AusNet

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

Planning Report: Dederang Transformer and Circuit Breaker Replacement

Date: October 2025

AusNet

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1. Executive summary

Dederang Terminal Station (DDTS) is a critical station forming part of the interconnector to New South Wales (NSW) and connecting to major hydropower systems in northern Victoria. One of the three 330/220 kV transformers (H3) and two 330 kV circuit breakers at DDTS are in poor condition.

The H3 transformer has been in service for over 45 years and while external components such as the bushings, oil and tank are recoverable, the internal windings are beyond repair. Considering the combined issues of winding deterioration, fault level limitations, and operational constraints related to sound and thermal performance, replacement is recommended as the most practical and cost-effective solution over refurbishment.

Similarly, the two 330 kV circuit breakers identified for replacement are of a minimum-oil interrupter type with spring mechanisms and have exceeded their technical design life. These breakers are now exhibiting age and duty related defects including damage to rotating insulators, corrosion of drive linkages. Identified as among the oldest in AusNet's fleet with no manufacturer support and refurbishment not feasible, replacement is now prioritized to maintain reliability and mitigate operational risk.

The risk of failure for these assets is expected to increase, making a $49.8 million replacement investment cost-effective by 2031/32. The project delivery lead time is estimated to be four years, and AusNet hence proposes to start the project by 2028/2029 and have the RIT-T completed by end 2028, with most of the forecast expenditure falling into the 2027 to 2032 TRR period.

2. Background

Dederang Terminal Station (DDTS) is in northern Victoria. It is an important switching station as it forms part of the 330 kV interconnector between Victoria and NSW. DDTS has 220 kV connections to the major hydro power stations (Darthmouth, McKay Creek, West Kiewa, Eildon and Bogong) and the regional 220 kV network in Victoria. DDTS has three major 340 MVA 330/220 kV power transformers that tie the 330 kV Victoria to NSW interconnector with the regional 220 kV transmission network.

