Customer Reliability (VCR). The choice of VCR is based on those published by the AER and the composition of customers supplied by the terminal station. The resulting estimate of the weighted VCR applicable for affected customers at Shepparton Terminal Station is $39,423/MWh.

The total supply risk cost is calculated by estimating the impacts of different combinations of relevant forced outages to reliability of supply and weighting them by their probabilities of occurrence.

Safety risk costs

The Electricity Safety Act 1998[15] requires AusNet Services to design, construct, operate, maintain, and decommission its network to minimize hazards and risks to the safety of any person as far as reasonably practicable or until the costs become disproportionate to the benefits from managing those risks. By implementing this principle for assessing safety risks from explosive asset failures, AusNet Services uses:

- a value of statistical life[16] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[17]; and
- a disproportionality factor[18].

AusNet Services notes this approach, including the use of a disproportionality factor, is consistent with the practice notes[19] provided by the AER.

Financial risk costs

As there is a lasting need for the services that Shepparton Terminal Station provides, the failure rate-weighted cost of replacing failed assets (or undertaking reactive maintenance) is included in the assessment.[20]

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[14] Australian Energy Market Operator (AEMO), *"2019 Transmission Connection Point Forecast for Victoria"*.

[15] Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Electricity Safety Act 1998,"* available at http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst9.nsf/DDE300B846EED9C7CA257616000A3571/1D9C11F63DEBA5E2CA257E70001687F4/%24FILE/98-25aa071%20authorised.pdf.

[16] Department of the Prime Minister and Cabinet, Australian Government, *"Best Practice Regulation Guidance Note: Value of statistical life,"* available at https://www.pmc.gov.au/resource-centre/regulation/best-practice-regulation-guidance-note-value-statistical-life.

[17] Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13," available at https://www.safeworkaustralia.gov.au/system/files/documents/1702/cost-of-work-related-injury-and-disease-2012-13.docx.pdf.

[18] Health and Safety Executive's submission to the1987 Sizewell B Inquiry suggesting that a factor of up to 3 (i.e. costs three times larger than benefits) would apply for risks to workers; for low risks to members of the public a factor of 2, for high risks a factor of 10. The Sizewell B Inquiry was public inquiry conducted between January 1983 and March 1985 into a proposal to construct a nuclear power station in the UK.

[19] Australian Energy Regulator, *"Industry practice application note for asset replacement planning,"* available at https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/industry-practice-application-note-for-asset-replacement-planning.

[20] The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

Environmental risk costs

Environmental risks from plant that contains large volumes of oil, which may be released in an event of asset failure, is valued at $30,000 per event while risks from transformers with oil containing poly-chlorinated biphenyls (PCB), such as those at Shepparton Terminal Station, are valued at $100,000 per event.

3. Credible network options

AusNet Services will consider both network and non-network options to address the identified need caused by the deteriorating assets at Shepparton Terminal Station.

The network options AusNet Services has identified are presented below and the technical requirements that a non-network option would have to provide are detailed in the next chapter.

3.1. Option 1 – Replace B2 transformer, B3 transformer and switchgear in an integrated project

Option 1 involves replacement of two 220/66 kV transformers, 66 kV circuit breakers and secondary assets in a single integrated project. It includes:

- Sequential replacement of the B2 and B3 transformers; and
- Replacement of twelve 66 kV circuit breakers and associated primary and secondary equipment.

The estimated capital cost of this option is $38.5 million with no material change in the operating cost. AusNet Services' preliminary analysis shows that the optimal timing is to deliver a solution by 2024/25.

3.2. Option 2 – Staged replacement with one transformer replacement deferred

Option 2 is a staged replacement option that would reduce the failure risk of the assets in a staged approach. In the first stage, the secondary assets and all deteriorated primary assets except one of the 220/66 kV transformers will be replaced. The remaining 220/66 kV transformer will then be replaced around seven years after the completion of the first stage.

The estimated capital cost of the first and second stage of this option is $33.4 million and $8.3 million respectively. The change in operating cost is negligible. AusNet Services' preliminary analysis shows that the optimal timing is to deliver a solution by 2024/25.

3.3. Options considered and not progressed

Retirement of aging circuit breakers and switchgear is not a credible option unless a suitable arrangement is available to supply the existing demand. Options that reduce the terminal stations' capability is therefore not progressed further.

Refurbishment is not a credible technical solution and also does not reduce the asset failure risk and is therefore not progressed further for this RIT-T.

