

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

Planning Report:

WOTS Spare Transformer

Date:

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1. Executive summary

Wodonga Terminal Station (WOTS) is owned and operated by AusNet Services, and it forms the main supply point for north-eastern Victoria. It consists of two 330/66/22 kV (X) three-winding 75 MVA transformers with a new 75 MVA cold spare transformer available on site.

To alleviate existing constraints on the sub-transmission and distribution network in north-eastern Victoria (Wodonga–Barnawartha area) and enable greater integration of renewable generation, AusNet Distribution has decided to install and commission the spare 330/66/22 kV 75 MVA transformer from WOTS as the third in-service transformer under their RIT-T. However, this will leave the site without a spare transformer, which poses a significant risk of major supply disruptions in the event of a failure, given the unique specifications of the unit.

The project has an estimated delivery lead time of three years. Accordingly, AusNet proposes to commence the project in 2027, with the completion by 2030, and all forecast expenditure to fall within the 2027–2032 TRR period.

2. Background

WOTS is owned and operated by AusNet Services and provides supply to north-eastern Victoria with two 75 MVA 330/66/22 kV transformers and a cold spare transformer. It is part of the 330 kV interconnector between NSW and Victoria and have connections to Dederang Terminal Station (DDTS) and New South Wales.

A cold spare transformer was procured during [provide year] to manage the risk of a transformer failure as AusNet does not own similar transformers given the unique rating and voltage ratio of these two transformers at WOTS.



Figure 1: Victorian main transmission system

The Connection Enablement: Wodonga–Barnawartha in North-Eastern Victoria RIT-T proposes to convert the cold spare transformer to an in-service transformer. This project will not procure a replacement spare transformer and will leave this key station without any spare transformer.

Asset Condition

The WOTS X1 and X2 have experienced winding displacement following a historic phase to ground fault. Their design is similar to a transformer that failed in 2008 due to inadequate structural support, which compromised short-circuit resilience. The Frequency Response Analysis (FRA) indicated significant shifts in poles and zeros across all phase windings, showing structural anomalies with up to 4% deviation from factory values for the zero-sequence impedance.

A recent limited-access inspection suggested minor winding displacement in the associated fault-limiting reactors. While no current deterioration in dielectric or thermal performance was observed, winding displacement is cumulative and non-linear, posing a high failure risk during future fault events. Critically, this condition increases the likelihood of simultaneous failure of both transformers, which would have severe operational consequences, as WOTS has only two 330/66/22 kV (X) transformers currently in service.

The 330 kV and 66 kV windings exhibit advanced age-related wear, and multiple leaks in the oil system due to aged cork-neoprene gaskets require attention. But the insulating oil was deemed acceptable for continued service.

Further information can be found in WOTS Spare Transformer – Asset Condition Report.

Table 1 shows the forecast failure rates for the X1, X2 and the cold spare transformer at WOTS.

Transformer Failure Rates	2025	2026	2027	2028	2029	2030	2031	2032
X1	0.0417	0.0426	0.0435	0.0445	0.0455	0.0464	0.0474	0.0484
X2	0.0470	0.0480	0.0490	0.0500	0.0510	0.0520	0.0530	0.0541
Spare Transformer	0.006704	0.007163	0.007635	0.008118	0.008614	0.009121	0.009640	0.010171

Table 1: Transformer forecast failure rates

3. Identified need

The sub-transmission and distribution systems at WOTS are supplied from the two 330/66/22 kV (X) three-winding 75 MVA transformers.

Load is at risk in the event of a transformer failure (N-1 outage scenario) and is forecast to increase as maximum demand increases over time. In the event of a transformer failure, the cold spare can be deployed to restore capacity and mitigate further interruptions.

However, under N-2 conditions, following the loss of both the X1 and X2 transformers, the load at risk increases significantly due to the absence of an additional spare 75 MVA transformer. In such a case, a new 75 MVA transformer will have to be procured. The long procurement lead time for a new transformer will result in extended disruption of supply to customers supplied from WOTS 66 kV and 22 kV.

