AusNet

Transmission Revenue Reset 2027 to 2032 (TRR 2027-32)

Planning Report: Thomastown Terminal Station (TTS) B4 Transformer Replacement

Date: October 2025

Table of contents

1. Executive summary

Thomastown Terminal Station (TTS) is one of the major 220/66 kV stations that supplies metropolitan Melbourne. It is located north of greater Melbourne and includes five 150 MVA 220/66 kV transformers that supply approximately 177,460[1] Jemena Electricity Networks and AusNet Distribution customers in the Thomastown, Coburg, Preston, Watsonia, North Heidelberg, Lalor, Coolaroo and Broadmeadows areas.

The B4 150 MVA 220/66 kV transformer is in a very poor condition and the risk of a failure that could result in involuntary load shedding is forecast to increase.

The B4 transformer replacement can be done in-situ if the project proceeds in the next few years provided it is scheduled during the lower demand seasons. In-situ replacement will however not be possible if its replacement is deferred after the 2027 to 2032 regulatory control period based on the latest demand forecast. If the project is delayed, it will have to be replaced in a new location as it will not be possible to obtain an outage for in-situ replacement. In situ replacement is only possible when supply is not compromised during the replacement outages, which could take several months. A window for in-situ replacement is possible now but will not be possible after the 2027 to 2032 regulatory control period based on the latest demand forecast. This is further explained in Section 4.2.

Replacement in a new location will cost much more ($29.9 million vs. $23.14 million) as some assets will also have to be relocated and underground 66 kV cable will be required to connect the transformer to the 66 kV switchyard.

An investment of $23.14 million to replace the B4 transformer by 2031 is the preferred option. The project delivery lead time is estimated to be four years, and AusNet hence proposes to start the project in 2026/27 and have the RIT-T completed by early 2026 with all forecast expenditure falling into the 2027 to 2032 regulatory control period.

2. Background

Thomastown Terminal Station (TTS) is one of the major 220/66 kV stations that supplies metropolitan Melbourne. It is located north of greater Melbourne and includes five 150 MVA 220/66 kV transformers that supply approximately 177,460[2] Jemena Electricity Networks and AusNet Electricity Services customers in the Thomastown, Coburg, Preston, Watsonia, North Heidelberg, Lalor, Coolaroo and Broadmeadows areas.

TTS has connections to Keilor (KTS), South Morang (SMTS), Templestowe (TSTS) and Brunswick (BTS) 220 kV terminal stations.

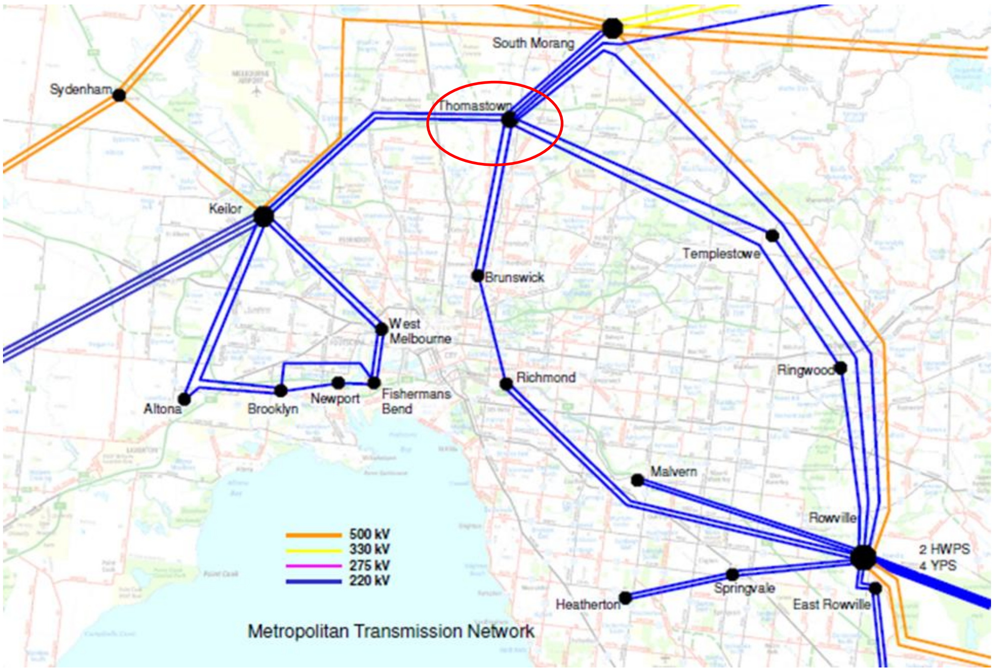

Figure 1: Metropolitan Melbourne main transmission system

[1] As per 2024 Transmission Connection Planning Report
[2] As per 2024 Transmission Connection Planning Report

Asset Health

The TTS B4 transformer is in very poor condition and reached the end of its operational life due to irreversible degradation of its winding cellulose insulation. This condition is similar to that of the MWTS B2 unit, which failed in 2009 following a fault downstream of the transformer.