3.4. Material inter-regional network impact

As the 66 kV supply from Shepparton Terminal Station is electrically radial, and the network impact is confined to the Shepparton and Goulburn-Murray area, none of the network options being considered are likely to have a material inter-regional network impact. A 'material inter- regional network impact' is defined in the NER as:

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

an adverse impact on the quality of supply in another Transmission Network Service Provider's network."

4. Non-network options

AusNet Services welcomes proposals from proponents of non-network options that could be implemented on a stand-alone basis or in conjunction with a network option to meet or contribute to meeting the identified need for this RIT-T. AusNet Services will evaluate non-network options based on their economic and technical feasibility.

Table 4 lists some of the potential non-network services that AusNet Services considers may assist in meeting the identified need:

Non-network option	High-level requirements	Supplementary network requirements
Supply to the Shepparton and Goulburn-Murray area	Permanent supply that meets a peak demand of about 350 MVA and total annual energy of more than 1,000 GW. This service must also be expandable to meet forecast growth in the service area.	As this service would avoid the need for the 220/66 kV connection station, transmission lines could bypass Shepparton Terminal Station and the terminal station could be retired.
Back-up supply (combined network and non-network solution)	At least 150 MW of back-up supply for major transformer failure(s).	This service could defer the need for replacement of the 150 MVA 220/66 kV transformers.
Supply to at least one 66 kV feeder that is connected to Shepparton Terminal Station	Supply for the entire service requirement of any of the 66 kV feeders to allow the supply area to become self-sufficient.	This service allows selective-replacement of assets, disconnection of the relevant 66 kV feeder, and retirement of relevant feeder circuit breakers but will require reconfiguration of distribution networks. Depending on the size and which feeder the non-network option is offered at, this service could reduce the scope of replacement needs and allow deferral of investment while mitigating the failure risks from deteriorating assets.

Table 3 - Potential services that could be provided by non-network options

4.1. Required technical characteristics of a non-network option

Up to 150 MW of demand is at risk of being shed during simultaneous outages of two 220/66 kV transformers to avoid overloading of the remaining transformer. Non-network options could potentially address this supply shortfall and the risk costs associated with such an event.

Figure 5 shows the typical annual demand profile serviced by Shepparton Terminal Station and the supportable demand levels for different network outage configurations. Using this reference demand profile, any non-network option would need to be able to reliably reduce the loading on the terminal station by at least 150 MW for up to 12 hours per day within 6 hours following failure of one or more transformers.

Whilst this section provides basic information that proponents of non-network solutions could use to evaluate their proposals, AusNet Services invites a collaborative approach and is open to discussions to maximize the potential benefits from non-network options.

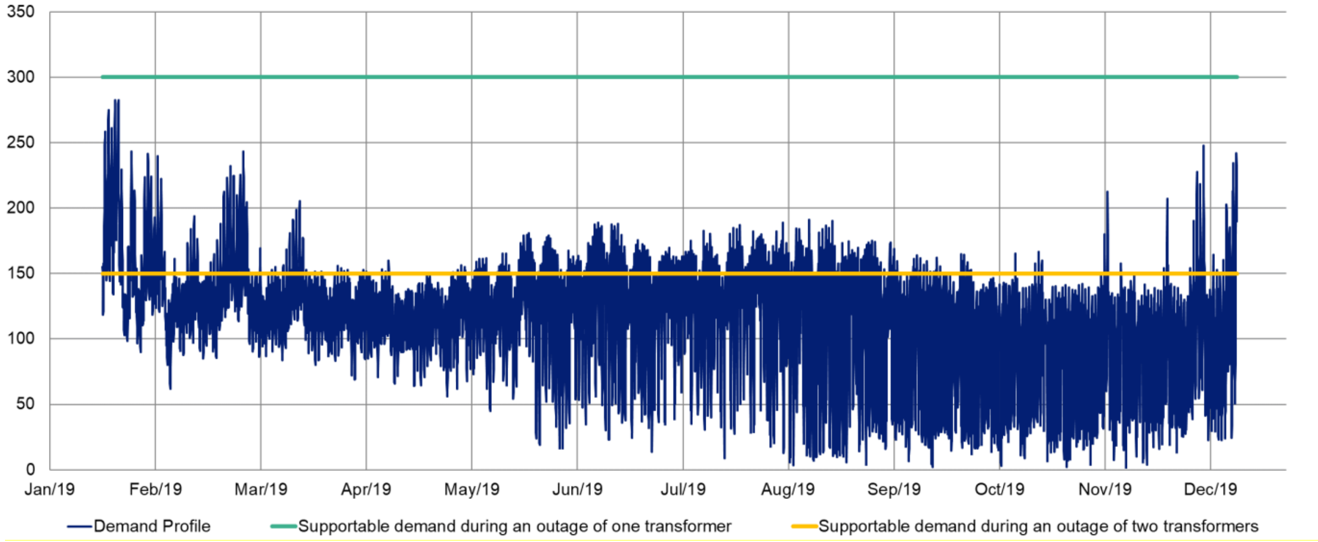

Figure 5 - Typical annual demand profile (MVA) and supportable demand levels for different network outages

