Planning Report Thomastown (TT) Zone Substation

AMS – Electricity Distribution Network

PUBLIC

Document number	AMS 20-252
Issue number	1
Status	Approved
Approver	Tom Langstaff
Date of approval	23/07/2019

ISSUE/AMENDMENT STATUS

Issue	Date	Description	Author	Approved
1	23/07/2019	First Issue	Networks Planning	T Langstaff

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1 Executive Summary

AusNet Services is a regulated Victorian Distribution Network Service Provider (DNSP) that supplies electrical distribution services to more than 745,000 customers. Our electricity distribution network covers eastern rural Victoria and the fringe of the northern and eastern Melbourne metropolitan area.

As expected by our customers and required by the various regulatory instruments that that we operate under, AusNet Services aims to maintain service levels at the lowest possible cost to our customers. To achieve this, we develop forward looking plans that aim to maximise the present value of economic benefit to all those who produce, consume and transport electricity in the National Electricity Market (NEM).

This report presents our forward looking investment plans to manage the existing and emerging service level constraints in the Thomastown (TT) Zone Substation supply area to ensure that we maintain service levels to our customers over the short and long term. The report outlines how we quantify service risk, identifies and assesses the costs and benefits of potential options to mitigate the identified risks, and provides forward looking plans outlining the optimal service risk mitigation solutions, and timing of those solutions, to maintain service levels.

1.1 Identified Need

TT commenced operation as a 66/22kV transformation station in the early 1950s. Two 20/27MVA transformers were installed in the early 1960s and a third 20/30MVA transformer was installed in the late 1960s. Two 66kV and eighteen 22kV bulk oil circuit breakers were installed at this station in the 1950s and 1960s.

The physical condition of some assets has deteriorated and they are now presenting an increased risk of failure.

The key service constraints at TT are:

- Security of supply risks presented by the increasing likelihood of asset failure due to the condition of the assets;
- Health and safety risks to workers presented by a possible explosive failure of bushings on a number of the assets;
- Plant collateral damage risks presented by a possible explosive failure of bushings on a number of assets;
- Environmental risks associated with insulating oil spill or fire; and
- Reactive asset replacement risks presented by the increasing likelihood of asset failure due to the deteriorating condition of the assets.

1.2 Proposed Preferred Option

The options analysis identifies that the preferred option, being the one that maximises the net economic benefit to all those that produce, consume and transport electricity in the NEM, is to:

- Replace the 66kV and 22kV circuit breakers by 2020, at an estimated capital cost of [C.I.C] (Real $2018).

Applying a discount rate of 6.44% per annum, this proposed preferred option has a net economic benefit of [C.I.C] million, relative to the Do Nothing Different option, over the forty-five-year assessment period.

While the optimal timing of the propsed preferred option is by 2020, to allow sufficient time to complete the regulatory investment test for distribution (RIT-D), and to smooth the overall network capital expenditure, AusNet Services plans to implement the proposed preferred option by 2021.

1.3 Next Steps

This planning report outlines the service level risk mitigation investment that AusNet Services has assessed as prudent, efficient and providing the optimal balance of supply reliability and cost.

While this report outlines AusNet Services' plans for maintaining service levels, and serves to support AusNet Services' revenue request for the 2022-26 EDPR period, the proposed investment is subject to the regulatory investment test for distribution (RIT-D).

As such, the proposed investment will be confirmed via the formal RIT-D process, which includes publication of three reports at the various RIT-D stages, and includes a formal consultation process where interested parties can make submissions that help identify the optimal solution.

2 Introduction

2.1 Purpose

This planning report outlines asset condition, asset failure risks and network development plans relevant to Thomastown (TT) Zone Substation for the period 2022-26. It provides an analysis of viable options to address the identified risks and maintain efficient delivery of electrical energy from TT consistent with the National Electricity Rules (NER) and stakeholder's requirements. It also summarizes the scope, delivery schedule and expenditures associated with the most economical solution to emerging constraints.

2.2 Scope

The scope of this planning report is limited to the equipment within TT Zone Substation.

It excludes sub-transmission and distribution feeders entering and exiting the zone substation.

2.3 Asset Management Objectives

As stated in *AMS 01-01 Asset Management System Overview*, the high-level asset management objectives are:

- Comply with legal and contractual obligations;
- Maintain safety;
- Be future ready;
- Maintain network performance at the lowest sustainable cost; and
- Meet customer needs.

As stated in *AMS 20-01 Electricity Distribution Network Asset Management Strategy*, the electricity distribution network objectives are:

- Improve efficiency of network investments
- Maintain long-term network reliability
- Implement REFCLs within prescribed timeframes
- Reduce risks in highest bushfire risk areas
- Achieve top quartile operational efficiency
- Prepare for changing network usage.

3 Background

3.1 Substation Description

Thomastown (TT) Zone Substation is located in the northern suburbs of metropolitan Melbourne on the same site as the Thomastown Terminal Station (TTS), approximately 15km north of Melbourne (Melway map reference 8 H11). It is the main source of electricity for the suburbs of Thomastown, Lalor, Reservoir, Kingsbury and Bundoora.

