Maintaining supply reliability in the Thomastown area

Project Specification Consultation Report

Regulatory Investment Test - Transmission

Expected Publication - November 2020

Important notice

Purpose

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

Disclaimer

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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 Thomastown and the suburbs north of greater Melbourne. Options investigated in this RIT-T will mitigate the risk of an asset failure at Thomastown Terminal Station (TTS).

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).

TTS is owned and operated by AusNet Services and is located in Thomastown. It was commissioned in the 1960's and serves as the main transmission connection point for distribution of electricity to approximately 185,000 customers. Peak demand at the station during the summer of 2018/19 reached 522.7 MW and demand is forecast to largely remain at historical levels, which supports the ongoing need for TTS.

Identified need

As expected of assets that have been in service for an extended time, the condition of some of the circuit breakers at TTS 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 incur cost for emergency replacement. Therefore, the 'identified need' this RIT-T intends to address is to maintain supply reliability in Thomastown and the suburbs north of greater Melbourne and mitigate risks from asset failures.

AusNet Services estimates that the present value of the baseline risk costs associated with maintaining the existing assets in service is more than $17 million. The biggest risk is a failure of a 66 kV circuit breaker that would result in a supply interruption to electricity consumers. AusNet Services is therefore investigating options to allow continued delivery of safe and reliable electricity supply to Thomastown and suburbs to the north of greater Melbourne.

Credible options

Network or non-network investments are likely to deliver more economical and reliable solutions to maintain supply reliability in Thomastown and suburbs to the north of greater Melbourne, 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 selected 220 kV and 66 kV circuit breakers and switchgear that are in poor condition; or
- Option 2 – Deferring the replacement of selected 220 kV and 66 kV circuit breakers and switchgear that are in poor condition.

AusNet Services 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 Thomastown Terminal Station and which are of sufficient scale and flexibility to supply 600 MW or more; and
- options that allow for one or more of the 66 kV distribution feeders to become self-

[1] Australian Energy Market Commission, *"National Electricity Rule version126,"* available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current, viewed on 7 November 2019.
[2] Australian Energy Regulator, *"Application guidelines Regulatory investment test for transmission,"* available at https://www.aer.gov.au/system/files/AER%20-%20Final%20RIT-T%20application%20guidelines%20-%2014%20December%202018_0.pdf, viewed on 7 November 2019.

sufficient in islanded operation by providing local supply or demand curtailment in conjunction with local supply options.

Assessment approach

AusNet Services will investigate the costs, economic benefits, and ranking of options in this RIT-T assessment. 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 220 kV and 66 kV circuit breakers and switchgear that are in poor condition (Option 1) is the most economic option as it 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 circuit breakers and switchgear at TTS.

The optimal timing of delivery of the preferred option is by 2023/24.

The robustness of this RIT-T has been tested by a sensitivity analysis, which concluded that the preferred option has the highest net present benefit of all options for all sensitivities studied. Therefore, AusNet Services concludes that delivery of Option 1 by 2023/24 is the most economical and thus the preferred option to address the identified need at TTS.

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 xx February 2021. In the subject field, please reference 'RIT-T PSCR Thomastown Terminal Station.'

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 31 March 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 31 March 2021.

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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 Thomastown and suburbs to the north of greater Melbourne, to address asset failure risk at Thomastown Terminal Station (TTS).

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 2019 Victorian Transmission Annual Planning Report (VAPR)[6].

1.1. Making submissions

AusNet Services welcomes written submissions on 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 xx February 2021. In the subject field, please reference 'RIT-T PSCR Thomastown 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.

[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 Rule version126,"* available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current, viewed on 7 November 2019.

[5] Australian Energy Regulator, *"Application guidelines Regulatory investment test for transmission,"* available at https://www.aer.gov.au/system/files/AER%20-%20Final%20RIT-T%20application%20guidelines%20-%2014%20December%202018_0.pdf, viewed on 7 November 2019.

[6] Australian Energy Market Operator, *"Victorian Annual Planning Report,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Victorian-transmission-network-service-provider-role/Victorian-Annual-Planning-Report, viewed on 7 November 2019.

2. Identified need

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

2.1. Supply to the Thomastown area

The 220/66 kV TTS is owned and operated by AusNet Services and is in Thomastown, north of greater Melbourne. Since it was commissioned in 1960's, TTS served as the main transmission service connection point for distribution of electricity to communities in the towns of Thomastown, Coburg, Preston, Watsonia, North Heidelberg, Lalor, Coolaroo and Broadmeadows.[7]