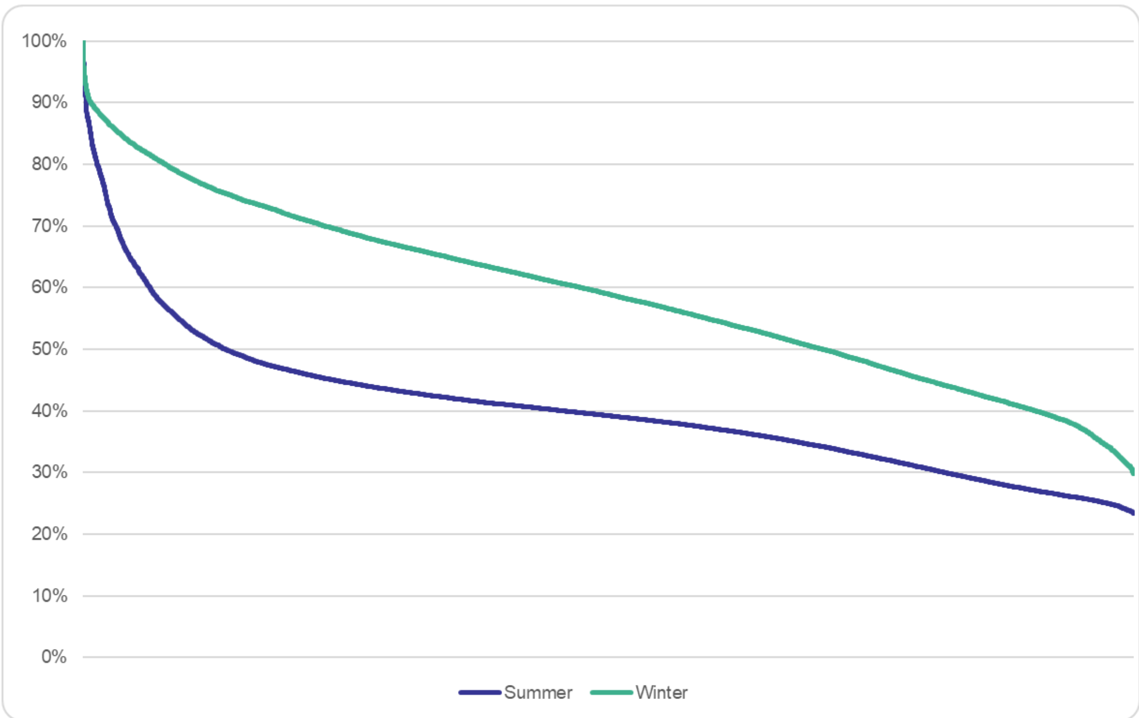

Figure 6 – Shepparton Terminal Station summer and winter demand duration curves

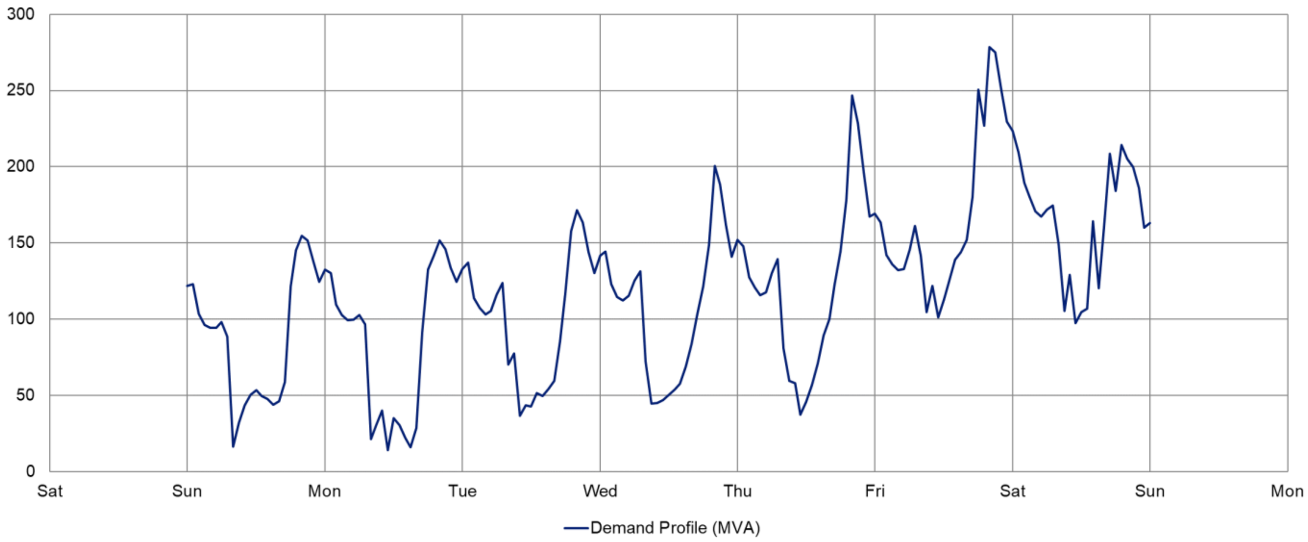

Figure 7 – Shepparton Terminal Station typical summer weekly demand profile

4.2. Location of non-network option

Non-network options connected to any of the 66 kV feeders supplied from Shepparton Terminal Station could be effective in addressing the supply shortfall risk.

4.3. Information to be included in non-network solution proposals

To manage a complex portfolio of demand management of sufficient scale, proposals for non-network solutions must be at least 5 MW in size and of proven technology which may include embedded generation, energy storage (including battery system) that injects power into the grid as required, voluntary curtailment of customer demand, and permanent reduction of customer demand (including energy efficiency).

Table 4 shows the relevant parameters that must be included in any proposal for non-network solution.

Table 4 - Required information that a proponent of non-network option must submit

Parameter	Description
Block ID	Block Identifier (e.g. Block 1) of non-network solution
Block capacity	Discrete amount of the non-network option (reduced demand or additional supply) capacity in MW. Sum of block capacities must meet a minimum requirement of 5 MW. AusNet Services may choose to select a subset of blocks it determines that is most economical and reliable to dispatch.
Location	For new generation solutions, details of the proposed sites for the new generators
Availability period	Time periods the blocks are available (months/days/hours)
Call notice period	Minimum period of time before the block can be dispatched
Establishment fee	Setup payment that applies to a block
Availability fee	A fee per month for a block to be made available to be dispatched

Parameter	Description
Indicative dispatch fee	Fee for a block to be dispatched per MWh
Dispatch lead time	Time required (in hours) to activate the non-network service
Timeframe for project delivery	When the block of DR will be available for dispatch
Communications	Proposed dispatch communications protocol with AusNet Services' control room