The transformer bushings show advanced age-related deterioration, and historical oil leaks have led to high moisture ingress within the oil system. Combined with approximately 4.8% moisture content in the solid insulation, this increases the risk of dielectric failure under elevated temperatures.

Forensic investigations in 2009 and 2014 identified a common cooling deficiency across transformers of the same design and manufacturer which contributes to insulation failure. Findings from the inspection include severe thermal degradation of the 220 kV and 66 kV windings with high winding temperature gradients and inefficient OFAF cooling performance. Moreover, the Degree of Polymerisation (DPv) is below 200, confirming the end-of-life condition of the transformer.

While external components such as bushings, oil, tank and cooling systems are recoverable, the internal windings are not. Given the advanced insulation deterioration and elevated failure risk, replacement is recommended over refurbishment.

More information can be found in the TTS B4 Replacement Asset Condition Report.

Table 1: TTS B4 asset forecast failure rate

Transformer Failure Rates	2025	2026	2027	2028	2029	2030	2031	2032
B4 Transformer	0.0507	0.0517	0.0528	0.0539	0.0549	0.0560	0.0571	0.0582

3. Identified need

TTS is part of the main transmission network, which provides major transmission services in Victoria. AusNet Services expects that these transmission services will continue to be required given the transmission network developments that are foreshadowed in AEMO's Integrated System Plan (ISP) and Victorian Annual Planning Report (VAPR), and VicGrid's Victorian Transmission Plan (VTP).

The B4 transformer's poor condition increases risk of asset failure and as a result prolonged outages. Without remedial action, beyond routine maintenance, affected assets are likely to deteriorate faster. Further increases in the probability of asset failure will result in a higher likelihood of impact on transmission network users, heightened safety risks due to potential asset failure, environmental risks, collateral damage risks, and the risk of increased costs resulting from emergency asset replacements and reactive repairs.

Therefore, the 'identified need' this project intends to address is to maintain reliable transmission network services at TTS and to mitigate risks from asset failures.

AusNet calculated the present value of the baseline risk to be approximately $87.5 million over the forty-five-year period from 2025. Figure 4 highlights the main risks, which include supply risk that may result in involuntary loadshedding for network users, and reactive asset replacement risk due to increased costs associated with responding to asset failures.

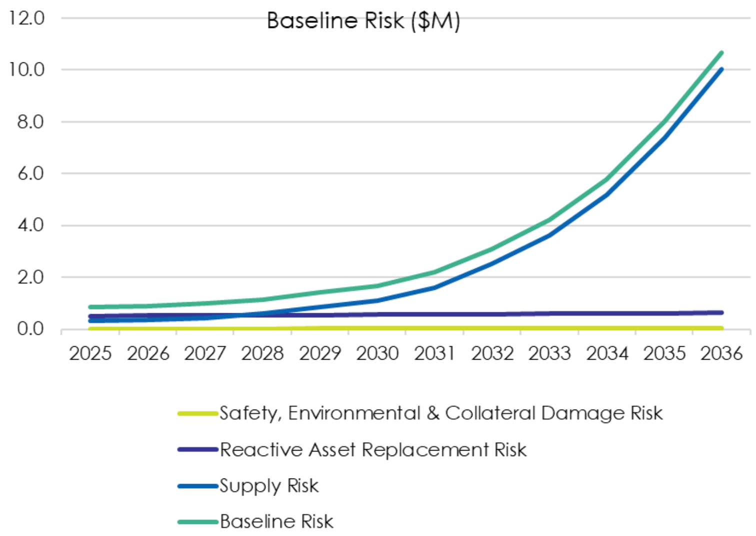

Figure 4: Baseline risk at TTS

Undertaking the options identified, will allow AusNet Services to maintain reliable transmission network services at TTS and mitigate safety and environmental risks as required by the NER and Electricity Safety Act 1998[1].