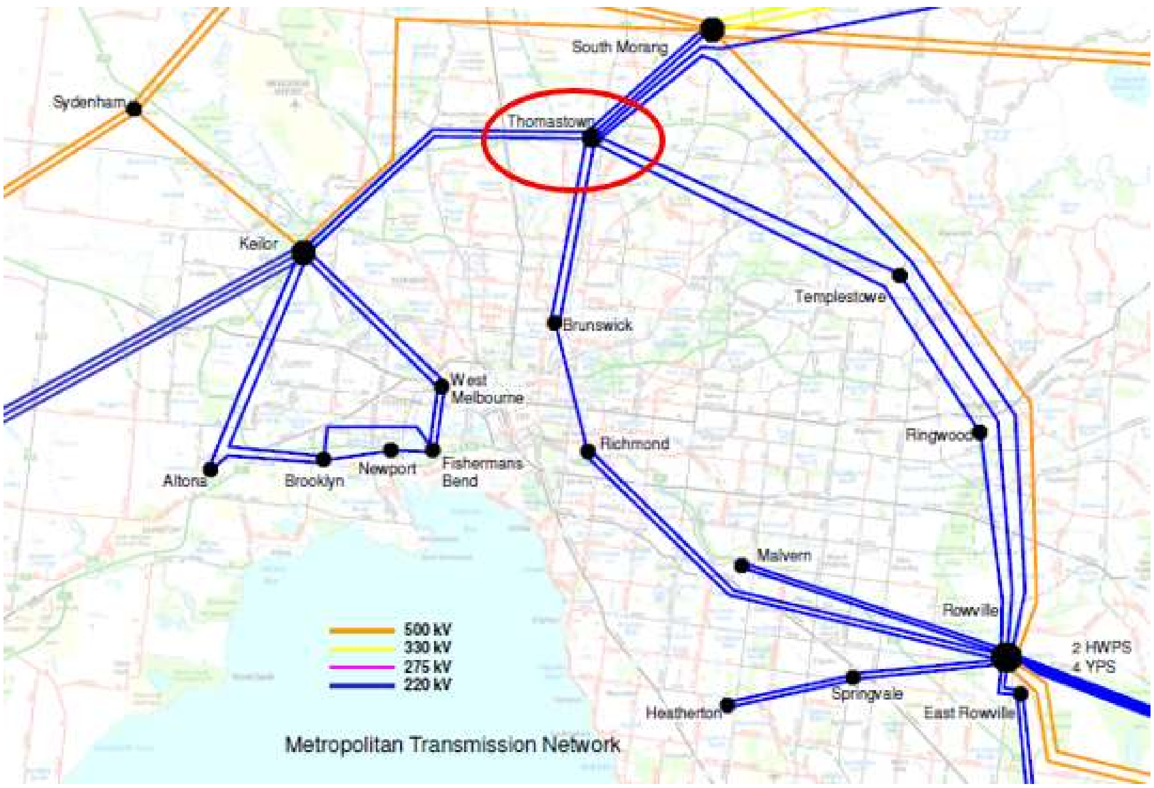

Figure 1 – Metropolitan transmission network and Thomastown Terminal Station

Electricity demand

Approximately 185,000 customers depend on TTS for their electricity supply. The commercial sector constitutes 50.2% and the residential sector constitutes 37.3% of the total annual energy consumed at TTS as illustrated in Table 1.

Table 1 - Customer demand composition at TTS

Customer type	Share of consumption (%)
Commercial	50.2%

[7] Distribution of electricity to relevant communities is supported by AusNet Services and Jemena.

Customer type	Share of consumption (%)
Residential	37.3%
Industrial	12.5%
Agricultural	0.01%
Total	100%

Peak demand during the summer of 2018/19 at TTS reached 522.7 MW. The Australian Energy Market Operator (AEMO) forecasts[8] that peak demand at TTS will remain at current levels. Figure 2 shows the 10% probability of exceedance (POE10)[9] and the 50% probability of exceedance (POE50)[10] forecasts for peak demand during summer and winter periods.[11]

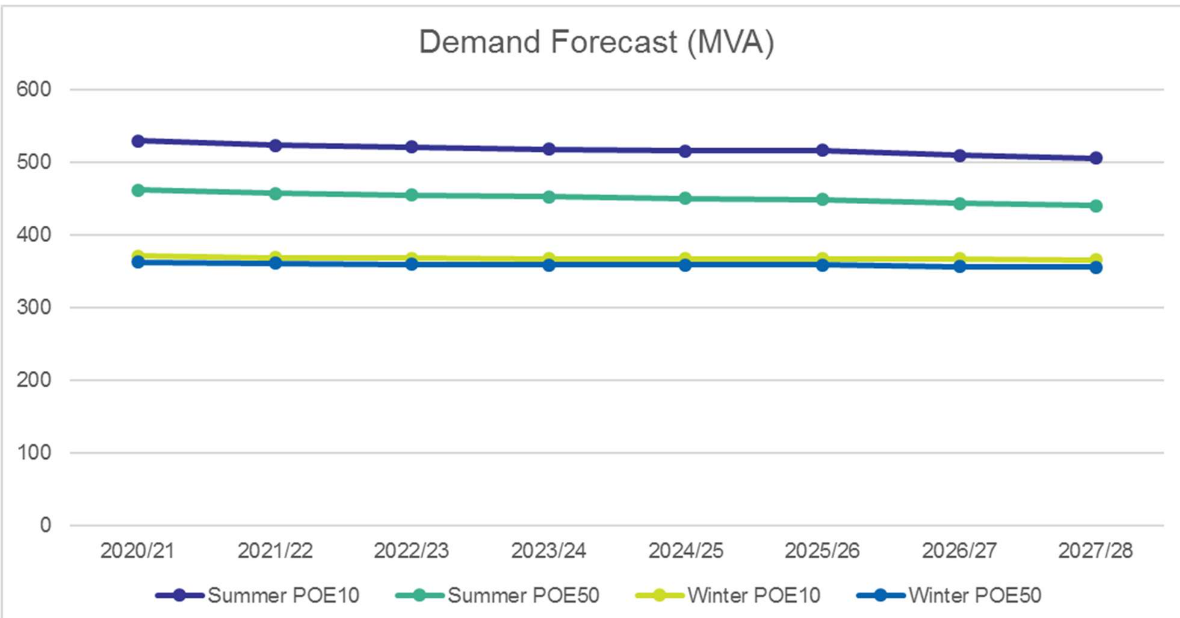

Figure 2 - Demand forecasts for Thomastown Terminal Station

AEMO and the relevant Distribution Network Service Providers (DNSPs) recognise there is an ongoing need for electricity supply services to communities in the Thomastown area as reflected in the official demand forecast for TTS.

Embedded generation

There is one 66 kV customer zone substation which has 4.1 MVA of embedded generation connected to their 11 kV internal network downstream from TTS.

[8] Australian Energy Market Operator (AEMO), *"2018 Transmission Connection Point Forecast for Victoria,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/Victoria, viewed on 7 November 2019.

[9] A POE10 forecast indicates a level where there is 10 % likelihood that actual peak demand will be greater.

[10] A POE50 forecast indicates a level where there is 50 % likelihood that actual peak demand will be greater.

[11] 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).

Electricity network

TTS is connected to Keilor (KTS), South Morang (SMTS), Templestowe (TSTS) and Brunswick (BTS) Terminal Stations and Eildon Power Station (EPS) via 220kV transmission lines, as shown in Figure 1.

TTS supplies eleven 66 kV feeders that distribute electricity to AusNet Services and Jemena customers, as shown in Figure 3. The zone substations supplied from TTS include Broadmeadows (BD), Coburg North (CN), Broadmeadows South (BMS), Visy Coolaroo (VCO), Coolaroo (COO), Coburg South (CS), Watsonia (WT), East Preston switch houses A and B (EP), Thomastown (TT), North Heidelberg (NH), East Preston (EPN), and Nilsen Electrical Industries (NEI).