Metering	Metering equipment installed or to be installed to measure and record the data to be verified
Any other special technical requirements	e.g. terms of commitment and length of service.

Proposals for non-network solutions should be emailed to rittconsultations@ausnetservices.com.au by 18 March 2021.

5. Assessment approach

Consistent with the RIT-T requirements and practice notes on risk-cost assessment methodology[21], AusNet Services will undertake a cost-benefit analysis to evaluate and rank the net economic benefits from various credible options. AusNet Services proposes to undertake this assessment over a 45-year period.

All options considered will be assessed against a business-as-usual case where no proactive capital investment to reduce the increasing baseline risks is made.

Optimal timing of an investment option will be the year when the annual benefits from implementing the option become greater than the annualised investment costs.

5.1. Proposed sensitivity analysis and input assumptions

The robustness of the investment decision and the optimal timing of the preferred option will be tested by a sensitivity analysis. This analysis involves variation of assumptions from those employed under the base case.

Table 5 - Input assumptions used for the sensitivity studies

Parameter	Lower Bound	Base Case	Higher Bound
Asset failure rate	AusNet Services assessment – 25%	AusNet Services assessment	AusNet Services assessment + 25%
Demand forecast	AEMO 2019 Transmission Connection Point Forecasts - 15%	AEMO 2019 Transmission Connection Point Forecasts	AEMO 2019 Transmission Connection Point Forecasts + 15%
Value of customer reliability	Latest AER VCR figures - 25%	Latest AER VCR figures	Latest AER VCR figures + 25%
Discount rate	2.58% - a symmetrical adjustment downwards	4.68% - the latest commercial discount rate	6.78% - a symmetrical adjustment upwards

5.2. Material classes of market benefits

NER clause 5.16.1(c)(4) formally sets out the classes of market benefits that must be considered in a RIT-T. AusNet Services estimates that the only class of market benefits that is likely to be material is the change in involuntary load shedding. AusNet Services' proposed approach to calculate the benefits of reducing the risk of load shedding is set out in section 2.3.