TT supplies approximately 28,600 customers, split fairly evenly with AusNet Services supplying approximately 14,100 customers and Jemena supplying approximately 14,500 customers. The load at TT is urban in nature and includes mostly residential and industrial load with some commercial loads.

The northern suburbs of Melbourne are at an elevation of 74m above sea level. TT has typical Melbourne climate with summer average maximum temperature of 26°C, winter average minimum temperature of 6°C and with extreme temperatures reaching 46°C in summer and -3°C in winter. The average rainfall is 590mm for Essendon, the nearest weather station.

TT is supplied at 66kV via two short 66kV circuits that originate from the TTS.

The location of TT within the AusNet Services distribution network is as shown below in Figure 1.

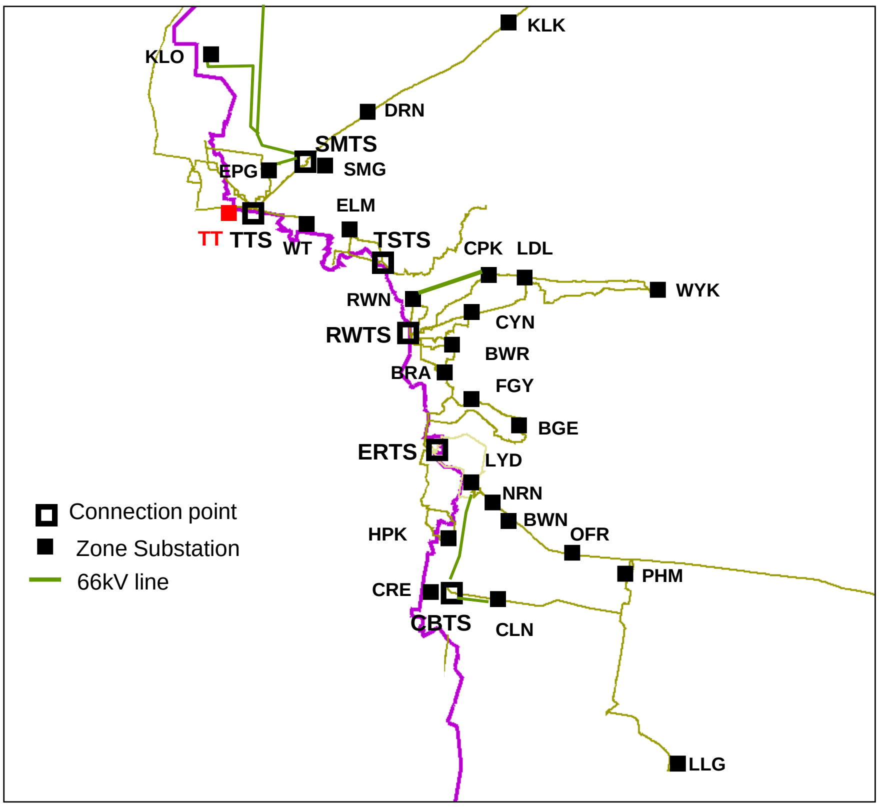

Figure 1: TT location within AusNet Services distribution network

The configuration of primary electrical circuits within TT is as shown in the following single line diagram Figure 2.

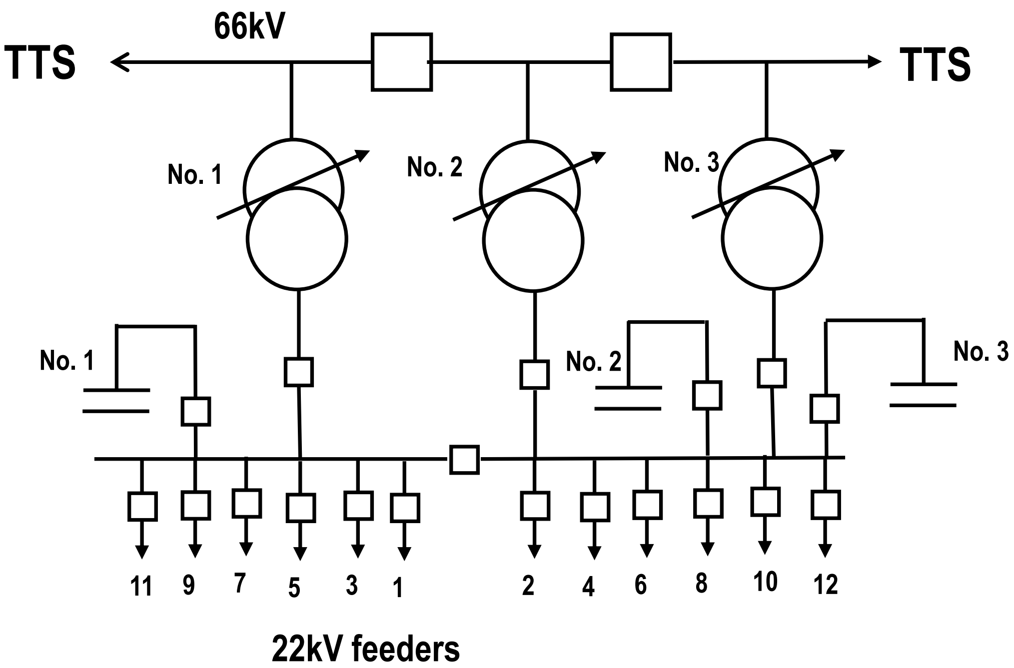

Figure 2: Single Line Diagram of TT

3.2 Customer Composition

TT has twelve 22kV feeders of which eight supply into the AusNet Services supply area and four (TT3, TT8, TT10 and TT11) supply into the Jemena electricity network area.