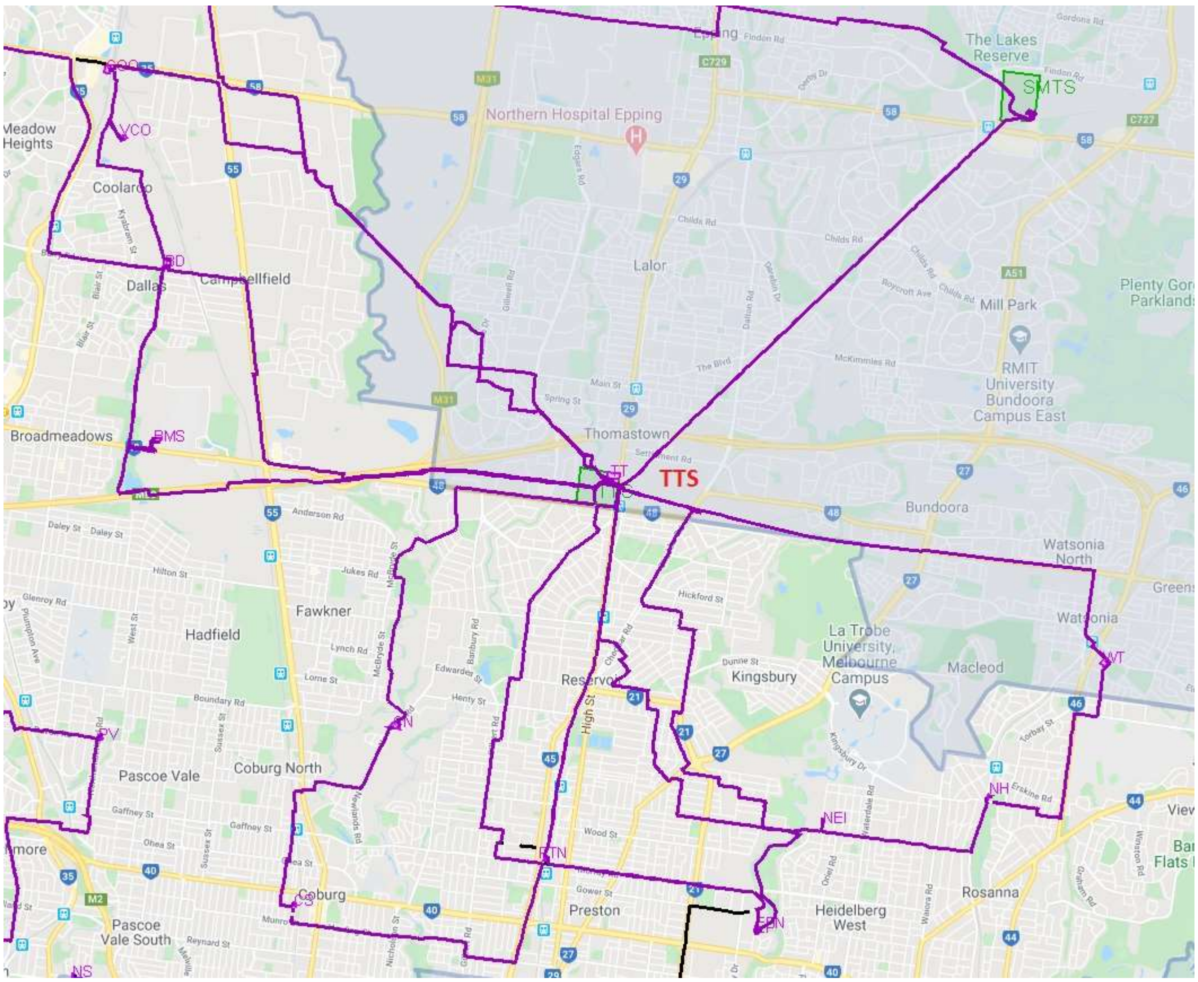

Figure 3 – Distribution network supplied from Thomastown Terminal Station[12]

2.2. Asset condition

Several primary (circuit breakers and switchgear) and secondary (protection and control) assets at TTS are in 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 (extreme deterioration) – as set out in Appendix C. The latest asset condition assessment for TTS 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

[12] Purple lines represent 66 kV feeders

increase further if no remedial action is taken. Table 2 provides a summary of the condition of relevant major equipment.

Table 2 - Summary of major equipment condition scores

Asset class	Condition scores				
	C1	C2	C3	C4	C5
Power transformers	3	1		1	
220 kV circuit breakers	18	2	4		1
220 kV current transformers	3		9		6
66 kV circuit breakers		2	3	5	16
66 kV current transformers	2	9	17	6	4
66 kV voltage transformers	1		9	3	7

220 kV circuit breakers

Most of the 220 kV circuit breakers at TTS are in good condition with the exception of one 220 kV capacitor bank circuit breaker. Circuit breakers used to switch capacitor banks have higher duty cycles than other circuit breakers and need to be replaced more frequently. This circuit breaker has provided 35 years of service and will be close to 40 years when it is planned to be replaced.

220 kV instrument transformers

Most of the 220 kV instrument transformers at TTS are in good condition, with the exception of six 220 kV current transformers that are in poor condition. The six current transformers are associated with the No.1 and No.3 220 kV capacitor banks.

66 kV circuit breakers

Twenty one of the twenty six 66 kV circuit breakers, including one bus tie circuit breaker, are in poor condition and are approaching their end of economic and technical life. 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.

Three of the 21 circuit breakers that are in poor condition will be replaced by another committed project and the four circuit breakers that are not in service do not need to be replaced. The remaining fourteen poor condition 66 kV circuit breakers need replacement within the next five years to maintain supply reliability to customers served by TTS.

66 kV instrument transformers

Several 66 kV instrument transformers at TTS are assessed to be in poor or very poor condition (C4 and C5). Management of safety risks from potential explosive failures of instrument transformers is costly due to the need for regular oil sampling and partial discharge condition monitoring.