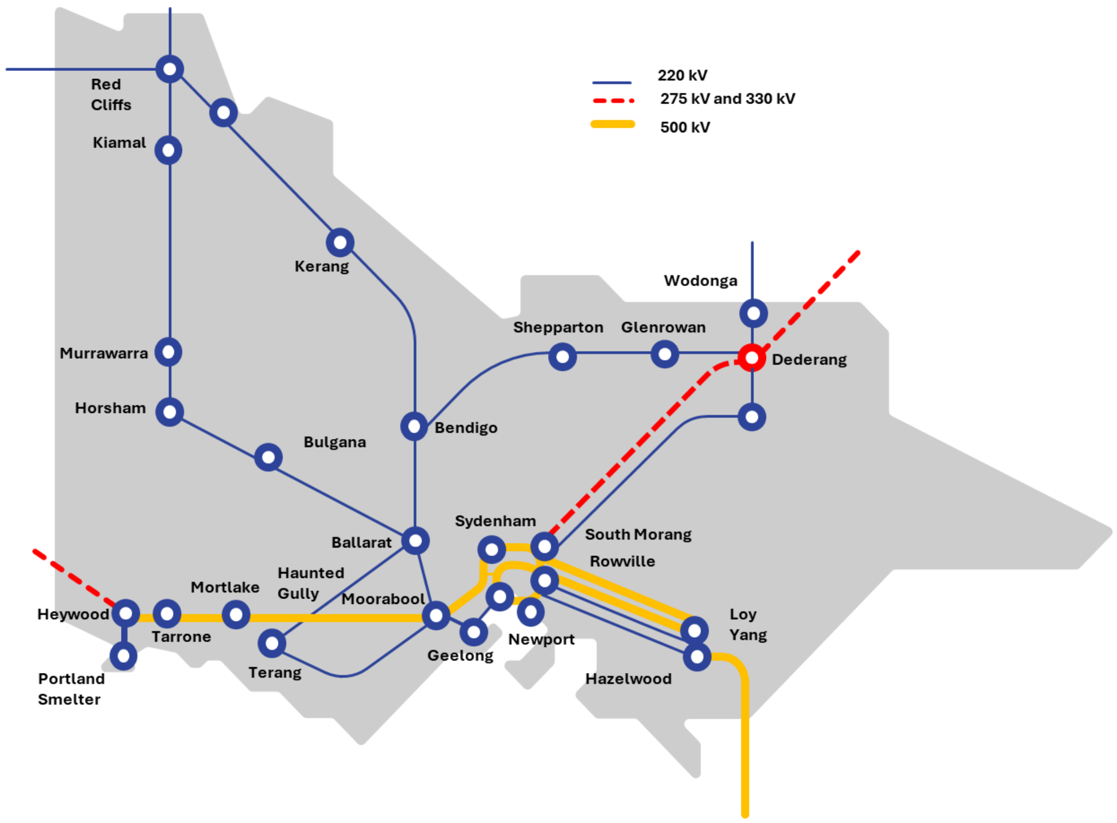

Figure 1: Victorian main transmission system

Asset Condition

The H3 transformer, commissioned in 1978, shows advanced deterioration of its resin-bounded cellulose winding support insulation, significantly increasing failure risk particularly under through faults exceeding its 17 kA design limit. The H1 and H2 transformers are rated for continuous operation at 340 MVA at 45°C, whereas the H3 transformer is rated for up to 340 MVA for 24 hours with additional standby cooling. This results in reduced station output during periods of high temperature and contingency events.

The 330 kV and 245 kV bushings show severe physical deterioration, high risk of oil leaks and internal arcing, potentially leading to explosive failure along with extensive leaks from aged gaskets in the oil system, posing a flashover risk. While external components of the H3 are recoverable, the internal windings are beyond repair. In addition to deterioration of the windings, the fault level limitation and sound and thermal constraints make replacement the more economical solution to manage the risk of failure of this transformer compared with refurbishment.

The H1 and H2 transformers are in average (C3) condition with commissioning dates of 2015 and 2003 respectively.

Table 1 shows the forecast failure rates for the three H transformers at DDTS, and detailed asset condition information is available in the Asset condition report.

Table 1: Transformer forecast failure rates

Transformer Failure Rates	2025	2026	2027	2028	2029	2030	2031	2032
H1	0.011340	0.011914	0.012501	0.013099	0.013709	0.014331	0.014965	0.015609
H2	0.022554	0.023317	0.024091	0.024876	0.025671	0.026476	0.027291	0.028116
H3	0.040076	0.041039	0.042011	0.042992	0.043982	0.044981	0.045989	0.047005

The two 330 kV circuit breakers being considered for replacement were manufactured in 1979 and have exceeded the manufacturer technical design life. These circuit breakers are of a minimum-oil type interrupter design with a spring type mechanism and have three interrupters per phase in series. This type of circuit breaker has generally provided reliable service, however they are becoming less reliable and are beginning to exhibit a range of age and duty related defects, such as:

- Damage to rotating insulators
- Corrosion of the drive linkage
- Mechanical fatigue on the components
- Lack of manufacturer technical support and spares

The circuit breaker asset management strategy identified this type of circuit breaker as amongst the oldest in AusNet's 220 kV circuit breaker fleet, and their replacement is now prioritised as refurbishment is not a feasible option.

Table 2 shows the forecast failure rates for these two circuit breakers.

Table 2: DDTS circuit breaker forecast failure rates

Circuit Breaker Failure Rates	2025	2026	2027	2028	2029	2030	2031	2032
WOTS line Bus 2 circuit breaker	0.1224	0.1284	0.1337	0.1392	0.1448	0.1504	0.1562	0.1621
H3 transformer Bus 1 circuit breaker	0.1224	0.1284	0.1337	0.1392	0.1448	0.1504	0.1562	0.1621

Further information on the asset condition can be found in DDTS H3 Transformer and CB Replacement Asset Condition Report.

3. Identified need

DDTS 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 poor condition of some of the assets at the terminal station has increased the likelihood of asset failures which would result in prolonged outages. Without remedial action, other than ongoing maintenance practice (business-as-usual), affected assets are expected to deteriorate further and more rapidly. 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 DDTS and to mitigate risks from asset failures.