Table 1 provides details of the 22kV supply feeders.

Table 1: TT feeder information

Feeder	Feeder Length (km)	Feeder description	Number of Customers	Type of Customer
TT1	5.3	Summer peaking, urban feeder	200	0.5% residential 60% commercial 39% industrial 0.5% farming
TT2	7.0	Summer peaking, urban feeder	471	1.5% residential 78% commercial 20.5% industrial
TT3	-	Jemena feeder	2,893	-
TT4	9.9	Summer peaking, urban feeder	2,637	93.5% residential 5.9% commercial 0.6% industrial
TT5	10.6	Summer peaking, urban feeder	1,765	87.6% residential 11.9% commercial 1.5% industrial
TT6	23.2	Summer peaking, urban feeder	4,710	97.3% residential 2.4% commercial 0.3% industrial

TT7	9.1	Summer peaking, urban feeder	453	2.6% residential 70.2% commercial 27.2% industrial
TT8	-	Jemena feeder	3,099	-
TT9	14.5	Summer peaking, urban feeder	3,531	94.2% residential 5.6% commercial 0.2% industrial
TT10	-	Jemema feeder	4,029	-
TT11	-	Jemena feeder	4,469	-
TT12	8.8	Summer peaking, urban feeder	342	2.0% residential 73.9% commercial 24.1% industrial

The TT 22kV feeders have open point interconnections with feeders from both Epping and Watsonia zone substations in the AusNet Services distribution network, providing a load transfer capability of 11.2MVA.

Some of the 22kV feeders have open point interconnections with feeders from both North Heidelberg (NH) and Coburg North (CN) zone substations in the Jemena distribution network, providing an additional load transfer capability of 12.5 MVA.

3.3 Zone Substation Equipment

3.3.1 Primary Equipment

TT comprises an air insulated 66kV switchyard with three 66kV buses separated by bus-tie circuit breakers. These 66kV buses are supplied by two incoming 66kV lines from Thomastown Terminal Station.

There are three 66/22kV transformers suppling two 22kV air insulated busbars, which are connected to one another with a bus tie circuit breaker. Aross the two 22kV buses there are twelve 22kV feeders and three 2X6MVAr capacitor banks.

The two 66kV bus tie circuit breakers are bulk oil units which were installed in the late 1960s.

The 22kV switchyard currently has nineteen 22kV circuit breakers including eighteen bulk-oil circuit breakers installed in the late 1950s, when the station was established, and one vacuum circuit breaker that was installed in 1999 to protect the No.2 capacitor bank.

Of the three 66/22kV transformers, the No.1 and No.2 units are rated 20/27MVA and were installed in the early 1960s, while the No.3 unit is rated 20/30MVA and was installed in the late 1960s.

3.3.2 Secondary Equipment

The two incoming 66kV lines are protected by duplicated current differential protection schemes using modern numerical relays.

The 66kV bus protection is covered by duplicated High Impedance Bus protection using old electromechanical relays.

The 66/22kV transformers are protected by overcurrent protection using old electromechanical relays and transformer differential schemes employing old digital relays.

The 22kV bus protection has duplicate schemes using modern numerical relays for bus differential protection and bus distance overcurrent protection.

The 22kV feeder circuit breakers have overcurrent, earth fault, directional sensitive earth fault and auto reclose schemes provided by modern numerical relays.

The 22kV capacitor bank protection has overcurrent, earth fault, unbalance and overvoltage schemes using modern numerical relays.

The station has two 300kVA station service transformers, and duplicated 240V AC systems and battery chargers that supply a 250V DC system for the protection relays and trip coils.

3.4 Asset Condition

AMS 10-13 Condition Monitoring describes AusNet Services' strategy and approach to monitoring the condition of assets.

Asset condition is measured with reference to an asset health index on a scale of C1 to C5. Table 2 provides a description of the asset condition scores.

Table 2: Asset condition Score and Remaining Service Potential

Condition Score	Condition	Condition Description
C1	Very Good	Initial service condition
C2	Good	Deterioration has minimal impact on asset performance. Minimal short term asset failure risk.
C3	Average	Functionally sound showing some wear with minor failures, but asset still functions safely at adequate level of service.
C4	Poor	Advanced deterioration – plant and components function but require a high level of maintenance to remain operational.
C5	Very Poor	Extreme deterioration approaching end of life with failure imminent.

The condition of the key assets at TT is discussed in detail in the Asset Health Reports for the key asset classes such as power transformers, instrument transformers and switchgear with information on asset condition rankings, recommended risk mitigation options and replacement timeframes.