5.3. Other classes of benefits

Although not formally classified as classes of market benefits under the NER, AusNet Services expects material reduction in: safety risks from potential explosive failure of deteriorated assets,

[21] Australian Energy Regulator, *"Industry practice application note for asset replacement planning,"* available at https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/industry-practice-application-note-for-asset-replacement-planning.

environmental risks from possible oil spillage, collateral damage risks to adjacent plant, and the risk of increased costs resulting from the need for emergency asset replacements and reactive repairs, by implementing any of the options considered in this RIT-T.

5.4. Classes of market benefits that are not material

AusNet Services estimates that the following classes of market benefits are unlikely to be material for any of the options considered in this RIT-T:

- Changes in fuel consumption arising through different patterns of generation dispatch - as the network is sufficiently radial to the extent that asset failures cannot be remediated by re-dispatch of generation and the wholesale market impact is expected to be the same for all options.
- Changes in costs for parties, other than the RIT-T proponent – there is no other known investment, either generation or transmission, that will be affected by any option considered.
- Changes in ancillary services costs – the options are not expected to impact on the demand for and supply of ancillary services.
- Change in network losses –while changes in network losses are considered in the assessment, they are estimated to be small and unlikely to be a material class of market benefits for any of the credible options.
- Competition benefits – there is no competing generation affected by the limitations and risks being addressed by the options considered for this RIT-T.
- Option value – as the need for and timing of the investment options are driven by asset deterioration, there is no need to incorporate flexibility in response to uncertainty around any other factor.

AusNet Services notes that non-network options of significant size and duration may impact the wholesale electricity market and the materiality of several of the classes of market benefits mentioned above. Where appropriate, AusNet Services will assess the materiality of these market benefits as part of the next step in the evaluation process.

6. Options assessment

This section details the analysis of the costs and benefits from the network options considered in this RIT-T. Any credible option that may arise from submissions in response to this PSCR will be assessed and presented as part of the next step of this RIT-T. If there are no new credible options to assess, AusNet Services intends to progress to the final stage (PACR) of the RIT-T.

All the options considered in this RIT-T will deliver a reduction in supply risk, safety risk, environmental risk, collateral risk and risk cost of emergency replacement if the asset failed.

6.1. Sensitivity analysis

This section describes the sensitivity of the net economic benefits, ranking of options, and optimal timing of the preferred option to different assumptions of key variables.

Sensitivity of net economic benefits

Using the base case as the reference, the net economic benefits from implementing an option changes with different assumptions of key variables. The net economic benefits are positive for all sensitivities studied for all the options. Sensitivity analysis also confirms that Option 1 is the most economical investment option for most sensitivities tested, as shown in Figure 8.