2.3. Description of the identified need

TTS provides electricity supply to Thomastown and suburbs to the north of greater Melbourne. 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. The poor condition of some of the assets at the terminal station has increased the likelihood of asset failures. Such failures would result in prolonged supply 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, environment 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 Thomastown area and to mitigate risks from asset failures.

AusNet Services calculated the present value of the baseline risk costs to be more than $17 million over the forty-five year period from 2020/2021. The key elements of the risk costs are shown in Figure 4.

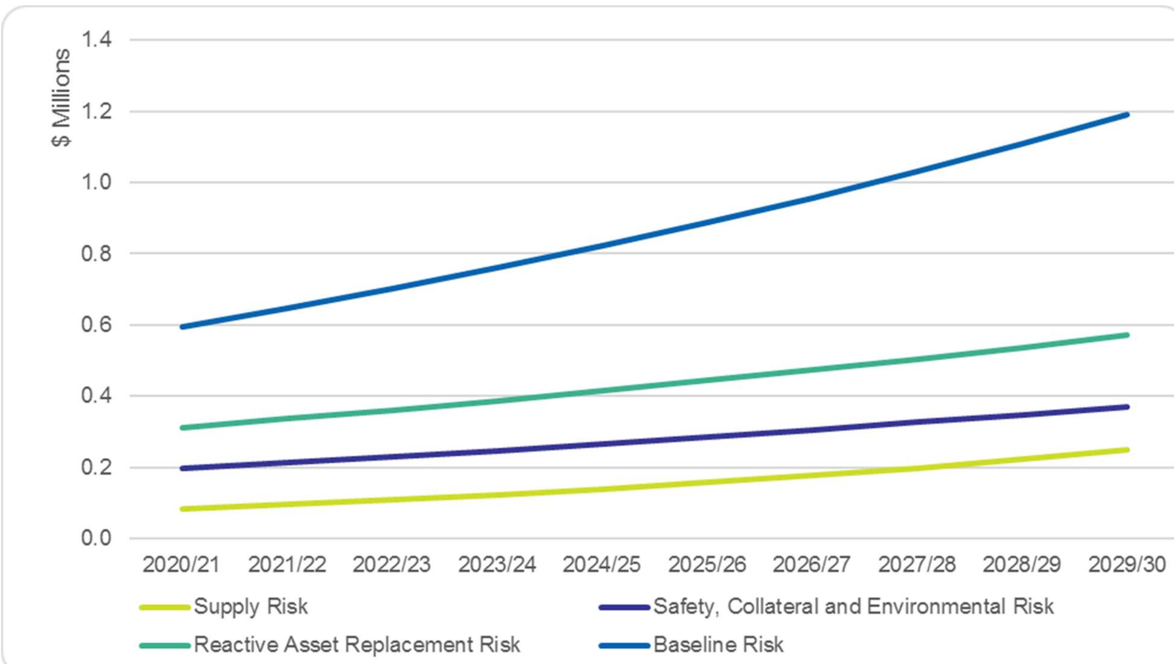

Figure 4 - Baseline risk costs

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

2.3.1. Assumptions

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

Supply risk costs

[13] Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Energy Safe 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, viewed on 7 November 2019.

Supply risk costs have been calculated from the expected unserved energy and AEMO's most recent demand forecast for TTS[14] and has been monetised at a Value of Customer Reliability (VCR)[15] of $38,320/MWh. The VCR rate is based on the AER survey and the load composition at TTS.

The total supply risk cost is calculated by estimating the community impact of different combinations of forced outages and weighting them by their probabilities of occurrence.

Safety risk costs

The Electricity Safety Act 1998[16] 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[17] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[18]; and
- a disproportionality factor[19].

AusNet Services notes this approach, including the use of a disproportionality factor, is consistent with the practice notes[20] provided by the AER.

Financial risk costs

As there is a lasting need for the services that TTS provides, the failure rate-weighted cost of replacing failed assets (or undertaking reactive maintenance) is included in the assessment.[21]

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 TTS, are valued at $100,000 per event.

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[14] Australian Energy Market Operator (AEMO), *"2019 Transmission Connection Point Forecast for Victoria,"* available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/Victoria, viewed on 7 November 2019.

[15] In dollar terms, the Value of Customer Reliability (VCR) represents a customer's willingness to pay for the reliable supply of electricity. The values produced are used as a proxy, and can be applied for use in revenue regulation, planning, and operational purposes in the National Electricity Market (NEM).

[16] Victorian State Government, Victorian Legislation and Parliamentary Documents, *"Energy Safe 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, viewed on 7 November 2019.

[17] 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, viewed on 7 November 2019.

[18] 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, viewed on 7 November 2019.

[19] 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.

[20] 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, viewed on 7 November 2019.

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

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

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 selected 220 kV and 66 kV circuit breakers and switchgear in an integrated project

Option 1 involves replacement of one 220 kV capacitor bank circuit breaker, fourteen 66 kV circuit breakers, selected instrument transformers and secondary assets in a single integrated project.

The estimated capital cost of this option is $14.1 million.

AusNet Services' preliminary analysis shows that the optimal timing is to deliver a solution by 2023/24.

3.2. Option 2 – Integrated replacement deferred by five years

Option 2 defers the replacement of selected 220 kV and 66 kV circuit breakers and associated primary switchgear and secondary equipment by 5 years. During this time poor condition assets would be maintained in a similar manner as the "Business as Usual" option.

The estimated capital cost of this option is $14.1 million and the investment year is deferred to 2028/29.

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 at TTS. 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 TTS is electrically radial, and the network impact is confined to the Thomastown 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."*

No material inter-regional network impact associated with any option considered in this RIT-T has been identified when applying AEMO's suggested screening test, which requires the investment to be tested against the following criteria:[22]

- a decrease in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW
- an increase in power transfer capability between transmission networks or in another TNSP's network of no more than the minimum of 3% of the maximum transfer capability and 50 MW
- an increase in fault level by less than 10 MVA at any substation in another TNSP's network
- the investment does not involve either a series capacitor or modification in the vicinity of an existing series capacitor.

[22] Inter-Regional Planning Committee, *"Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations,"* available at https://www.aemo.com.au/-/media/Files/PDF/170-0035-pdf.pdf, viewed on 7 November 2019.

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 identified non-network options based on their economic and technical feasibility.