A summary of the condition is provided in Table 3 and discussed in the following sections.

Table 3: TT Asset Condition Summary

Asset Type	Number of Assets				
	C1	C2	C3	C4	C5
66kV Circuit Breakers				2	
66/22kV Power Transformers			2	1	
22kV Circuit Breakers	2	2		3	15
22kV Current Transformers		6		3	6
22kV Voltage Transformers				2	

These condition scores are then used to calculate the asset failure rates using the Weibull parameters determined for each asset class.

3.5 Zone Substation Supply Capacity

TT zone substation is a summer peaking station and the peak electrical demand reached 75.6MVA in the summer of 2017/18.

The peak demand at TT is currently forecast to increase slowly at approximately 0.4% per annum.

Figure 3 shows the forecast maximum demand and supply capacities (cyclic ratings) for TT.

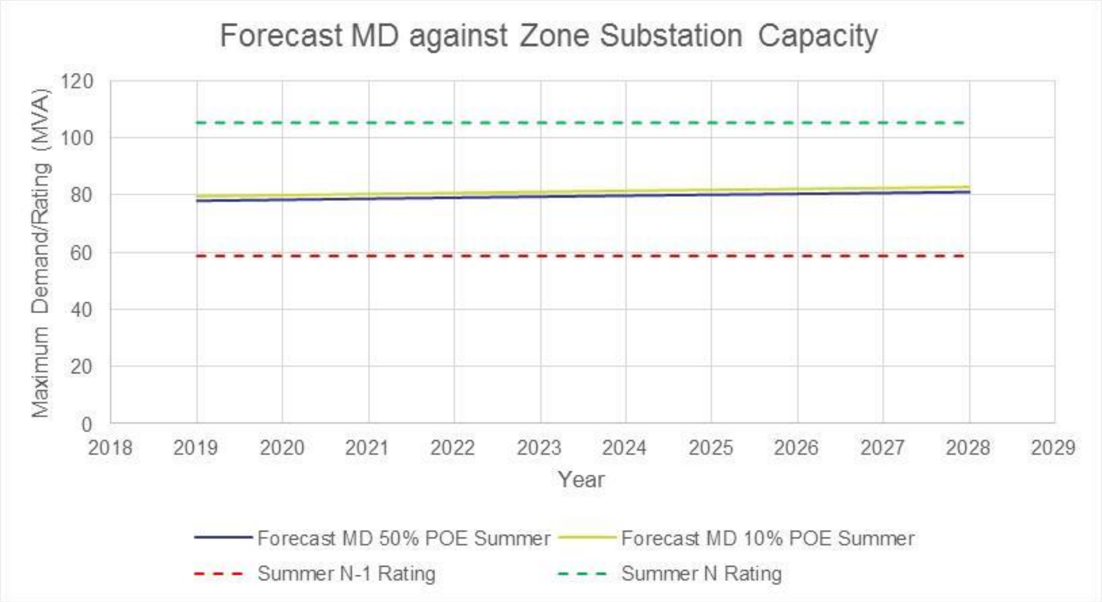

Figure 3: TT Forecast Maximum Demand against Zone Substation Capacity

3.6 Load Duration Curves

The zone substation load duration curves that feed into the risk-cost assessment model are derived from historical actual demands between:

- 1 October 2016 and 31 March 2017 for the summer 50% probability of exceedance (POE) curves;
- 1 April 2017 and 30 September 2017 for the winter 50% POE curves;
- 1 October 2013 and 31 March 2014 for the summer 10% POE curves; and
- 1 April 2017 and 30 September 2017 for the winter 10% POE curves.

The historical hourly demands are separated by season and unitised based on the recorded maximum demand within that season (summer and winter) and time period, which allows the load duration curve to be scaled according to the seasonal forecast maximum demand for each year of the assessment period.

The 50% POE unitised load duration for TT zone substation is presented in Figure 4, and the 10% POE unitised load duration for TT zone substation is presented in Figure 5.