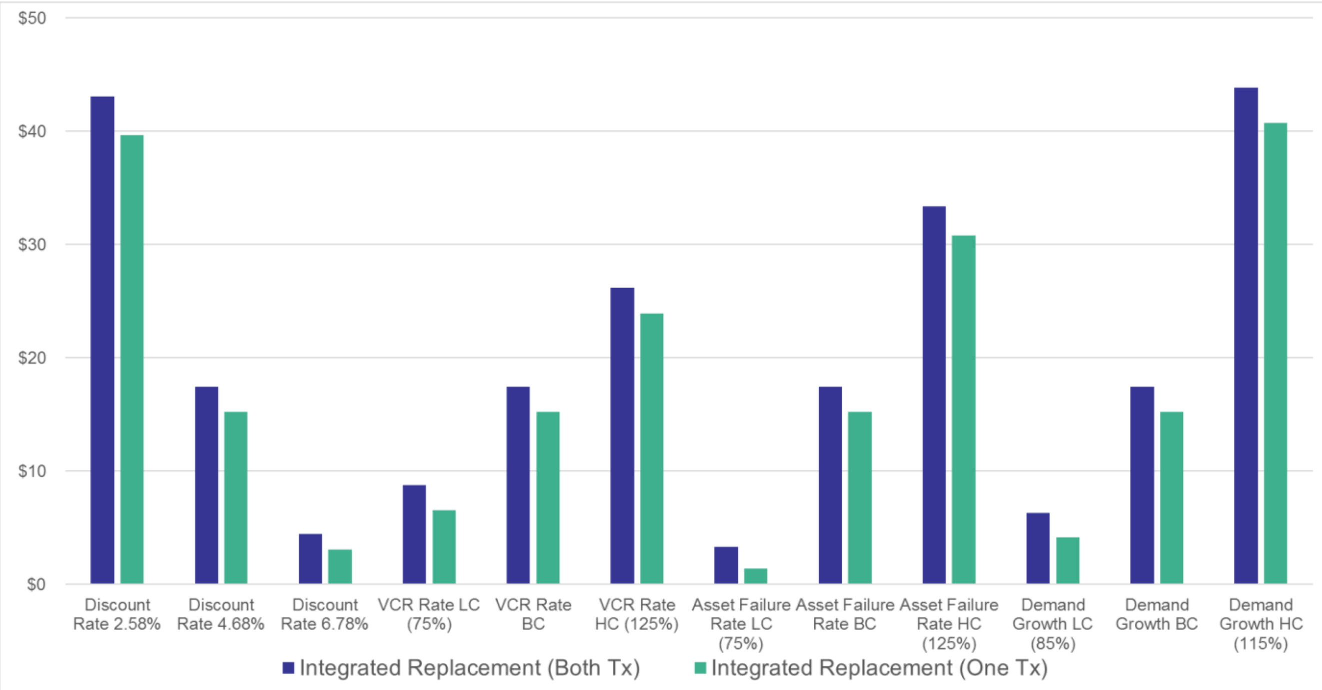

Figure 8 - Sensitivity of net economic benefits with respect to variation of key parameters

Sensitivity of optimal timing

Figure 9 shows that for most of the sensitivities investigated, the optimal timing of the preferred option is 2024/25.