Table 3 lists some of the potential non-network services that AusNet Services considers may assist in meeting the identified need:

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

Non-network option	High-level requirements	Supplementary network requirements
Supply to the Thomastown area	Permanent supply that meets a peak demand of about 530 MVA and total annual energy of more than 1,000 GWh. This service must also be expandable to meet forecast growth in the service area.	This service would avoid the need for the 220/66 kV connection station at Thomastown. However, 220 kV switching capability at TTS would still be needed as it connects many terminal stations and a power station.
Supply to at least one 66 kV feeder that is connected to TTS	Supply for the entire service requirement of any of the 66 kV feeders to allow that 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 may 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.

4.1. Required technical characteristics of a non-network option

A suitable non-network solution should be capable of either removing the need of 66 kV feeder/ bus tie/ transformer circuit breaker/s replacement or deferring the replacement of circuit breaker/s. This could be achieved either by providing the non-network support to supply the full load of the feeder/s or part of the load.

Figure 5 demonstrates the TTS 66 kV feeder arrangement. There are several 66 kV feeder loops as shown and the circuit breakers that are in poor condition needing replacement are marked with yellow boxes.

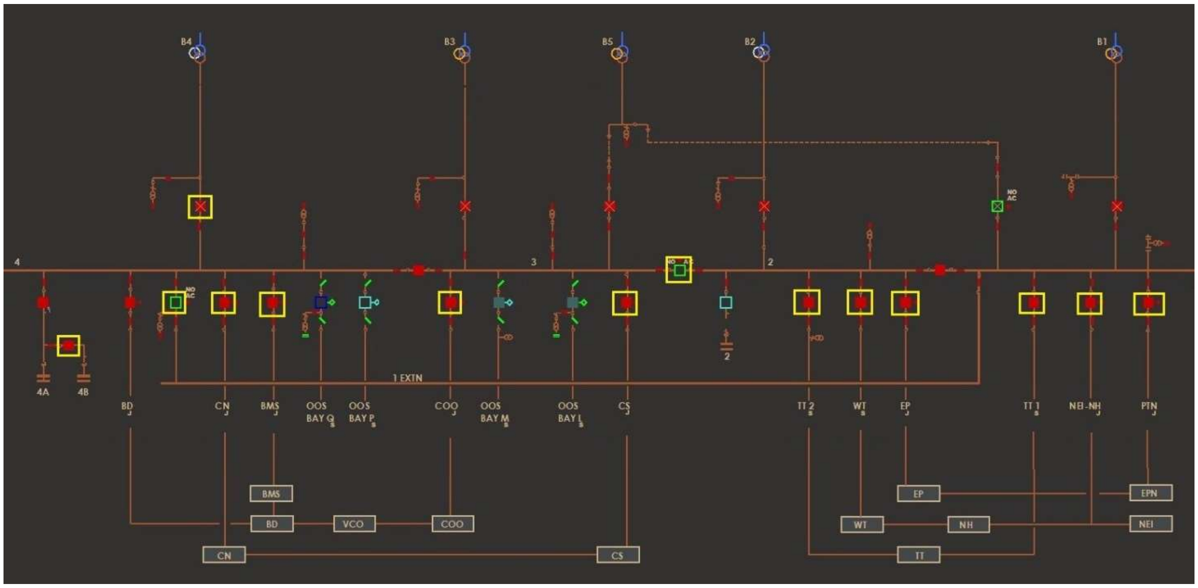

Figure 5 - TTS 66 kV feeder arrangement and circuit breakers that need to be replaced

The Table 4 below shows 66 kV feeder demand information for 2019.

Table 4 - TTS 66 kV feeder demand information - 2019

66 kV Feeder Name	Average Demand (MW)	Maximum Demand (MW)
BD	30.1	66.6
CN	30.4	75.6
BMS	25.7	67.7
COO	25.8	81.2
CS	17.2	69.4
TT2	17.5	49.8
WT	28.0	76.2
EP	7.9	40.0
TT1	16.4	53.9
NEI-NH	22.7	67.0
PTN	11.2	34.4

Figure 6, Figure 7 and Figure 8 show the 2019 annual demand profile, summer and winter demand duration curves and typical summer weekly demand profiles respectively for the TTS 66 kV network. Using this information, any non-network option needs to be able to reliably defer or avoid the need for one or more 66 kV circuit breaker replacements at TTS.

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.

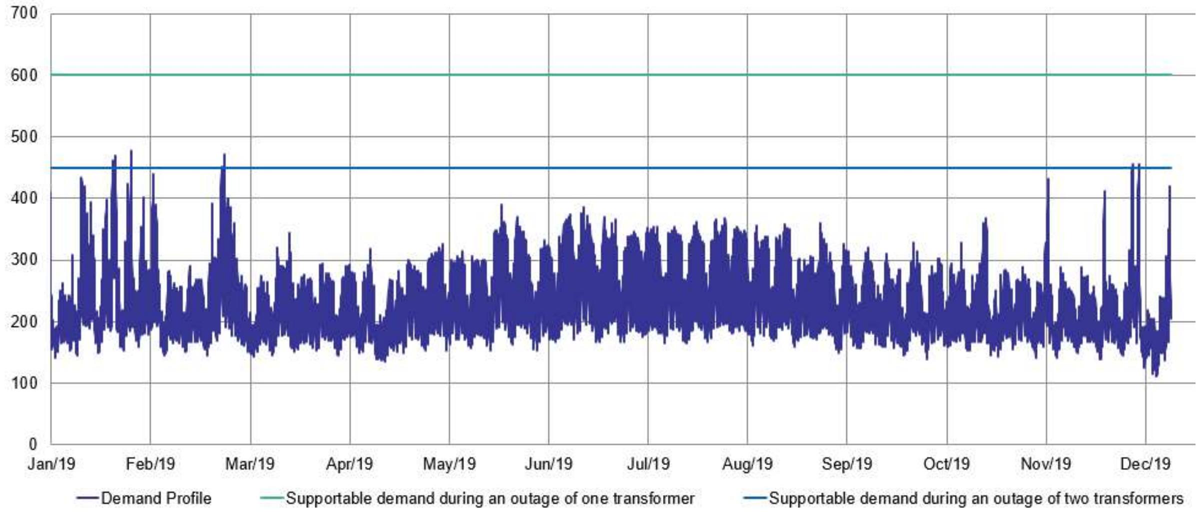

Figure 6 - Typical annual demand profile (MVA) and supportable demand levels for different network outages

