TRANSMISSION AND DISTRIBUTION POLES FAILURE RISK MITIGATION

Case for investment FY23 – 29
(Pre-optimisation)

August 2022

Contents

Investment Title	**Condition based replacement of transmission and distribution poles**
Project # / Code	
Portfolio	Repex
CFI Date	31/03/22
Pre RIT-D	☐
Final CFI (Pre-optimisation)	☒
Other	☐

Version	Date	Comments
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1. Executive Summary

1.1 Recommendation

This case for investment (CFI) recommends investment into the reinstatement and/or replacement of Endeavour Energy owned poles across the distribution and sub-transmission network during the FY23-FY29 period to address the safety, reliability, financial and bushfire risks associated with the failure of these assets whilst in service.

It is noted that this CFI is recommending these investments to be included into the portfolio risk-based asset investment planning and optimisation process during the period of FY23 – FY29.

The assessment conducted as part of this CFI into the proactive replacement of poles yielded no economically feasible interventions within the FY23 – FY29 investment period or the following period FY30-FY34. Therefore, proactive replacement scope has not been submitted within this CFI at this time for optimisation.

Within this recommended program of works, each asset has been assessed individually for the risk it presents. Furthermore, this is an on-going program with no material change proposed across the asset type and the highest cost credible option cost at each site falls below the threshold for application of the Regulatory Investment Test for Distribution (RIT-D) (currently $6.0 million). Therefore, the RIT-D is not applicable to this on-going program.

An allowance of $126 million is proposed for the replacement or reinstatement of transmission and distribution poles that are deemed to have failed conditionally during the FY23 - FY29 period.

1.2 Identified need

Endeavour Energy's has an in-service pole population of approximately 432,000. This pole population is comprised of 311,000 (72%) Endeavour Energy owned, 108,000 (25%) privately owned customer assets, with the remaining 13,000 (3%) being third party assets. The fleet strategy outlined within this CFI focuses on Endeavour Energy owned poles. This CFI strategy does not include pole top structures, columns, towers and pole earthing.

Endeavour Energy's Distribution and Transmission poles are predominately timber 285,000 (92%). There are also concrete poles 23,500 (7.5%), steel poles 2,200 (<1%) and composite poles 57 (<1%). Failure of a transmission or distribution pole may cause significant risks for persons or property nearby and possible loss of supply to customers.

The possible consequences of a pole failure include:

- Safety impacts: Injury to people due to being struck as a result of a pole failure including pedestrian's and/or drivers on the road or workers if the pole fails during the process of line construction on the pole or in the immediate vicinity. There is also the risk of electrocution from fallen live conductors resulting in serious injury or fatality.

- Reliability impacts: Failure of a pole may cause conductors to clash or fall to the ground resulting in extended loss of supply while the network is re-configured to isolate, sectionalise and repair the affected area.

- Financial impacts: the additional costs associated with clean-up after a failure and the repair/replacement of any adjacent assets in the vicinity of the failed pole. This also includes damage to property, livestock and vehicles.
- Bushfire impacts: Conductors making contact with the ground or other structures may ignite a bushfire due to arcing/sparking of the live conductor.
- No significant environmental or regulatory compliance consequences have been experienced or are anticipated for future failures of a pole.

1.3 Options analysis

There are no credible non-network solutions for replacing the functionality of transmission and distribution poles given their relatively low replacement cost and their identified need within Endeavour Energy's network.

For transmission and distribution poles, the only option available for addressing the failure risk of individual poles in a proactive planned manner (which is considered to be credible) is retirement followed by the replacement of the pole with a modern equivalent pole.

Poles are identified for proactive intervention at the time when the net present value of the intervention reaches its maximum value. The assessment conducted as part of this CFI into the proactive replacement of poles yielded no economically feasible interventions within the FY23 – FY29 investment period or the following period FY30-FY34. Therefore, proactive replacement scope has not been submitted within this CFI at this time for optimisation.