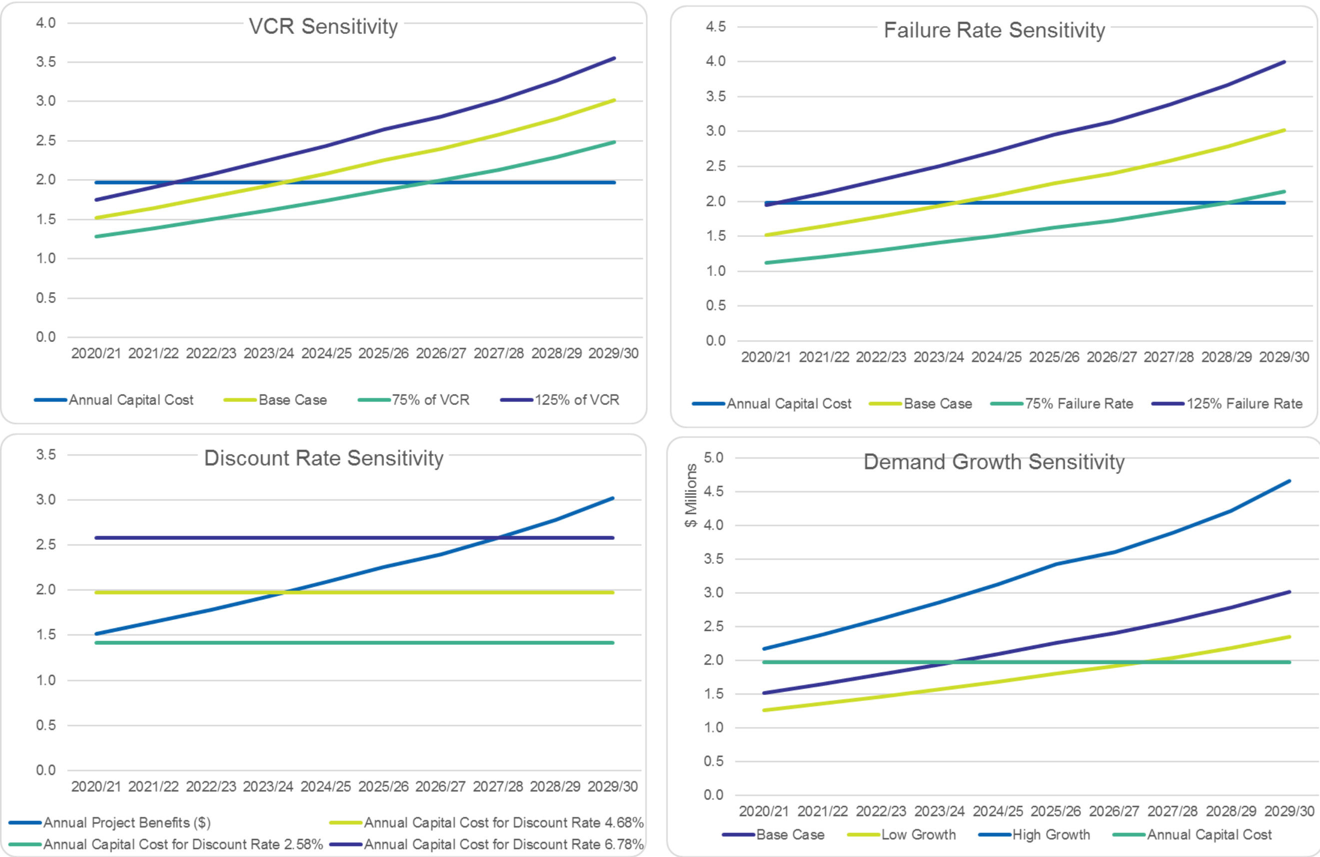

Figure 9 - Sensitivity of the optimal timing with respect to variation of key parameters

7. Draft conclusion and next steps

Amongst the options considered in this RIT-T, Option 1 is the most economical option to maintain supply reliability in the Shepparton and Goulburn-Murray area and manage safety, environmental and emergency replacement risks at Shepparton Terminal Station.

This preferred option involves the following scope of work in a single integrated project:

- Sequential replacement of the B2 and B3 transformers; and
- Replacement of twelve 66 kV circuit breakers and associated primary and secondary equipment.

The estimated capital cost of this option is $38.5 million with no material change in operating cost.

Based on AusNet Services' preliminary analysis, this option is economical to proceed by 2024/25.

Submissions

AusNet Services welcomes written submissions on the topics and the credible options presented in this PSCR and invites proposals from proponents of potential non-network options.

Submissions should be emailed to rittconsultations@ausnetservices.com.au on or before 18 March 2021. In the subject field, please reference 'RIT-T PSCR Shepparton Terminal Station.'

Exemption from preparing a PADR

Subject to receipt of technically and economically-feasible network or non-network options, publication of a Project Assessment Draft Report (PADR) may not be required for this RIT-T as:

- the preferred option, Option 1, which has a capital cost of less than $43 million, addresses the identified need most economically;
- all credible options will not have a material class of market benefits except for those specified in NER clause 5.16.1(c)(4)(ii), and 5.16.1(c)(4)(iii); and
- this project has the benefit of NER clause 5.16.4(z1);

Should AusNet Services consider that no additional credible options were identified during the 12-week consultation period, AusNet Services intends to produce a Project Assessment Conclusions Report (PACR) before 18 June 2021.

In accordance with NER clause 5.16.4(z1)(4), the exemption from producing a PADR will no longer apply if AusNet Services considers that an additional credible option that could deliver a material market benefit has been identified during the consultation period. Accordingly, AusNet Services will aim to produce a PADR which will include assessment of the net economic benefits from each additional credible option by 18 June 2021.