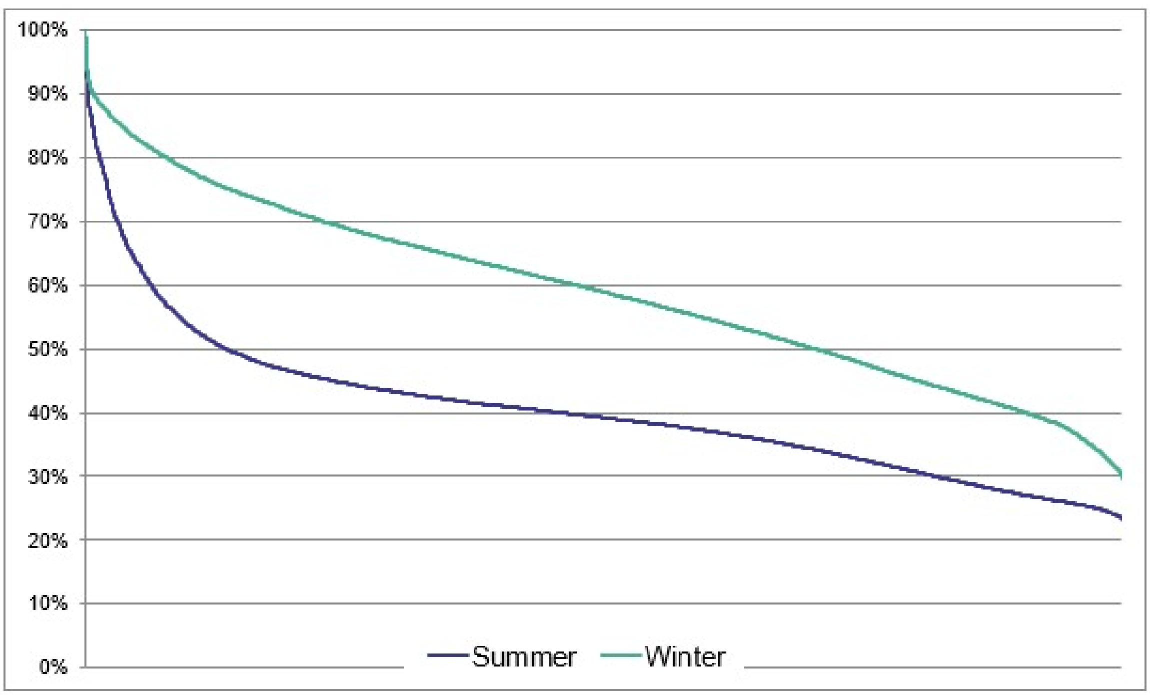

Figure 7 – Thomastown Terminal Station summer and winter demand duration curves

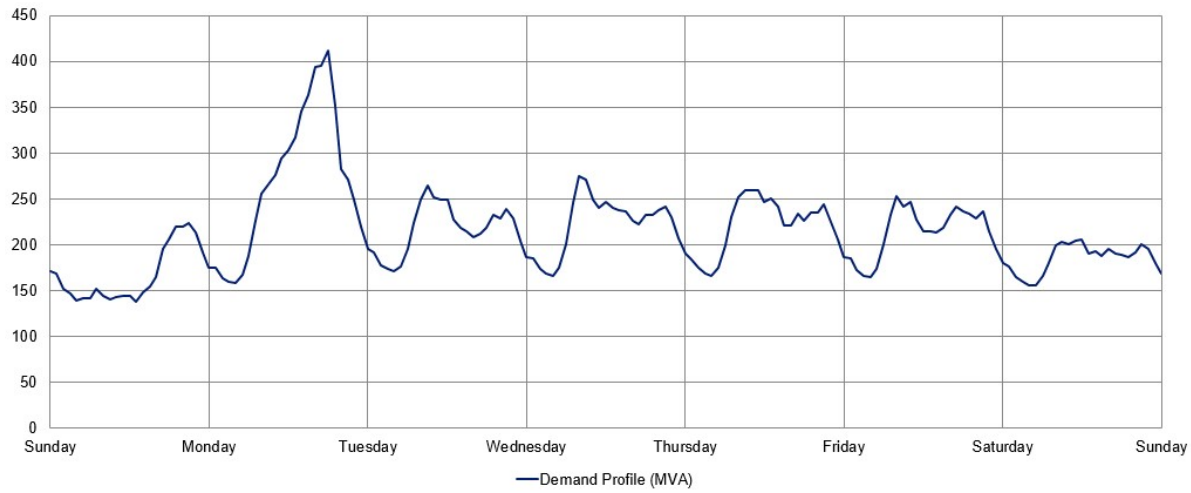

Figure 8 - Thomastown Terminal Station typical summer weekly demand profile

4.2. Location of non-network option

Non-network options connected to any of the 66 kV feeders supplied from TTS 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 would be preferably 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 5 shows the relevant parameters that must be included in any proposal for non-network solution.

Table 5 - 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 xx February 2021.

5. Assessment approach

Consistent with the RIT-T requirements and AER practice notes on risk-cost assessment methodology[23], 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 6 - 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 a change in involuntary load shedding. AusNet Services' proposed approach to calculate the benefits of reducing the risk of involuntary 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, 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

[23] 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, viewed on 7 November 2019.

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, environment 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 on 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 on key variables. While the benefits are sensitive, the net economic benefits are positive for all sensitivities studied and the ranking of options remains the same. Sensitivity analysis confirms that Option 1 presents the most robust investment decision and is also the most economical investment option for all sensitivities tested, as shown in Figure 9.