3.1. Key inputs and assumptions

Aside from the failure rates (determined by the condition of the assets) and the likelihood of relevant consequences, AusNet Services also adopted the following assumptions to quantify the risks associated with asset failure.

Market impact and supply risk costs

AusNet calculated the market impact cost, which consist of increased generation cost and involuntary load shedding resulting from an asset failure based on the Victoria statewide Value of Customer Reliability (VCR)[3].

Safety risk costs

The Electricity Safety Act 1998[4] 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 asset failures, AusNet Services uses:

- a value of statistical life[5] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[6;] and
- a disproportionality factor[7].

AusNet Services notes this approach, including the use of a disproportionality factor, is consistent with the practice notes[8] 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 assets (or undertaking reactive maintenance or repairs) is included in the assessment.[9]

Environmental risk costs

Environmental risks from plant that could impact the environment when it fails and where cleanup cost could be in the order of $30,000 per event.

4. Options assessed

AusNet Services considered both network and non-network options to address the identified need but did not find any suitable non-network solution. The two network options are presented below.

4.1. Option 1: Replace B4 transformer

Option 1 involves replacing the B4 transformer in-situ by 2030/31, which is within the next regulatory period. The estimated capital cost of this option is $23.2 million and the change in operating and maintenance cost is negligible. The project delivery lead time is 4 years.

---

3 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).
4 Victorian State Government, Victorian Legislation and Parliamentary Documents, "Electricity Safe Act 1998"
5 Department of the Prime Minister and Cabinet, Australian Government, "Best Practice Regulation Guidance Note: Value of statistical life"
6 Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13"
7 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.
8 Australian Energy Regulator, "Industry practice application note for asset replacement planning"
9 The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

4.2. Option 2: Deferred replacement

Option 2 involves deferring the replacement of the B4 transformer by 5 years to 2035. The investment cost of Option 2 is materially higher as the transformer will have to be replaced in a new location due to outage constraints and increased demand at TTS 66 kV.

In-situ replacement is only considered when the associated outage does not compromise supply security. This allows for demand up to the N-2[11] supply capacity, meaning the system must be able to tolerate both the planned outage of the transformer being replaced and a potential unplanned failure of another transformer.

In-situ replacement involves taking the existing transformer out of service for an extended period, often several months, to allow for decommissioning, removal, transformer pad and bund preparation, installation, and commissioning of the new unit in the same location. During this time, the station operates with reduced redundancy, increasing the risk to supply reliability.

In contrast, constructing a new transformer bay at a different location within the station allows the new transformer to be built and fully commissioned while the existing transformer remains in service. This approach significantly reduces the required outage window, as the existing transformer only needs to be taken offline briefly during the final cut-over phase. This method enhances operational flexibility and minimizes exposure to supply risks but comes at a greater cost and is used when the station demand is too high for in-situ replacement.

Building a new transformer bay incurs higher capital costs. Due to site constraints, the 66kV connections to the new transformer cannot be made using traditional overhead conductors and must instead be constructed using more expensive underground cables. Despite the increased cost, this approach will be required for the deferred replacement (Option 2) to reduce outage duration, construction safety, and to meet minimum system reliability standards during the transition.

The estimated capital cost of this option is $29.9 million as it will require relocation of assets and underground 66 kV cable to connect to the 66 kV switchyard. The change in operating and maintenance cost is negligible. The project delivery lead time is 4 years.

There is increased probability of asset failure and risk for this option given the later project completion date.

4.3. Material inter-regional network impact

The proposed asset replacements at TTS will not change the transmission network configuration and none of the network options considered are likely to have a material inter-regional network impact. A 'material inter- regional network impact' is defined in the NER as follows:

"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."

5. Assessment approach

Consistent with the RIT-T requirements and practice notes on risk-cost assessment methodology, AusNet Services undertook a cost-benefit analysis to evaluate and rank the net economic benefits of the credible options over a 45-year period.

All options considered have been assessed against a business-as-usual case (counter factual) where no proactive capital investment to reduce the increasing baseline risks is made.

Optimal timing of an investment option is the year when the annual benefits from implementing the option become greater than the annualised investment cost.