The identified need for this project is to maintain a reliable electricity supply to all customers supplied from WOTS and to minimise the impact of a major transformer failure.

Figure 2 illustrates the forecast increase in transformer failure risk

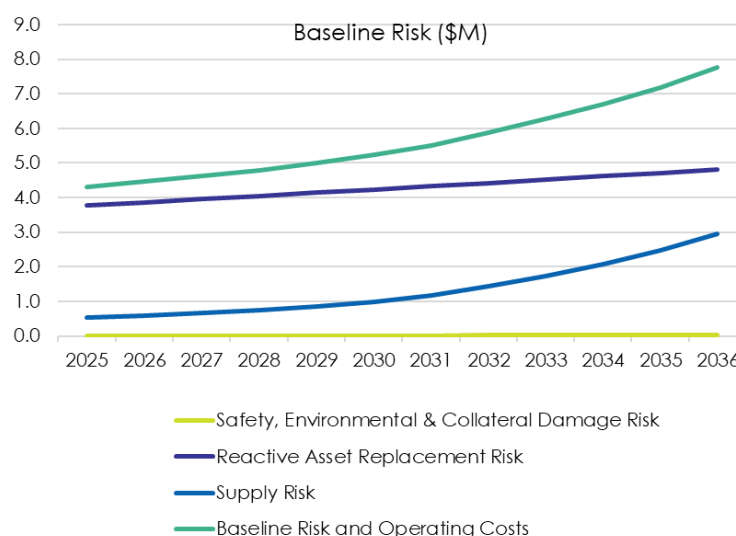


Figure 2: Baseline risk

3.1. Key inputs and assumptions

The identified need is underpinned by several assumptions, including the risk of asset failure (determined by the condition of the assets), the likelihood of the relevant consequences, and several assumptions adopted from the latest Inputs Assumptions and Scenarios Report (IASR). These assumptions are outlined below.

Market (wholesale market and involuntary load shedding) risk costs

AusNet Services calculated the involuntary load shedding at WOTS based on the latest AEMO connection point demand forecast and the ratings of the transformers and valuing it based on the Victoria statewide Value of Customer Reliability (VCR)¹.

Safety risk costs

The Electricity Safety Act 1998² 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 life³ to estimate the benefits of reducing the risk of death;
- a value of lost time injury⁴; and
- a disproportionality factor⁵.

AusNet Services notes this approach, including the use of a disproportionality factor, is consistent with the practice notes⁶ provided by the AER.

Financial risk costs

As there is a lasting need for the services that WOTS provides, the failure rate-weighted cost of replacing failed assets (or undertaking reactive maintenance) is included in the assessment.⁷

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 has been included in the assessment.

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 or received a proposal for a non-network solution. The two network options are presented below.

4.1. Option 1: Procure a cold spare 330/66/22 kV 75 MVA Transformer

Option 1 involves procurement of a cold spare to be stored at WOTS. The estimated capital cost of this option is \$12.28 million (direct expenditure with overheads and finance charges) and the change in operating and maintenance cost is negligible. The estimated project delivery time is 3 years and for the project to be completed by 2030.

¹ 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).

² Victorian State Government, Victorian Legislation and Parliamentary Documents, "Electricity Safe Act 1998"

³ Department of the Prime Minister and Cabinet, Australian Government, "Best Practice Regulation Guidance Note: Value of statistical life"

⁴ Safe Work Australia, "The Cost of Work-related Injury and Illness for Australian Employers, Workers and the Community: 2012-13"

⁵ Health and Safety Executive's submission to the 1987 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.

⁶ Australian Energy Regulator, "Industry practice application note for asset replacement planning"

⁷ The assets are assumed to have survived and their condition-based age increases throughout the analysis period.

4.2. Option 2: Deferred procure of a cold spare 330/66/22 kV 75 MVA Transformer

Option 2 is the same as Option 1 except deferring the replacement to 2035. It is assumed that cost escalation will be at the same rate as inflation.

4.3. Material inter-regional network impact

The proposed asset replacements at WOTS 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 (counterfactual) 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 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 ⁸	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

Table 1 - 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.