Appendix A - RIT-T assessment and consultation process

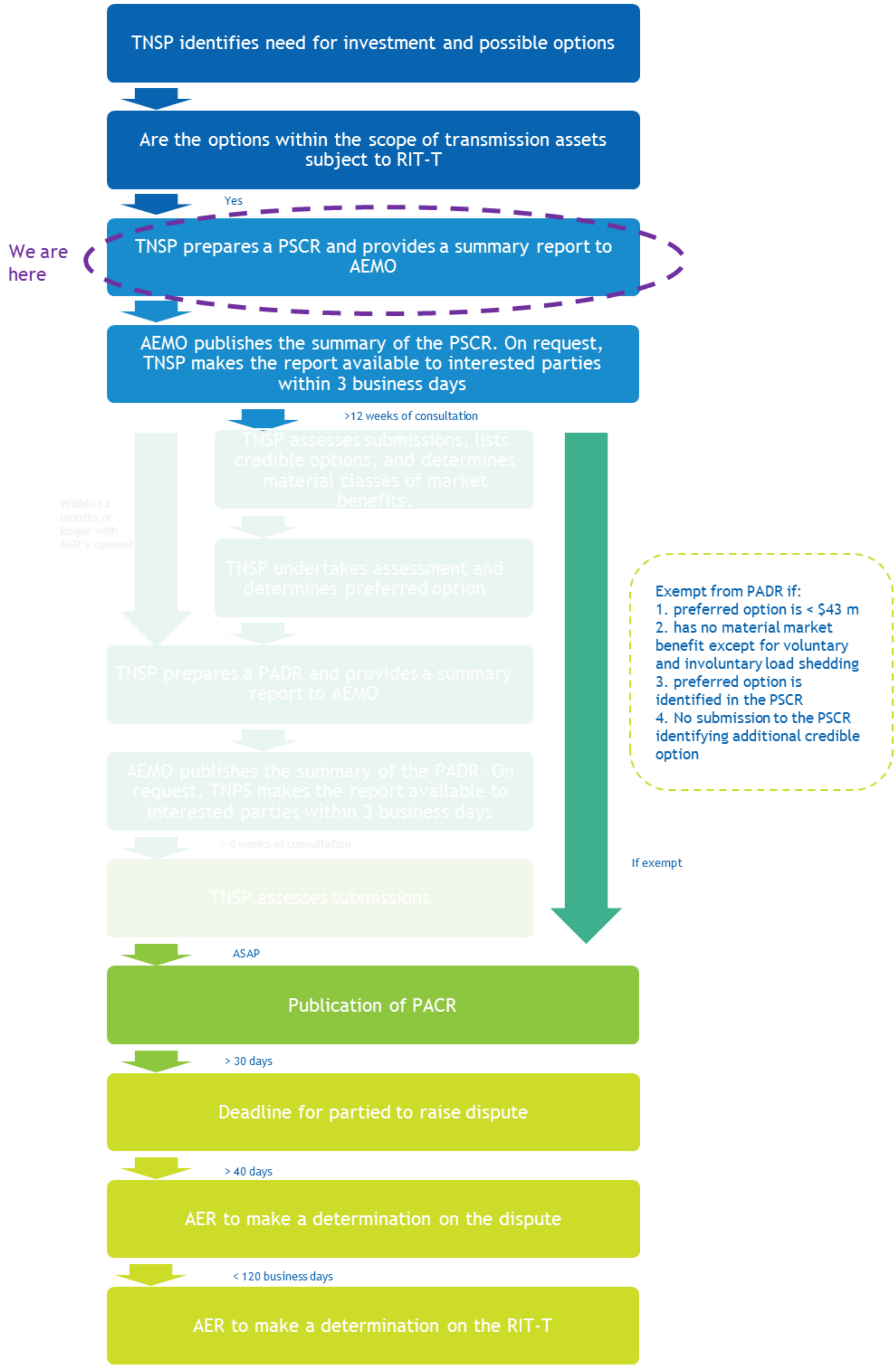

Figure 10 - RIT-T Process

Appendix B - Asset condition framework

AusNet Services uses an asset health index, on a scale of C1 to C5, to describe asset condition. The condition range is consistent across asset types and relates to the remaining service potential. The table below provides an explanation of the asset condition scores used.

Table 6 - Condition scores framework

Condition score	Likert scale	Condition description	Recommended action	Remaining service potential (%)
C1	Very Good	Initial service condition	No additional specific actions required, continue routine maintenance and condition monitoring	95
C2	Good	Better than normal for age		70
C3	Average	Normal condition for age		45
C4	Poor	Advanced deterioration	Remedial action or replacement within 2-10 years	25
C5	Very Poor	Extreme deterioration and approaching end of life	Remedial action or replacement within 1-5 years	15

Asset failure rates

AusNet Services uses the hazard function of a Weibull two-parameter distribution to estimate the probability of failure of an asset in a given year. The asset condition scores are used to establish a condition-based age which is used to calculate the asset failure rates using a two-parameter Weibull Hazard function (h(t)), as presented below.

$$h(t) = \beta.\frac{t^{\beta-1}}{\eta^{\beta}}$$

Equation 1: Weibull Hazard Function

where:

t = Condition-based age (in years)

η = Characteristic life (Eta)

β = Shape Parameter (Beta)

Hazard functions are defined for the major asset classes including power transformers, circuit breakers, and instrument transformers. All assets in the substation risk-cost model use a Beta (β) value of 3.5 to calculate the failure rates. The characteristic life represents that average asset age at which 63% of the asset class population is expected to have failed.

The condition-based age (t) depends on the specific asset's condition and characteristic life (η).