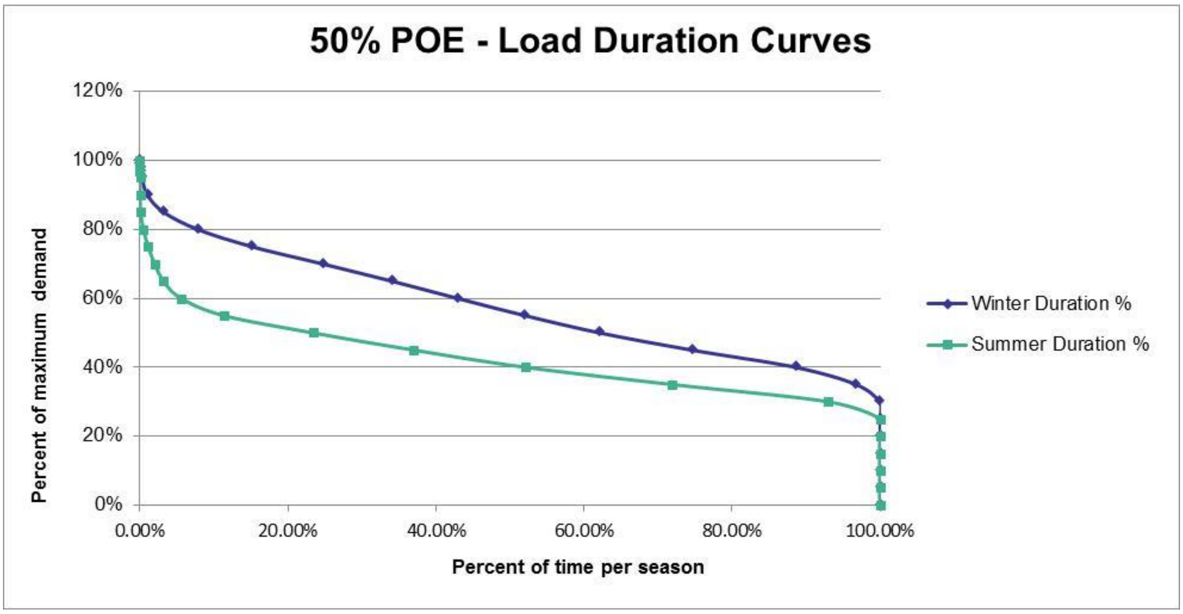

Figure 4: TT 50% POE Load Duration Curve

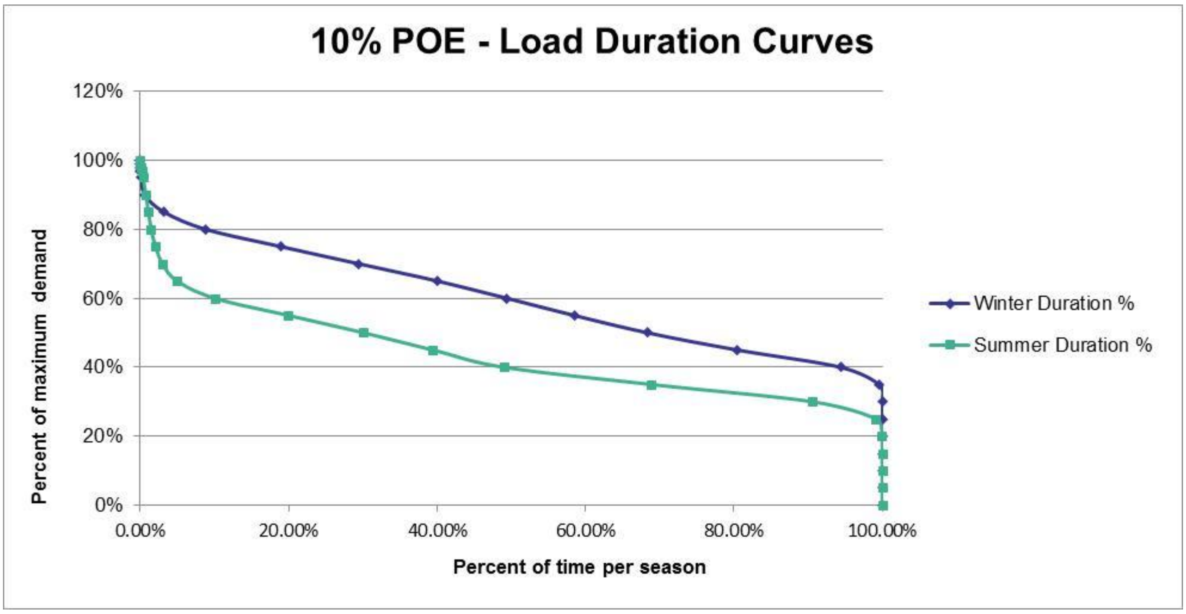

Figure 5: TT 10% POE Load Duration Curve

3.7 Feeder Circuit Supply Capacity

There is currently no requirement for additional feeders at TT due to the low load growth in the area.

3.8 Load Transfer Capability

The Distribution Annual Planning Report (DAPR) provides the load transfer capability (in MW) of the feeder interconnections between TT and its neighbouring zone substations.

This is then forecast forward in line with the forecast demand growth to give the forecast load transfer capability in Table 4.

Table 4: TT Load Transfer Capability

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Load Transfer Capability (MW)	23.7	23.8	23.5	23.4	23.3	23.2	23.1	23.0	22.9	22.8

4 Other Issues

4.1 Regulatory Obligations

This planning report acknowledges AusNet Services obligations as a Distribution Network Service Provider under the National Electricity Rules with particular emphasis on:

Clause 6.5.7 of the National Electricity Rules requires AusNet Services to only propose capital expenditure required in order to achieve each of the following:

(1) meet or manage the expected demand for standard control services over that period;

(2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;

(3) to the extent that there is no applicable regulatory obligation or requirement in relation to:

(i) quality, reliability or security of supply of standard control services; or

(ii) the reliability or security of the distribution system through the supply of standard control services

to the relevant extent:

(iii) maintain the quality, reliability and security of supply of standard control services, and

(iv) maintain the reliability and security of the distribution system through the supply of standard control services; and

(4) maintain the safety of the distribution system through the supply of standard control services.