In-situ replacement of the B4 transformer will be possible in the next few years given the latest demand forecast and the fact that the work can be scheduled to the lower demand periods of the year. However, in-situ replacement will not be possible if the project is deferred beyond the 2027 to 2032 regulatory control period given the demand forecast and outage constraints. The B4 transformer will have to be replaced in a new location if the investment is deferred to ensure that supplies are not compromised during the replacement outage[12].

---

[11] N-2 refers to a contingency scenario in which two critical elements are simultaneously out of service.

[12] Replacement in a new transformer bay (rather than in-situ replacement) will cost more as the transformer 66 kV connection will have to be made with more expensive underground cable rather than overhead connections given site constraints.

In-situ replacement of the B4 transformer will be feasible in the next few years, based on the latest demand forecast and the ability to schedule the work during lower-demand periods of the year. However, this option will not be viable if the project is deferred beyond the 2027–2032 regulatory control period, due to increasing demand and outage constraints. To ensure supply reliability under such conditions, the B4 transformer would need to be replaced at a new location within the station.

5.1. Scenarios and input assumptions

The robustness of the investment decision is tested using the range of input assumptions and scenarios described in the table below. This analysis involves variation of assumptions around the most likely values as per the IASR, AEMO's connection point forecast, AER latest VCR rates, and AusNet Service's best estimate of project cost and forecast asset failure rates.

Parameter	Lower Bound	Most likely (central) assumption or scenario	Upper Bound
VCR	75% of central assumption	Published VCR	125% of central assumption
Asset failure rate	75% of central assumption	Assessed failure rate	125% of central assumption
Demand Growth	85% of central assumption	Connection Point Forecast provided with AEMO 2024 VAPR	115% of central assumption
Discount rate[9]	WACC rate of a regulated network business (3.0%)	Latest commercial discount rate from IASR (7%)	Upper Bound (10%)
Project Capital Cost	85% of estimated cost	Estimated cost	115% of estimated cost

Table 2 - Summary of input assumptions for range of scenarios

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 classes of market benefits that are likely to be material include changes in involuntary load shedding, and changes in fuel consumption arising through different patterns of generation dispatch.

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, 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.

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:

- 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.

- Competition benefits – there is no competing generation affected by the limitations and risks being addressed by the options considered.
- 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.

6. Options assessment

This section presents the results of the economic cost benefit analysis that has been conducted to determine the preferred option and its economic timing.

All the options considered will deliver a reduction in market impact risk (including supply risk), safety risk, environmental risk, collateral risk and risk cost of emergency replacement in the event of asset failure.

Presented in Figure 5, the NPV benefits is higher for Option 1 (Replace B4 transformer) for all sensitivities where input variables are varied one at a time.

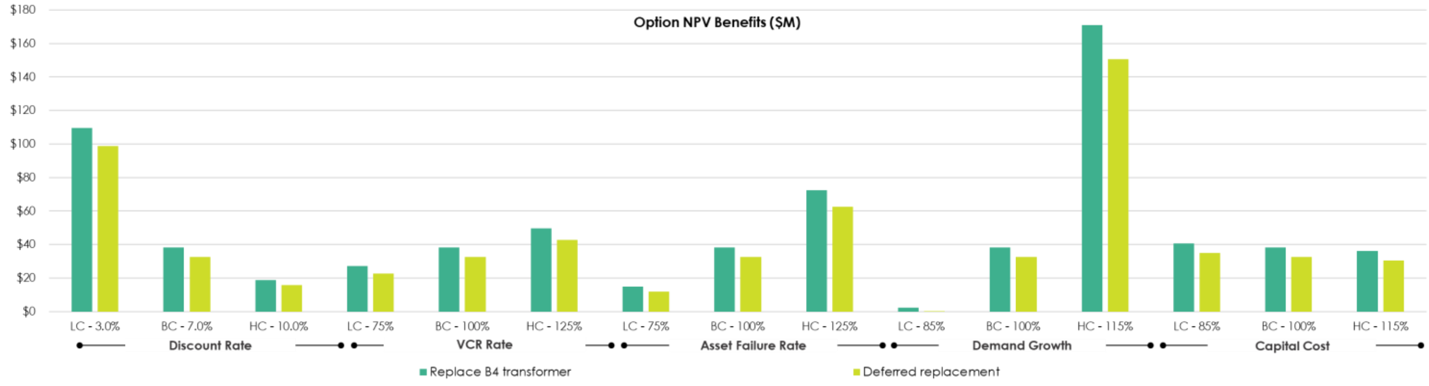

Figure 5 – Option selection, scenario and sensitivity study

6.1. Preferred Option

The NPV benefits of Option 1 (Replace B4 transformer) is higher than Option 2 for all the scenarios and sensitivities considered and it is therefore the preferred option. Scenario weighting will not make a difference to the preferred option as Option 1 has the highest NPV benefits for all of the 15 sensitivity studies considered.