1.4 Recommended option

The recommended option is the continuation of Endeavour Energy's condition-based intervention program for transmission and distribution poles with funding of $126 million in real FY23 terms be made available for reactive pole replacement or reinstatement during the FY23 – FY29 period.

This recommendation is made on the basis that the preferred solution represents the highest economic value (economic benefit) compared to other credible network and non-network options.

1.5 Budget

The total cost of the reactive replacement or reinstatement works is estimated to be $126 million in real FY23 terms.

2. Purpose

The purpose of this document is to seek endorsement of the case for investment (CFI) for managing the risks posed by pole's throughout Endeavour Energy's network.

This CFI is recommending these investments to be included into the portfolio risk-based asset investment planning and optimisation process during the period of FY23 – FY29.

This case for investment (CFI) recommends reactive intervention for poles that may functionally fail unexpectedly or conditionally fail during the FY23-FY29 period.

The fleet strategy outlined within this CFI only focuses on Endeavour Energy owned poles. This CFI does not include pole top structures, columns, towers and pole earthing.

This CFI will be grouped together with any other related CFI's and rolled up into an asset class plan (ACP) to provide an overall view of the asset classes performance at a macro level. ACP's will also be fed into system strategy documentation to view the CFI / ACP in the context of the entire network (e.g. by feeder, substation and/or region) to understand its contribution to the overall networks performance.

3. Identified needs and or opportunities

3.1 Background

A poles basic function is to support overhead electrical conductors to ensure adequate safety clearance is maintained from the ground (including vegetation, structures, buildings and other services) to mitigate the risk of inadvertent contact with live conductors. However, they also support a wide range of pole mounted network assets to assist in safe and reliable delivery of power throughout the network.

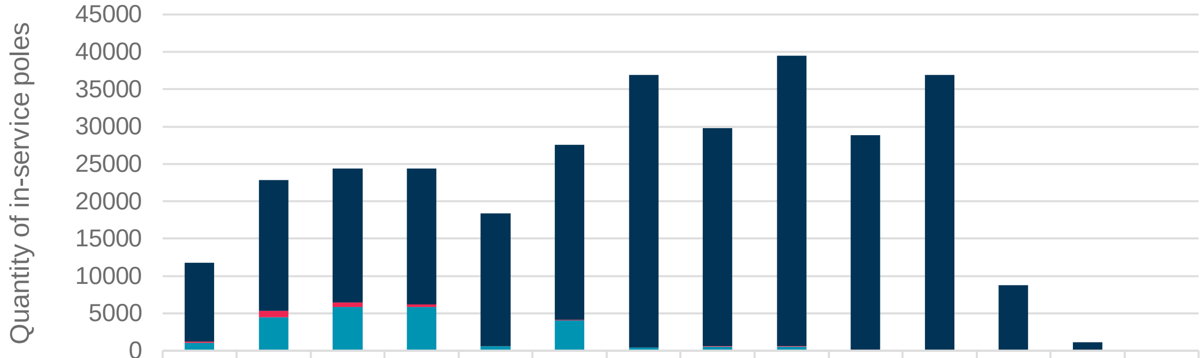
Endeavour Energy owns approximately 311,000 poles in service across the transmission and distribution network. Operating voltages range from 230V to 132kV.

Whilst developments in construction materials have led to the adoption of concrete, steel and composite poles throughout Endeavour Energy's network, the majority of the asset population consists of timber poles.

As a means of extending the service life of a pole, suitable poles can be installed with a mechanical support at and below, the ground line, referred to as a "pole nail".

The age profile of the fleet of 311,000 in-service Endeavour Energy owned poles is shown in Figure 1 below.