Section 98(a) of the Electricity Safety Act requires AusNet Services to:

design, construct, operate, maintain and decommission its supply network to minimise as far as practicable –

(a) the hazards and risks to the safety of any person arising from the supply network; and

(b) the hazards and risks of damage to the property of any person arising from the supply network; and

(c) the bushfire danger arising from the supply network.

The Electricity Safety act defines 'practicable' to mean having regard to –

(a) severity of the hazard or risk in question; and

(b) state of knowledge about the hazard or risk and any ways of removing or mitigating the hazard or risk; and

(c) availability and suitability of ways to remove or mitigate the hazard or risk; and

(d) cost of removing or mitigating the hazard or risk.

Clause 3.1 of the Electricity Distribution Code requires AusNet Services to:

(b) develop and implement plans for the acquisition, creation, maintenance, operation, refurbishment, repair and disposal of its distribution system assets and plans for the establishment and augmentation of transmission connections:

(i) to comply with the laws and other performance obligations which apply to the provision of distribution services including those contained in this Code;

(ii) *to minimise the risks associated with the failure or reduced performance of assets; and*

(iii) *in a way which minimises costs to customers taking into account distribution losses.*

4.2 Station Configuration Supply Risk

Failure of some 22kV equipment will result in supply outages to customers as backup circuit breakers operate to isolate the failed equipment.

This would be for an estimated duration of two hours, which is the typical time it takes operators to travel to site and manually re-configure circuits to isolate the failed equipment and sequentially restore supply to as many customers as possible.

Table 5 lists the estimated bus outage consequence factors for failure of each major type of equipment based on the substation layout.

Table 5: TT Bus Outage Consequence Factors

Failed Equipment	Estimated Bus Outage Consequence
Transformer	0%
22kV circuit breaker	53%
66kV circuit breaker	0%
22kV current transformer	53%
66kV current transformer	0%
22kV voltage transformer	0%
66kV voltage transformer	0%

5 Identified Need

TT commenced operation as a 66/22kV transformation station in the early 1950s. Two 20/27MVA transformers were installed in the early 1960s and a third 20/30MVA transformer was installed in the late 1960s. Two 66kV and eighteen 22kV bulk oil circuit breakers were installed at this station in the 1950s and 1960s.

The physical condition of these assets has deteriorated and they are now presenting an increased risk of failure.

The key service constraints at TT are:

- Security of supply risks presented by the increasing likelihood of asset failure due to the condition of the assets;
- Health and safety risks to workers presented by a possible explosive failure of bushings on a number of the assets;
- Plant collateral damage risks presented by a possible explosive failure of bushings on a number of assets
- Environmental risks associated with insulating oil spill or fire; and
- Reactive asset replacement risks presented by the increasing likelihood of asset failure due to the deteriorating condition of the assets.

6 Risk and Options Analysis

6.1 Risk-Cost Model Overview

AusNet Services' risk-cost model quantifies the benefits of potential investment options by comparing the service level risk of the Do Nothing (Counterfactual) option with the reduced service level risk assuming the credible option is place.

The investment cost to implement the credible option is then subtracted from the monetised benefit to compare credible options and identify the option that maximises the net economic benefit (the proposed preferred option).

The areas of service level risk costs, and risk cost reduction benefits, that AusNet Services considers include:

- Supply risk;
- Safety risk;
- Collateral damage risk;
- Reactive replacement risk;
- Environment risk;
- Operations and maintenance costs; and
- Losses.

Further details on the model can be found in AusNet Services' Risk-Cost Assessment Model Methodology paper.

6.2 Risk Mitigation Options Considered

The following options have been identified to address the risk at TT:

1. Do Nothing Different (counterfactual)
2. Retire one transformer
3. Retire one transformer and sure up supply capacity via network support
4. Use network support to defer retirement and replacement
5. Replace 66kV and 22kV switchgear
6. Replace one transformer and 66kV and 22kV switchgear
7. Replace three transformers and 66kV and 22kV switchgear

An economic cost-benefit assessment is used to assess and rank the economic efficiency of each option.

The following sections provide a brief summary of each of these options.

6.2.1 Option 1: Do Nothing Different

The Do Nothing Different (counterfactual) option assumes that AusNet Services would not undertake any investment, outside of the normal operational and maintenance processes.

Under this option, increasing supply risk would be managed by increased levels of involuntary load reduction.

Increased non-supply risks, such as those associated with safety, collateral damage, reactive replacement and environmental impacts, would be accepted as unmanaged rising risk costs.

The Do Nothing Different (counterfactual) option establishes the base level of risk, and provides a basis for comparing potential options.

Since this option assumes no investment outside of the normal operational and maintenance processes, this is a zero investment cost option.

6.2.2 Option 2: Retire one transformer

This options tests whether the current installed capacity of the substation is still required to meet customer demand and whether equipment could be retired rather than replaced.

The capital cost for this option is [C.I.C], for associated decommissiong works.

6.2.3 Option 3: Retire one transformer and sure up supply capacity via network support

This option tests whether the current installed capacity of the substation is still required to meet customer demand and whether equipment could be retired and network support used rather than replacing poor condition assets.