AusNet Services calculated the present value of the baseline risk to be more than $80M over the forty-five-year period from 2025. The key risks are shown in Figure 2 with the largest components being the supply risk that will impact network users because of involuntary load shedding, and reactive asset replacement risk from increased cost when responding to an asset failure.

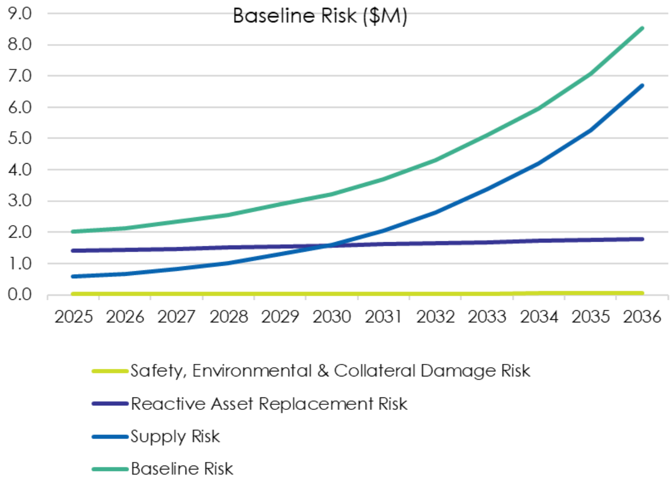

Figure 2: Baseline risk

By undertaking the options identified, AusNet Services will be able to maintain reliable transmission network services at DDTS 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 Services 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)[2].

Safety risk costs

The Electricity Safety Act 1998[3] 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[4] to estimate the benefits of reducing the risk of death;
- a value of lost time injury[5;] and
- a disproportionality factor[6].

[1] Victorian State Government, Victorian Legislation and Parliamentary Documents, "Electricity Safe Act 1998"
2 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).
3 Victorian State Government, Victorian Legislation and Parliamentary Documents, "Electricity Safe Act 1998"
4 Department of the Prime Minister and Cabinet, Australian Government, "Best Practice Regulation Guidance Note: Value of statistical life"
5 Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13"
6 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.

AusNet Services notes this approach, including the use of a disproportionality factor, is consistent with the practice notes[7] provided by the AER.

Financial risk costs

As there is a lasting need for the services that DDTS provides, the failure rate-weighted cost of replacing failed assets (or undertaking reactive maintenance) is included in the assessment.[8]

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 three network options are presented below.

4.1. Option 1: Replace H3 transformer and selected 330 kV switchgear

Option 1 involves replacement of the H3 transformer with a new transformer and retaining the H3 transformer as a cold spare transformer in a single integrated project. Option 1 includes replacement of two 330 kV circuit breakers (H3 transformer Bus 1 circuit breaker and WOTS Bus 2 circuit breaker). The estimated capital cost of this option is $49.8 million (direct expenditure with overheads and finance charges) and the change in operating and maintenance cost is negligible.

4.2. Option 2: Replace H3 transformer and selected 330 kV switchgear, and procure a cold spare three-phase transformer

Option 2 involves replacement of the H3 transformer with a new transformer and procuring a cold spare three-phase transformer in a single integrated project. Option 2 includes replacement of two 330 kV circuit breakers (H3 transformer Bus 1 circuit breaker and WOTS Bus 2 circuit breaker). The estimated capital cost of this option is $70.8 million (direct expenditure with overheads and finance charges) and the change in operating and maintenance cost is negligible.

4.3. Option 3: Deferred replacement of H3 transformer and selected 330 kV switchgear

Option 3 is the same as Option 1 except deferring the replacement of the H3 transformer and selected 330 kV switchgear to 2036. The estimated capital cost of this option is $49.8 million (direct expenditure with overheads and finance charges) and the change in operating and maintenance cost is negligible. It is assumed that cost escalation will be at the same rate as inflation.