⁸ 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 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 3 and Figure 4, 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.

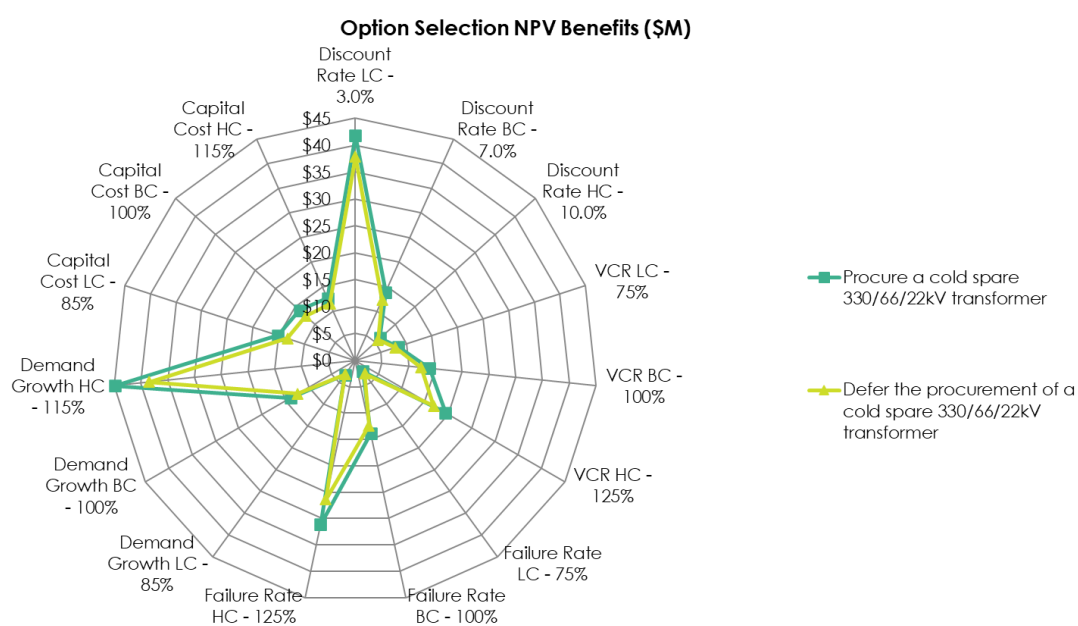


Figure 3: Option selection

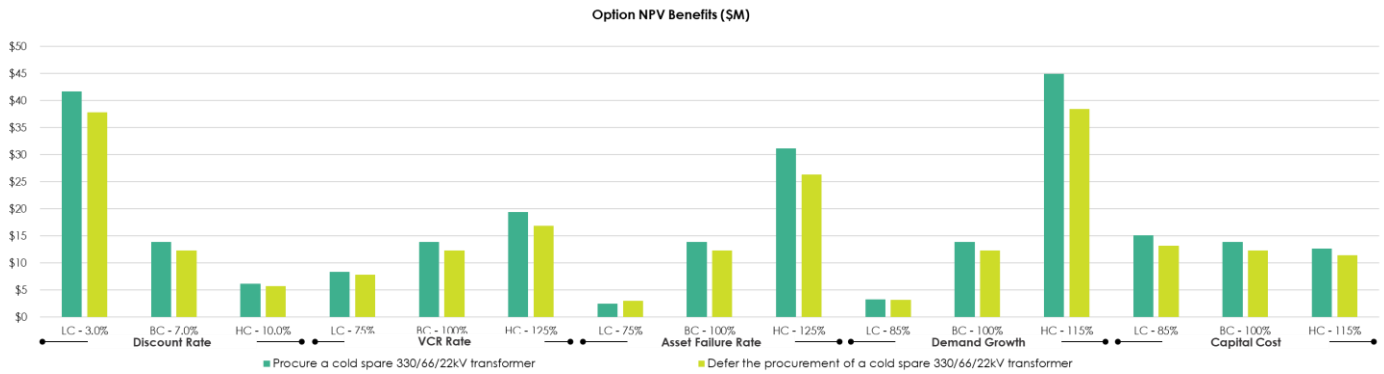


Figure 4: Option sensitivities and scenarios

6.1. Preferred Option

Option 1 (Procurement of the cold spare) has the highest net economic benefit for all of the scenarios and sensitivities considered and is therefore the preferred option. Scenario weighting will not make a difference to the preferred option as Option 1 has the highest net benefits for all sensitivity studies.