Figure 1 - Endeavour Energy network poles age profile



	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	>=65
Timber	10539	17551	17959	18204	17749	23364	36423	29184	38864	28749	36878	8785	1171	39
Steel	210	852	598	351	51	83	23	14	13	18	13	5		
Concrete	1042	4430	5860	5850	603	4084	458	566	568	54	44	6		
Composite		49	7	1										

Pole age at FY22 (years)

3.2 Risks and identified need

The functional failure of a pole occurs when the pole has insufficient strength to support the load applied to it. The pole may break and fall to the ground or the conductors may provide enough support to keep the pole standing upright.

There are on average 7 unassisted functional failures per annum directly related to the condition of the pole where the failure of a pole has resulted in an extended outage incident recorded within Endeavour Energy's Outage Management System (OMS).

The possible consequences of a pole failure include:

- Safety impacts: Injury to people due to being struck as a result of a pole failure including pedestrian's and/or drivers on the road or workers if the pole fails during the process of line construction on the pole or in the immediate vicinity. There is also the risk of electrocution from fallen live conductors resulting in serious injury or fatality.
- Reliability impacts: Failure of a pole may cause conductors to clash or fall to the ground resulting in extended loss of supply while the network is re-configured to isolate, sectionalise and repair the affected area.
- Financial impacts: the additional costs associated with clean-up after a failure and the repair/replacement of any pole mounted assets as well as adjacent poles and assets damaged in the vicinity of the failed pole. This also includes damage to property, livestock and vehicles.
- Bushfire impacts: Conductors making contact with the ground or other structures may ignite a bushfire due to arcing/sparking of the live conductor.
- No significant environmental or regulatory compliance consequences have been experienced or are anticipated for future failures of a pole.

Due to the large pole population within Endeavour Energy's network and the increased risk of failure over time, a replacement strategy is required to manage these risks and customer needs associated with these assets.

4. Consequence of nil intervention

4.1 Consequence of no intervention

The nil intervention option involves no capital expenditure for the replacement or reinstatement of poles, therefore if a pole were to fail, it would not be replaced or reinstated. Due to the defined service level of poles within the network, this option is not feasible due to negative impact and consequences of failure for each pole as noted in section 3.2 above and hence the no intervention option for poles is not considered for this CFI.

Under a nil intervention scenario, the risk costs would increase exponentially over time as other supporting elements in the network also failed and were not replaced. These exponential additional risk costs have not been modelled or included in the assessments as part of this CFI.

4.2 Counterfactual (business as usual)

The business as usual (BAU) “counterfactual” scenario includes a pole remaining in-service until it either functionally or conditionally fails and then replacement of the pole after failure, providing its service is still required. Nil proactive capital intervention is carried out.

The scope of works under the BAU include:

- Maintenance:
    - All poles are subject to routine inspection and treatment, with typical overhead line inspection periods being every 5.5 years dependent on pole type, however, additional ground line inspections are required for timber poles as they are subject to fungal decay and termite infestation which can negatively impact the structural integrity of the pole over time leading to failure
- Repair of any minor damage such as replacement of missing pole caps, termite treatment for infested poles, removal of excess loose sap wood, re-straighten excessively leaning poles;
- Re-instatement: where found suitable, a steel support is secured to a timber pole at groundline to provide additional support and extend the lifespan of the pole.
- Reactive replacement after failure.

Currently, “failure” refers to the inability of the pole to perform its required function as a consequence of the condition of the asset:

- Failure of the pole to perform under its rated loading at groundline, mid-pole or in within its head.

Conditional failures occur when a pole fails to meet the minimum serviceable requirements as outlined in *in MMI0001 Pole and Line Inspection and Treatment Procedures.* Conditional failures can occur due to reduced wall thickness caused by internal rot or termites, excessive lean, damage due to fire or a third party or poor external condition of the head of the pole compromising structural integrity e.g.: splits, knots, cracks.

When a pole is deemed to have conditionally failed, a defect is raised, and the pole is replaced within a specified timeframe based on its priority.

Over the past 5 years, Endeavour Energy has replaced on average approximately 2,000 poles per annum based on its condition and re-instated a further 300 poles per annum at a combined intervention cost of approximately $17 million per year ($FY23 real).