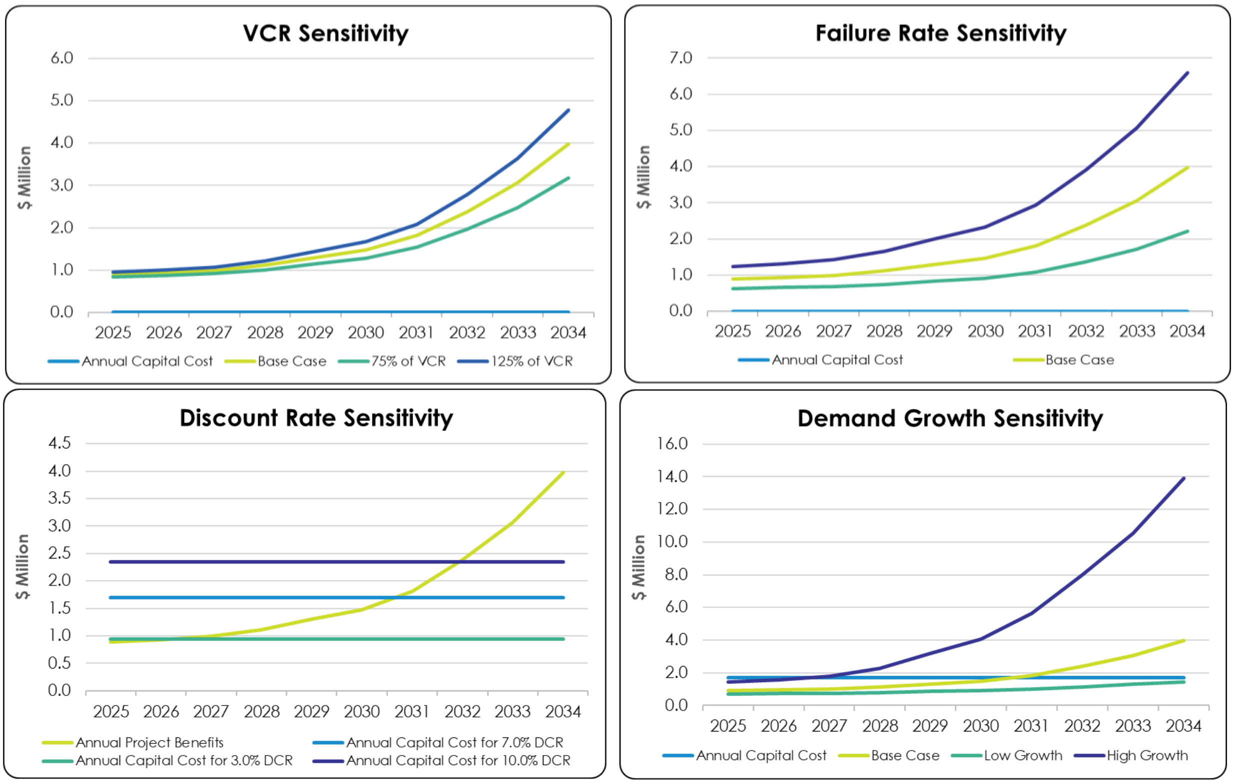

Figure 6 - Optimal investment timing sensitivity study9

6.2. Optimal timing of the preferred option

This section describes the optimal investment timing of the preferred option for different input assumptions. Figure 6 shows that the optimal timing of the preferred option (Option 1) is 2031 and that investment is needed within the 2027 to 2032 regulatory control period.

Figure 7 shows that the investment economic timing for a 15% increase in investment cost.