7 Australian Energy Regulator, "Industry practice application note for asset replacement planning"
8 The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

4.4. Material inter-regional network impact

The proposed asset replacements at DDTS 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:

"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 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.

5.1. Proposed 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 Victorian Annual Planning Report (VAPR) forecast, AER latest VCR rates, and AusNet Service's best estimate of project cost and forecast asset failure rates.

Table 3: Summary of input assumptions for range of scenarios

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 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

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.

9 Discount rates as recommended in the AEMO Inputs, Assumptions and Scenarios Report (IASR)

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 asset 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 anyone of the options described in Section 4.

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 3, the total risk cost reduction or project benefits outweighs the investment cost for all options for all of the sensitivities where input variables are varied one at a time.

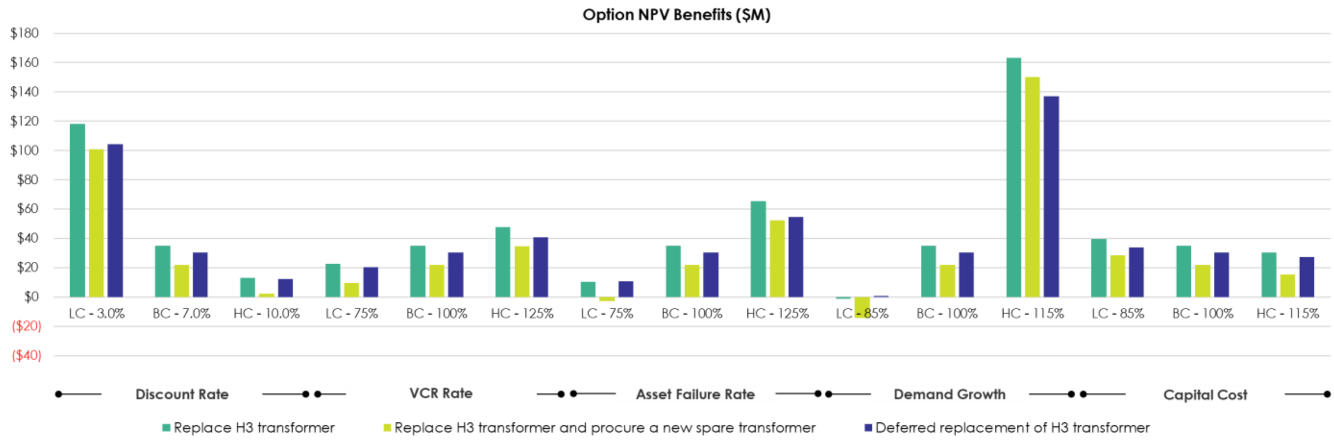

Figure 3: Option selection

6.1. Preferred Option

Option 1 (Replace H3 transformer) has the highest net economic benefit for most of the scenarios and sensitivities considered and is therefore the preferred option. The uptake of new data centers has not been considered in the demand forecast and the low demand growth sensitivity is hence considered unlikely to occur.

6.2. Optimal timing of the preferred option

This section describes the optimal investment timing of the preferred option for different assumptions of key variables. Figure 4 shows that the optimal timing of the preferred option (Option 1) is 2031/32 and that investment is needed within the 2027 to 2032 regulatory control period.