6.2. Optimal timing of the preferred option

This section describes the optimal investment timing of the preferred option for different input assumptions. Figure 5 shows that the optimal timing of the preferred option (Option 1) is starting from 2030 with all the investment needed within the 2027 to 2032 regulatory control period.

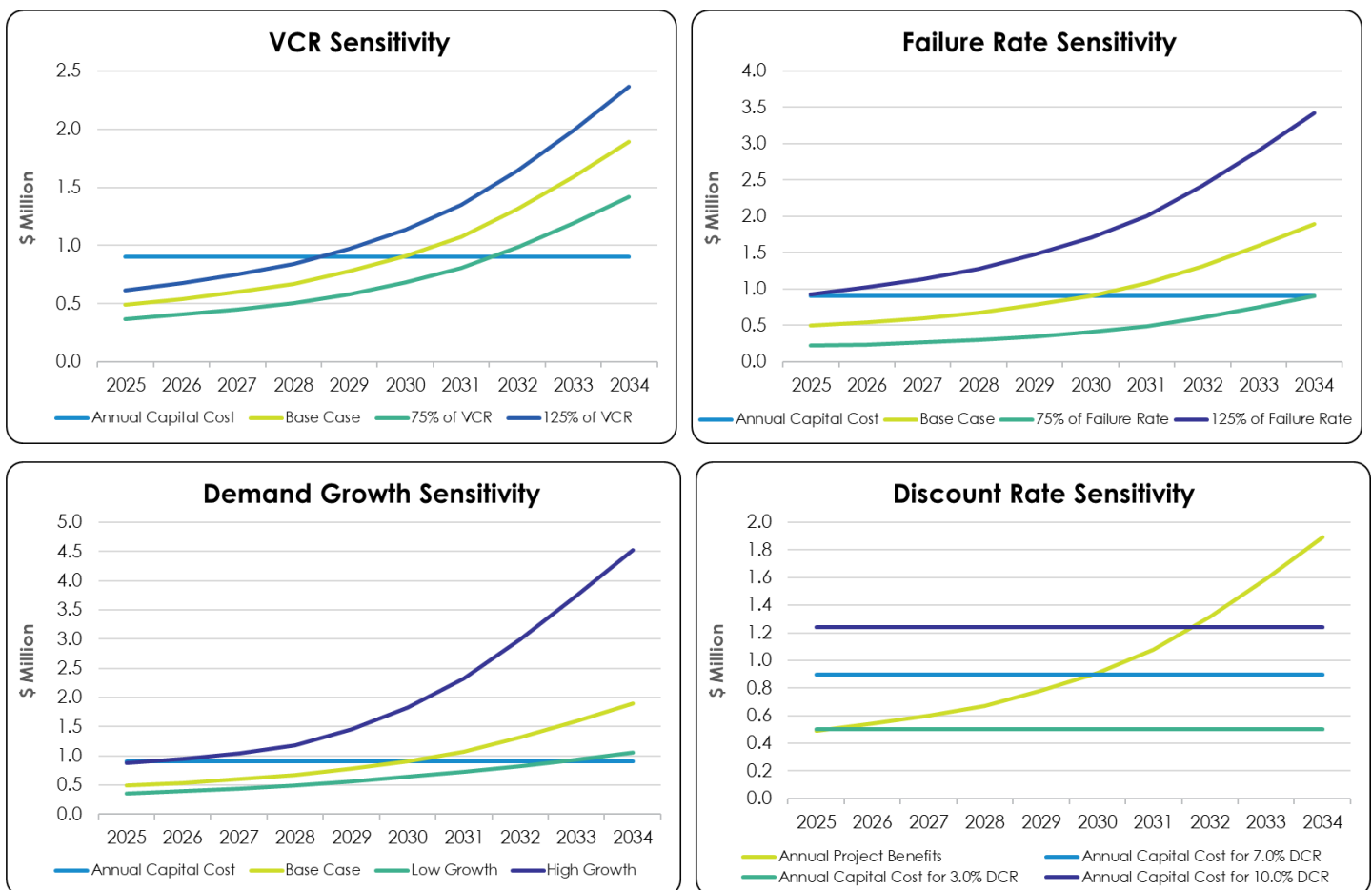


Figure 5: Option scenario and sensitivity study

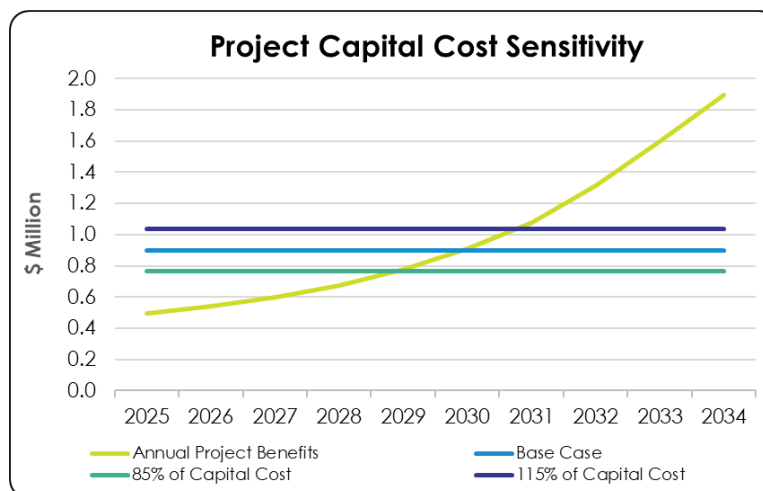


Figure 6: Optimal investment timing sensitivity study

Figure 6 shows that the investment economic timing for a 15% increase in investment cost.

7. Conclusion

Amongst the options considered, Option 1 is the most economical option to address the identified need and is hence the preferred option.

The preferred option involves the procurement of a cold spare to be stored on site at WOTS.

The estimated capital cost of this option is \$12.28 million with no material change in operating and maintenance cost. The project is economic by 2030, and AusNet Services is targeting a commissioning date of end 2029 with all cost falling within the 2027 to 2032 regulatory control period.