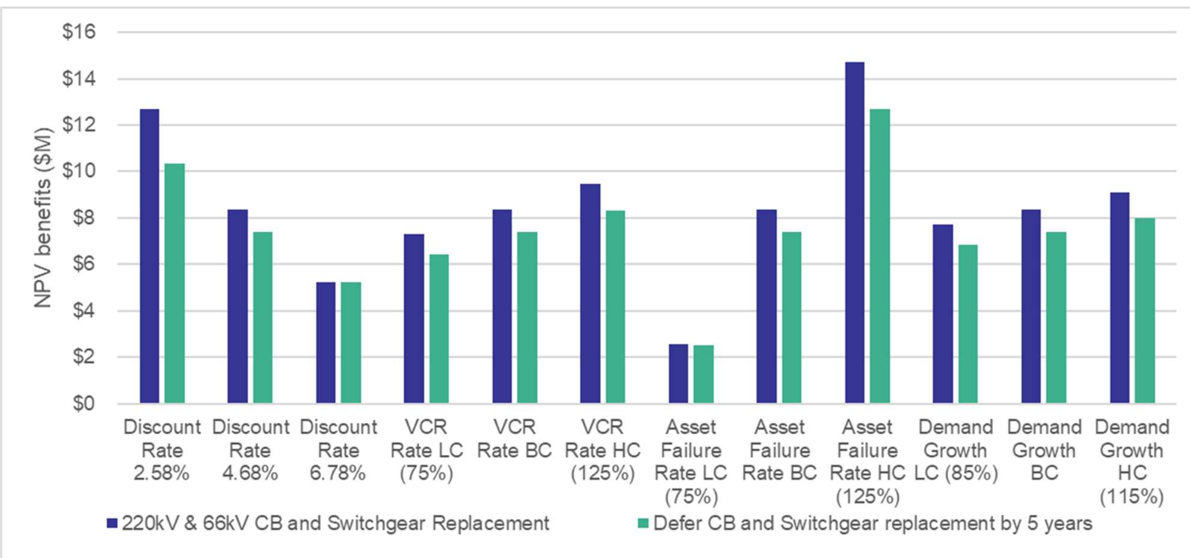

Figure 9 - Sensitivity of the net economic benefits with respect to variation of key parameters

Sensitivity of optimal timing

Figure 10 shows that for most of the sensitivities investigated, the optimal timing of the preferred option is by 2023/24.

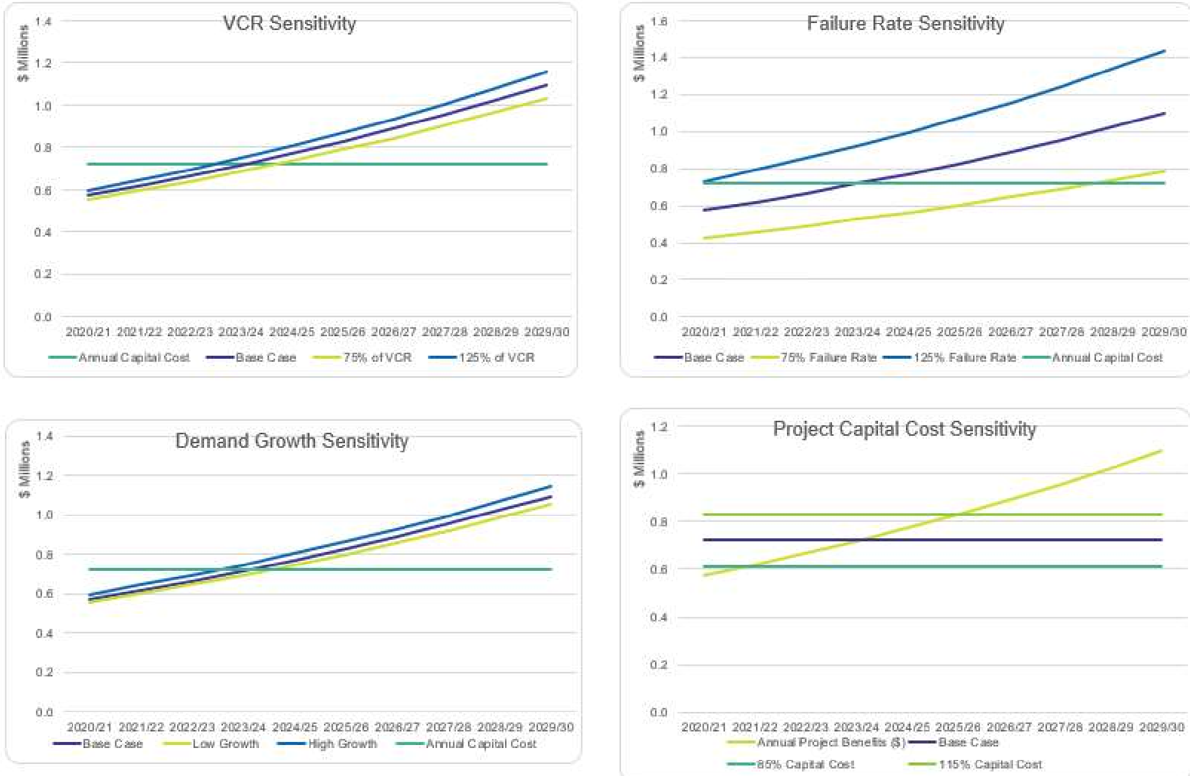

Figure 10 - Sensitivity of the optimal timing with respect to variation of key parameters

7. Draft conclusion and next steps

Amongst the network options considered in this RIT-T, Option 1 is the most economical option to maintain supply reliability in the Thomastown area and manage safety, environmental and emergency replacement risks at TTS.

Option 1 involves replacement of one 220 kV capacitor bank circuit breaker and fourteen 66 kV circuit breakers and associated primary and secondary equipment in a single integrated project.

The estimated capital cost is $14.1 million. This option is economical by 2023/24.

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 xx February 2021. In the subject field, please reference 'RIT-T PSCR Thomastown 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 31 March 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 before 31 March 2021.