For the purpose of this assessment only costs that have occurred due to a functional failure has been considered. A summary of the risk presented by the counterfactual case is shown in and below. All costs are in real FY23 terms and are present values (PV). A discount rate of 3.26% has been used throughout the economic evaluation.

Table 1 – BAU risk cost summary

Risk category	PV of residual risk ($M)	Risk proportion (%)
Safety	14	33
Reliability	7	17
Financial	2	5
Bushfire	8	19
Reactive capital replacement costs	11	26
Total	**42**	**100**

As noted in Table 1 above, the residual risk presented by the BAU case totals $42 million. The residual risk value presented by each pole ranges from $7 to $5,869 and averages $138 across the fleet of 311,000.

5. Options considered

5.1 Risk treatment options

Before assessing the network intervention option, consideration has been given to a range of alternative approaches which could possibly contribute to addressing the risk presented by poles. These approaches are summarised in Table 2 below.

Table 2 - Pole risk treatment options

Option	Assessment of effectiveness	Conclusion
Additional maintenance to extend the life of the existing asset	Existing maintenance include remedial treatment for termite attack as well as re-instatement of suitable timber poles. Both methods are proven to extend the life of timber poles, however, these maintenance activities are not effective in managing risk for the entire pole population.	No technically feasible solution
Reduce the supply load on the asset through network reconfiguration, network automation, demand management or other non-network options	The risk of failure is independent of supply load. A minor reduction in reliability risk cost could be achieved by transferring load from any of the distribution substations. Due to the primary function of poles, there is no credible non-network option to replace their functionality.	No technically feasible solution
Implementing operational controls such as no climbing degraded poles	Operational controls are already in place for poles that have conditionally failed, in that poles are tagged with warning tag and are prohibited to climb by field staff. These controls are in place to limit the safety risks presented by this equipment to workers, but the principal risk that drives the need for intervention is safety to the public and reliability, neither of which can be affected by practicable controls.	Controls only the safety risk elements for workers
Replacement to maintain option value and reduce the consumer's long-term service cost	Replacement of pole.	Recommended approach for further consideration

5.2 Non-network options

Due to the nature of the asset and its primary functionality being support structures for overhead conductors, there are no credible non-network solutions which could replace their functionality and therefore network options have been considered to address the identified need.

5.3 Credible network options

Once a pole has been inspected and assessed as per MMI 0001 and has been determined as requiring intervention various network options are considered based on its measured condition. Options are shown in Table 3 below.

Table 3 - Credible network options - pole intervention

Intervention option	Description	Conclusion
Proactive pole replacement	As per MMI 0001, pole intervention options are determined at time of retirement. If the pole is found to be still required, the intervention options include: • Removing the pole: Design input would be required to ensure loading of adjacent poles doesn't exceed existing strength ratings and also to ensure adequate conductor clearances are maintained; • Reinstatement (of timber poles): Suitability for re-instatement is determined through the pole function as well as its remaining wall thickness; • Replacement of the pole: Like-for-like; or • Replacement of pole with a non-combustible type pole: Typically when a timber pole is located within an area prone to bushfires.	Credible option and has progressed for further assessment

Replacement of poles based on condition is considered a credible network option

5.3.1 Pole replacement

Under this option, the intervention includes an assessment of the need for the service level of the pole and if deemed required the complete replacement of the pole in a proactive manner.

A value of $7,500 for the replacement of a distribution pole and a value of $14,500 for the replacement of a transmission pole has been assumed for this assessment. These costs have been based on actual costs of previously delivered works and includes:

- Project Management;
- Design;
- Materials;
- Labour and plant; and
- Traffic management.

These values are calculated as the average unit rate based on historical replacement of distribution and transmission poles between FY17-FY21.