The capital cost for this option is [C.I.C], for associated decommissiong works and setup of a 20MW network support agreement.

In addition to the capital cost, there is ongoing operational costs associated with this option that represent the network support availability and activation costs, and which vary year-by-year based on the network support expected under this option, as outlined in Table 6.

Table 6: Network support services annualised costs ($ million)

2021	2022	2023	2024	2025
C.I.C				

6.2.4 Option 4: Use network support to defer retirement and replacement

This options tests whether network support can be used to defer the replacement of poor condition assets. This option addresses the supply risks associated with poor condition assets, but does not address the safety, environmental or collateral damage risks as the assets remain in service.

The capital cost of this option is [C.I.C], for setup of a 20MW network support agreement.

In addition to the capital cost, there is ongoing operational costs associated with this option that represent the network support availability and activation costs, and which vary year-by-year based on the network support expected under this option, as outlined in Table 7.

Table 7: Network support services annualised costs ($ million)

2021	2022	2023	2024	2025
C.I.C				

6.2.5 Option 5: Replace 66kV and 22kV switchgear

This option replaces the two existing 66kV circuit breakers and the existing two outdoor 22kV bus and circuit breakers with three indoor switchboards and associated secondary equipment in Stage 1. The transformers are then replaced in Stage 2 of this asset renewal proposal, scheduled for completion around 5 to 10 years after Stage 1.

This option does not address the risks associated with the transformers.

The capital cost of this option is [C.I.C].

6.2.6 Option 6: Replace one transformer and 66kV and 22kV switchgear

This option replaces one of the existing transformers with a new 20/33MVA unit, replaces the two existing 66kV circuit breakers and replaces the existing outdoor 22kV bus and circuit breakers with three new indoor switchboards. It also includes replacing all associated secondary equipment.

Under this option those assets with high failure risks, including one transformer, current transformers and circuit breakers and the 22kV busses, are replaced as an integrated project.

The capital cost of this option is [C.I.C].

6.2.7 Option 7: Replace three transformers and 66kV and 22kV switchgear

This option replaces the existing transformers with three new 20/33MVA units, replaces the two existing 66kV circuit breakers and replaces the two existing outdoor 22kV buses and circuit breakers with three new indoor switchboards. It also includes replacing associated secondary equipment.

Under this option those assets with high failure risks, including transformers, current transformers and circuit breakers and the 22kV busses, are replaced as an integrated project.

The capital cost of this option is [C.I.C].

6.3 Risk-Cost Model Results

6.3.1 Existing Service Level Risk

Figure 6 shows the existing service level risk. The risk costs are dominated by supply risk, with a component of non-supply risk (safety, environment, collateral damage and reactive replacement). The escalation in risk costs over time is driven by the deterioration in the condition of assets.

C.I.C

Figure 6: Do Nothing Different – Service Level Risk Cost

6.3.2 Economic Cost Benefit Analysis

The economic analysis allows comparison of the economic cost and benefits of each option to rank the options and to determine the economic timing of the preferred option.

It quantifies the capital, operational and maintenance costs along with service level risk reduction benefits for each option.

Table 8 lists the annualised net economic benefit of each option for each year, with the option that maximises this benefit highlighted.

Table 8: Annualised net economic benefit ($M)

	2020	2021	2022	2023	2024	2025	2026	2027	2028
Option 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Option 2	C.I.C								
Option 3									
Option 4									
Option 5									
Option 6									
Option 7									
Option 8									

This indicates that Option 5 is the most economic option prior to 2025, with Option 6 becoming the most economic option by summer 2024/25.

6.3.3 Sensitivity Analysis

Table 9 presents the net present value of net economic benefits under a variety of sensitivities. The net economic benefit assessment takes account of each option's total capital, operating and maintenance costs, compared to the reduction in service level risk cost that option is expected to deliver.

The robustness of the economic assessment is tested for the following sensitivities:

- Asset failure rates, varied at ±50% of the base failure rate;
- Maximum demand forecasts, varied to ±5% of the base forecast;
- Value of customer reliability (VCR), varied to ±25% of the base VCR;
- Proposed option costs, varied to ±15% of the base option cost;
- Value of statistical life (VoSL) of [C.I.C], varied from a [C.I.C] low case, to a [C.I.C] high case; and
- Discount rate of 6.44%, varied to ±2% per annum of the base discount rate.

The preferred option under each sensitivity is highlighted, and the option that maximises net benefits under the majority of sensitivities is considered the proposed preferred option.