8. Appendix 1: Cost Estimate

PROJECT EXPENDITURE FORECASTS		2027	2028	2029	TOTAL
1	DESIGN & STUDIES/ASSESSMENTS	\$ 35,361.50	\$ 318,253.49	\$ -	\$ 353,614.99
2	INTERNAL LABOUR	\$ 130,711.25	\$ 209,138.01	\$ 182,995.76	\$ 522,845.02
3	MATERIALS (AusNet Free Issue Materials)		\$ 6,494,159.65	\$ -	\$ 6,494,159.65
4	PLANT & EQUIPMENT		\$ -	\$ 50,897.94	\$ 50,897.94
5	CONTRACTS (incl incentive)		\$ -	\$ 3,756,365.90	\$ 3,756,365.90
6	PROJECT DIRECT EXPENDITURE	\$ 166,072.75	\$ 7,021,551.15	\$ 3,990,259.59	\$ 11,177,883.50
7	OVERHEADS		\$ -	\$ -	\$ 561,129.75
8	FINANCE CHARGES (IDC)		\$ -	\$ -	\$ 509,711.49
9	PROJECT DIRECT EXPENDITURE (SAP)	\$ 166,072.75	\$ 7,021,551.15	\$ 3,990,259.59	\$ 12,248,724.73
10	MANAGEMENT RESERVE				\$ 856,420.22
11	TOTAL EXPENDITURE FOR APPROVAL	\$ 166,072.75	\$ 7,021,551.15	\$ 3,990,259.59	\$ 13,105,144.95

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