Appendix A - RIT-T assessment and consultation process

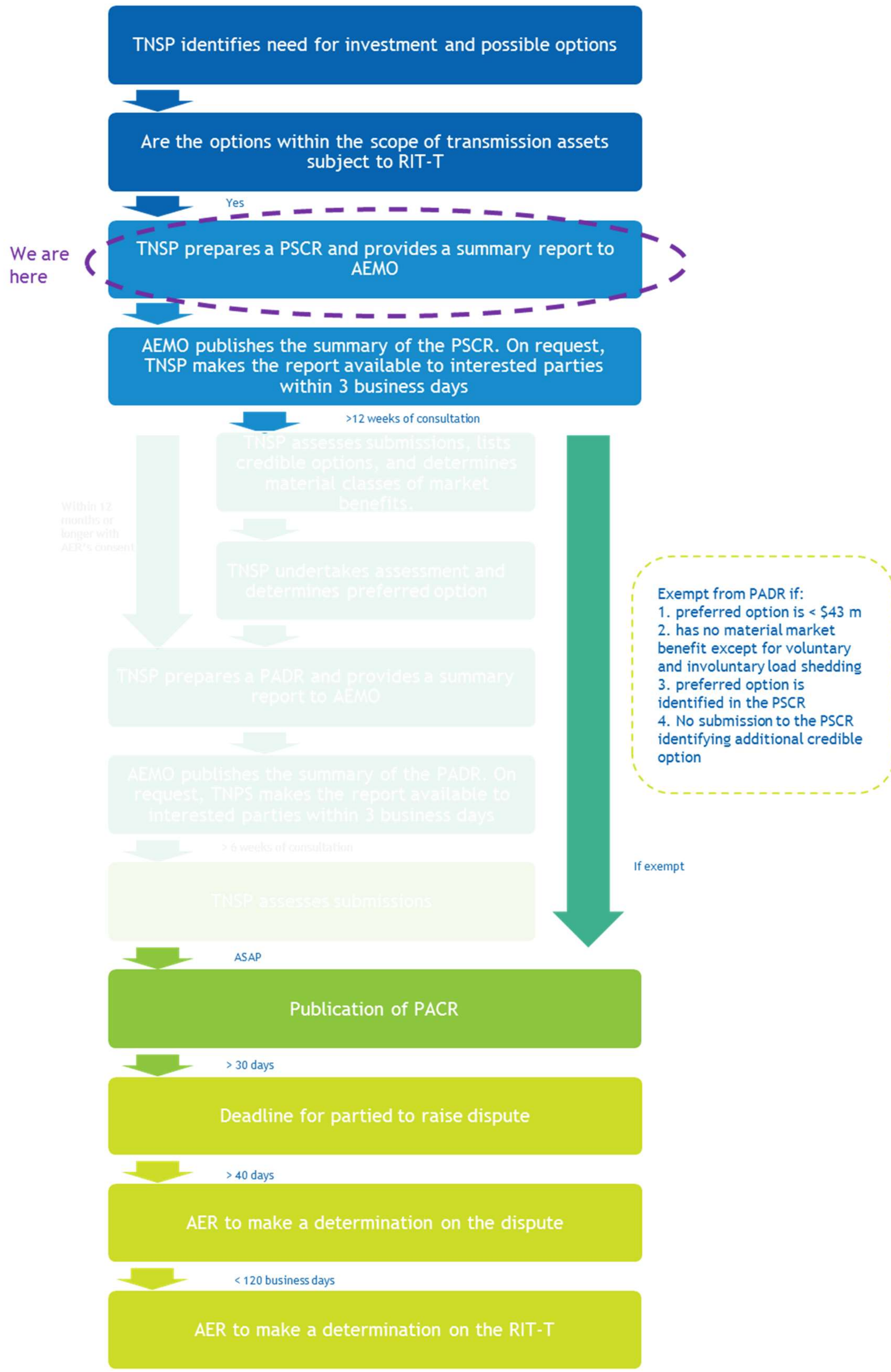

Figure 11 - RIT-T Process

Appendix B - Checklist of compliance clauses

The table below demonstrates the compliance of this PSCR with the requirements of clause 5.16.4(b) of the National Electricity Rules version 126[24], which states that a RIT-T proponent must prepare a PSCR which must include:

Table 7 - Summary of requirements

Requirement	Relevant section
(1) a description of the identified need;	2
(2) the assumptions used in identifying the identified need (including, in the case of proposed reliability corrective action, why the RIT-T proponent considers reliability corrective action is necessary);	2
(3) the technical characteristics of the identified need that a non-network option would be required to deliver, such as: (i) the size of load reduction of additional supply; (ii) location; and (iii) operating profile;	4
(4) if applicable, reference to any discussion on the description of the identified need or the credible options in respect of that identified need in the most recent National Transmission Network Development Plan;	Not applicable
(5) a description of all credible options of which the RIT-T proponent is aware that address the identified need, which may include, without limitation, alterative transmission options, interconnectors, generation, demand side management, market network services or other network options;	3
(6) for each credible option identified in accordance with subparagraph (5), information about: (i) the technical characteristics of the credible option; (ii) whether the credible option is reasonably likely to have a material inter-network impact; (iii) the classes of market benefits that the RIT-T proponent considers are likely not to be material in accordance with clause 5.16.1(c)(6), together with reasons of why the RIT-T proponent considers that these classes of market benefit are not likely to be material; (iv) the estimated construction timetable and commissioning date; and (v) to the extent practicable, the total indicative capital and operating and maintenance costs.	3 and 5
A RIT-T proponent is exempt from paragraphs (j) to (s) if: 1. the estimated capital cost of the proposed preferred option is less than $43 million (as varied in accordance with a cost threshold determination); 2. the relevant Network Service Provider has identified in its project specification consultation report: (i) its proposed preferred option; (ii) its reasons for the proposed preferred option; and (iii) that its RIT-T project has the benefit of this exemption;	7

24 Australian Energy Market Commission, *"National Electricity Rule version126,"* available at https://www.aemc.gov.au/regulation/energy-rules/national-electricity-rules/current, viewed on 7 November 2019.

Requirement	Relevant section
3. the RIT-T proponent considers, in accordance with clause 5.16.1(c)(6), that the proposed preferred option and any other credible option in respect of the identified need will not have a material market benefit for the classes of market benefit specified in clause 5.16.1(c)(4) except those classes specified in clauses 5.16.1(c)(4)(ii) and (iii), and has stated this in its project specification consultation report; and 4. the RIT-T proponent forms the view that no submissions were received on the project specification consultation report which identified additional credible options that could deliver a material market benefit.	

Appendix C - 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 8 - 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).