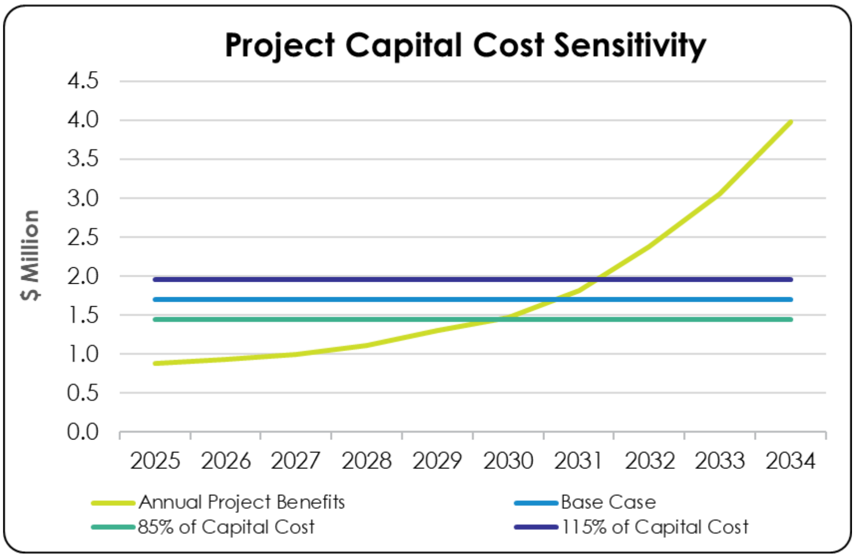

Figure 7 - Optimal investment timing sensitivity study[9]

7. Conclusion

Amongst the options considered, Option 1 presents the most economical option for maintaining reliable transmission network services at TTS and effectively managing safety, environmental, collateral and emergency replacement risks. The preferred option involves the replacement of the B4 transformer with a 150 MVA 220/66 kV.

The estimated capital cost of this option is $23.2 million (excluding management reserve) with no material change in operating and maintenance cost. The project is economically justified by 2031, and AusNet Services is targeting a commissioning date at the end of year 2031, with all project capital cost falling within the 2027 to 2032 regulatory control period. Implementing Option 1 will avoid the higher cost of having to install the replacement transformer in a new location.

8. Appendix 1: Cost Estimate

Cost estimates (Forecast Capex in calendar years)

PROJECT COST SUMMARY	UNCERTAINTY ADJUSTED ESTIMATE
Project Number:	TD-0016676
Project Title:	TTS B4 Replacement
Estimate Type:	Indicative Estimate
Revision:	Rev 1
Issued Date:	7/10/2025

	PROJECT EXPENDITURE FORECASTS	2027	2028	2029	2030	TOTAL
1	DESIGN & STUDIES/ASSESSMENTS	$ 192,454.17	$ 962,270.83	$ -	$ -	$ 1,154,725.00
2	INTERNAL LABOUR	$ 179,129.05	$ 429,909.73	$ 429,909.73	$ 286,606.49	$ 1,325,555.00
3	MATERIALS (AusNet Free Issue Materials)	$ 990,241.51	$ 5,941,449.04	$ 2,475,603.77	$ 495,120.75	$ 9,902,415.07
4	PLANT & EQUIPMENT	$ -	$ -	$ 105,147.16	$ 52,573.58	$ 157,720.74
5	CONTRACTS (incl insurance and incentives)	$ -	$ -	$ 5,486,923.66	$ 2,743,461.83	$ 8,230,385.49
6	PROJECT DIRECT EXPENDITURE P(50)	$ 1,361,824.73	$ 7,333,629.61	$ 8,497,584.31	$ 3,577,762.65	$ 20,770,801.29
7	OVERHEADS	$ 68,363.60	$ 368,148.21	$ 426,578.73	$ 179,603.68	$ 1,042,694.22
8	FINANCE CHARGES (IDC)	$ 6,826.44	$ 251,558.45	$ 659,673.10	$ 436,447.10	$ 1,354,505.09
9	PROJECT DIRECT EXPENDITURE (SAP)	$ 1,437,014.77	$ 7,953,336.26	$ 9,583,836.15	$ 4,193,813.43	$ 23,168,000.61
10	MANAGEMENT RESERVE [P(90)-P(50)]			$ 457,118.57	$ 1,066,609.99	$ 1,523,728.56
11	TOTAL EXPENDITURE FOR APPROVAL (Including P(90))	$ 1,437,014.77	$ 7,953,336.26	$ 10,040,954.71	$ 5,260,423.42	$ 24,691,729.17

AusNet Services

Level 31
2 Southbank Boulevard
Southbank VIC 3006
T +613 9695 6000
F +613 9695 6666
Locked Bag 14051 Melbourne City Mail Centre Melbourne VIC 8001
www.AusNetservices.com.au

Follow us on

@AusNetServices
@AusNetServices
@AusNet.Services.Energy