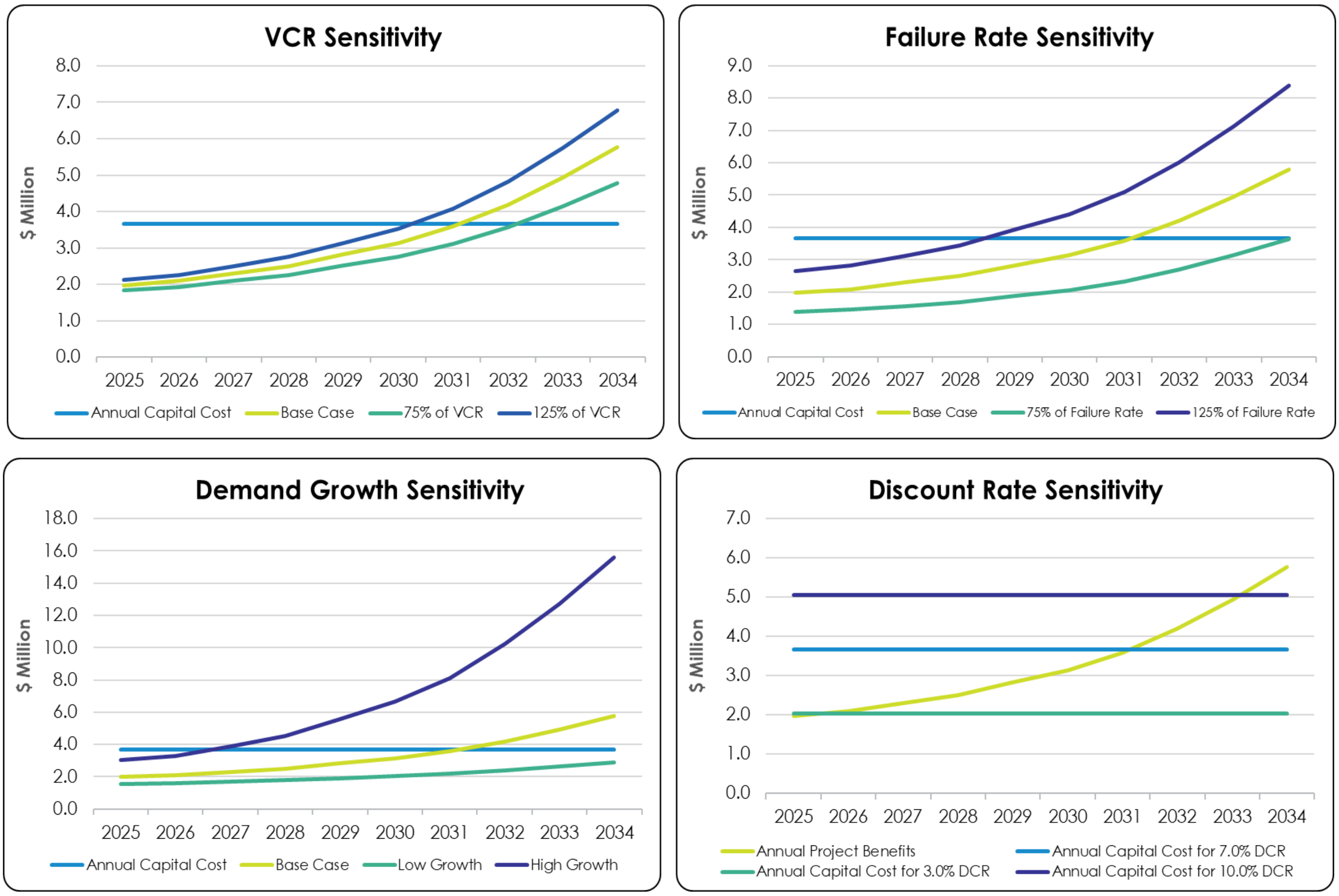

Figure 4: Optimal investment timing sensitivity study

Figure 5 shows that the investment economic timing is only two years later for a 15% increase in investment cost.