Table 9: NPV of Net Economic Benefit Analysis

<table>
<tr><th>Scenario</th><th>Option 1</th><th>Option 2</th><th>Option 3</th><th>Option 4</th><th>Option 5</th><th>Option 6</th><th>Option 7</th><th>Option 8</th></tr>
<tr><td>Base Case</td><td>$0.00</td><td rowspan="13" colspan="7">C.I.C</td></tr>
<tr><td>High Asset Failure Rate</td><td>$0.00</td></tr>
<tr><td>Low Asset Failure Rate</td><td>$0.00</td></tr>
<tr><td>High Demand</td><td>$0.00</td></tr>
<tr><td>Low Demand</td><td>$0.00</td></tr>
<tr><td>High VCR</td><td>$0.00</td></tr>
<tr><td>Low VCR</td><td>$0.00</td></tr>
<tr><td>High Option Cost</td><td>$0.00</td></tr>
<tr><td>Low Option Cost</td><td>$0.00</td></tr>
<tr><td>High VoSL</td><td>$0.00</td></tr>
<tr><td>Low VoSL</td><td>$0.00</td></tr>
<tr><td>High Discount Rate</td><td>$0.00</td></tr>
<tr><td>Low Discount Rate</td><td>$0.00</td></tr>
</table>

The sensitivity analysis indicates the preferred option is Option 6, as it has the highest net benefit under eight of sensitivities tested, however Option 5 has the highest net benefit under four of the sensitivities tested.

Based on the information presented in Table 8 and Table 9, and with consideration of the customer survey and customer forum discussions, AusNet Services proposes to implement Option 5 as the proposed preferred solution. While Option 6 presents marginally higher long-term benefits under the majority of sensitivities, these additional benefits come at a higher short term cost that can be reduced by replacing the worst condition assets now, being the 22kV and 66kV switchgear, and deferring replacement of the high cost transformers until after the 2022-26 EDPR period.

6.3.4 Economic Timing of Preferred Option

The annual benefit of implementing a credible alternative option to the Do Nothing Different (counterfactual) is the difference between total service level risk cost with a credible option in place, and the total service level risk cost of the Do Nothing Different option.

The optimal economic timing of the proposed option is the point in time when the annual benefit of implementing the proposed option outweighs the annualised cost to implement that option.

The optimal economic timing to implement the proposed preferred option is by 2020, as presented in Figure 7.

C.I.C

Figure 7: Economic timing of the proposed preferred option

7 Conclusion and Next Steps

The assessment outlined in this report shows that the service level risk to customers supplied from Thomastown (TT) Zone Substation is forecast to grow to unacceptable levels within the 2022-26 EDPR period.

The forecast increase in service level risk is driven by increasing supply and non-supply (safety, environmental, collateral damage and reactive replacement) risk driven by deterioration in the condition of zone substation assets, resulting in an increasing likelihood of asset failure.

7.1 Proposed Preferred Option

The options analysis identifies that the preferred option, being the one that maximises the net economic benefit to all those that produce, consume and transport electricity in the NEM, is to:

- Replace the 66kV and 22kV circuit breakers by 2021, at an estimated capital cost of [C.I.C] (Real $2018).

Applying a discount rate of 6.44% per annum, this proposed preferred option has a net economic benefit of [C.I.C] million, relative to the Do Nothing Different option, over the forty-five-year assessment period.

While the optimal timing of the proposed preferred option is by 2020, to manage the deliverability, allow sufficient time to complete the required regulatory investment test for disctrubition (RIT-D), and to spread costs throughout the 2022-26 EDPR, AusNet Services plans to implement the proposed preferred option by 2021.

7.2 Next Steps

This planning report outlines the service level risk mitigation investment that AusNet Services has assessed as prudent, efficient and providing the optimal balance of supply reliability and cost.

While this report outlines AusNet Services' plans for maintaining service levels, and serves to support AusNet Services' revenue request for the 2022-26 EDPR period, the proposed investment is subject to the regulatory investment test for distribution (RIT-D).

As such, the proposed investment will be confirmed via the formal RIT-D process, which includes publication of up to three reports at the various RIT-D stages, and includes a formal consultation process where interested parties can make submissions that help identify the optimal solution.

Appendix A Preferred Option Details

A.1 Scope of Work

The high level scope of work for the preferred solution includes:

- Replace two existing 66kV bus tie circuit breakers.
- Install three new indoor 22kV modular switchboards with integral feeder protection, bus protection and capacitor protection and control configured as three 22kV buses with one transformer incomer, four 22kV feeders, one capacitor bank and two bus ties.
- Reconnect existing twelve 22kV feeders, three capacitor banks and three transformers to the indoor switchboards. Demolish and remove existing outdoor 22kV switchyard.
- Supply and install new 66kV bus and 66/22kV transformer protection schemes with new DC supplies to AusNet Services 125 Volt standard DC supply.
- Supply and install two new kiosk style station service transformers connected to selected feeders.
- Upgrade site fencing and security in accordance with latest risk ranking.
- Upgrade switchyard lighting, surfaces, drainage, trenches to current standards.

A.2 Project Cost Summary

Design	C.I.C
SPA internal costs	
Sub-contractor indirects	
66kv equipment	
22kv equipment	
Transformers	
Line works	
Infrastructure - civil works	
Infrastructure - building works	
Infrastructure - services	
Protection & control systems	
Land / easement purchase	
Metering cost	
Outages	
Spares	
Nominal risk allowance	
Project direct costs	
Management contingency	
Project direct costs plus contingency	
Overheads	
Finance charges	
Operating expenditure	
WDV (written down value) of assets to be retired	
Total	