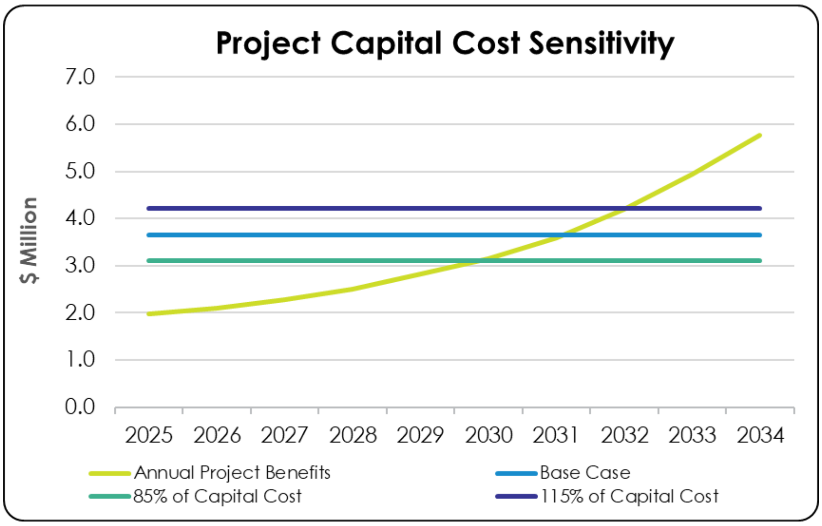

Figure 5: Optimal investment timing sensitivity study - Capex

7. Conclusion

Amongst the options considered, Option 1 is the most economical option for maintaining reliable transmission network services at DDTS and managing safety, environmental, collateral and emergency replacement risks. The preferred option involves the replacement of the H3 transformer at DDTS and retaining the old transformer as a spare.

The estimated capital cost of this option is $49.8 million with no material change in operating and maintenance cost. The project is economic by 2031/32, and AusNet Services is targeting a commissioning date of 2032 with most of the cost falling within the 2027 to 2032 regulatory control period.

8. Appendix 1: Cost Estimate

Cost estimate for Option 1.

	PROJECT EXPENDITURE FORECASTS	2026	2027	2028	2029	TOTAL
1	DESIGN & ASSESSMENT	$3,664,590				$3,664,590.00
2	INTERNAL LABOUR	$829,853	$829,853	$829,853	$829,853	$3,319,410.92
3	MATERIALS (AusNet Free Issue)		$6,463,541	$6,463,541	$6,463,541	$19,390,622.02
4	CONTRACTS		$5,809,487	$5,809,487	$5,809,487	$17,428,460.79
5	PLANT		$211,349	$211,349	$211,349	$634,047.58
6	**PROJECT DIRECT EXPENDITURE P(50)**	**$4,494,443**	**$13,314,230**	**$13,314,230**	**$13,314,230**	**$44,437,131**
7	MANAGEMENT RESERVE [P(90)-P(50)]					$2,387,137.92
8	PROJECT DIRECT EXPENDITURE (SAP)	$4,494,443	$13,314,230	$13,314,230	$13,314,230	$46,824,269
9	OVERHEADS		$1,109,447	$1,109,447	$1,109,447	$3,328,341.11
10	FINANCE CHARGES (IDC)		$681,369	$681,369	$681,369	$2,044,108.03
11	**TOTAL EXPENDITURE FOR APPROVAL (Including P(90) Risk)**					**$52,196,718.36**

Cost estimate for Option 2.

	PROJECT EXPENDITURE FORECASTS	2026	2027	2028	2029	TOTAL
1	DESIGN & ASSESSMENT	$3,913,220				$3,913,220.00
2	INTERNAL LABOUR	$1,032,942	$1,032,942	$1,032,942	$1,032,942	$4,131,768.75
3	MATERIALS (AusNet Free Issue)		$11,639,087	$11,639,087	$11,639,087	$34,917,260.67
4	CONTRACTS		$6,540,399	$6,540,399	$6,540,399	$19,621,195.61
5	PLANT		$206,520	$206,520	$206,520	$619,560.38
6	**PROJECT DIRECT EXPENDITURE P(50)**	**$4,946,162**	**$19,418,948**	**$19,418,948**	**$19,418,948**	**$63,203,005**
7	MANAGEMENT RESERVE [P(90)-P(50)]					$3,412,904.74
8	PROJECT DIRECT EXPENDITURE (SAP)	$4,946,162	$19,418,948	$19,418,948	$19,418,948	$66,615,910
9	OVERHEADS		$1,577,968	$1,577,968	$1,577,968	$4,733,904.92
10	FINANCE CHARGES (IDC)		$969,113	$969,113	$969,113	$2,907,338.14
11	**TOTAL EXPENDITURE FOR APPROVAL (Including P(90) Risk)**					**$74,257,153.22**

Note: The cost estimates above are in real dollars and indicative of the expected project delivery lead time. The start year in the above cost estimates does not reflect the intended project start year.

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