5.4 Economic evaluation

5.4.1 Option 1 – Proactive replacement

Poles are identified for proactive intervention at the time when the net present value of the intervention reaches its maximum value. The assessment conducted as part of this CFI into the proactive replacement of poles yielded no economically feasible interventions within the FY23 – FY29 investment period or the following period FY30-FY34. Therefore, proactive replacement scope has not been submitted within this CFI at this time for optimisation.

5.5 Evaluation Summary

This section is not applicable to this CFI as no proactive scope is being considered.

5.6 Economic evaluation assumptions

There are a wide range of assumptions of risk, their likelihoods and consequences which support the cost benefit assessment associated with this evaluation.

Refer to Appendix A for details of these assumptions.

5.7 Scenario assessment

This section is not applicable to this CFI as no proactive scope is being considered.

6. Preferred option details

6.1 FY23-FY29 scope and timing

This section is not applicable to this CFI as no proactive scope is being considered.

6.2 Additional scope and timing

This section is not applicable to this CFI as no proactive scope is being considered.

6.3 Investment summary

6.3.1 Planned proactive works

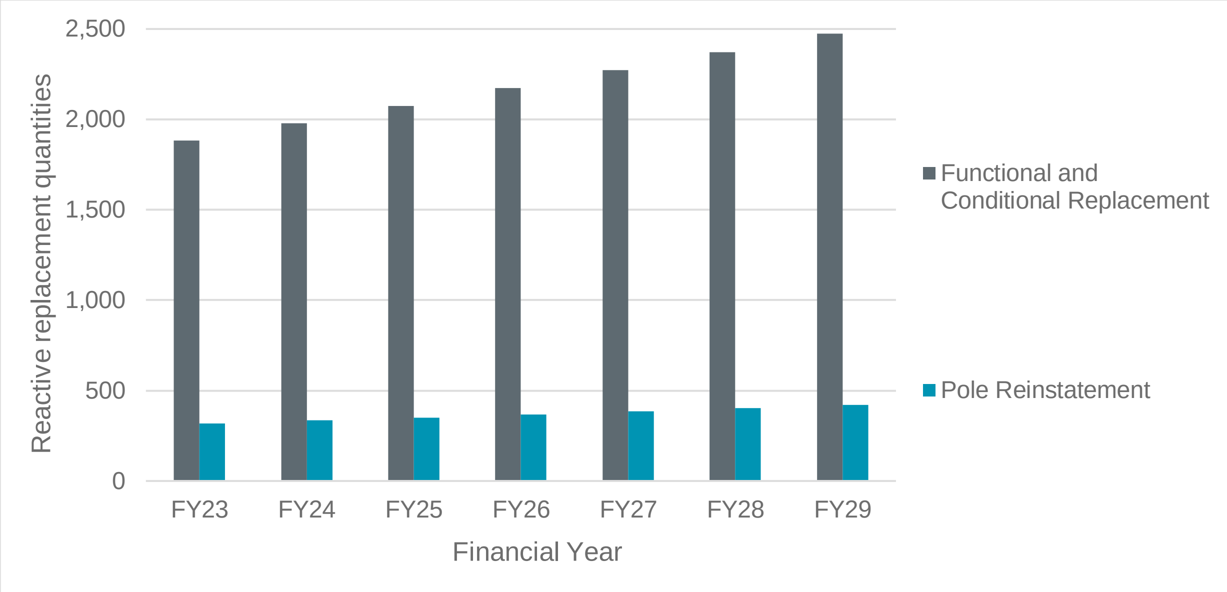
Poles are identified for proactive intervention at the time when the net present value of the intervention reaches its maximum value. The assessment conducted as part of this CFI into the proactive replacement of poles yielded no economically feasible interventions within the FY23 – FY29 investment period or the following period FY30-FY34. Therefore, proactive replacement scope has not been submitted within this CFI at this time for optimisation.

6.3.2 Reactive investment

Reactive modelling for the FY23 -FY29 period has forecast approximately 17,810 poles that will reach a functional or conditional failed state (e.g. found to be in a poor condition indicative of imminent failure and/or no longer capable of performing its function). Of these poles approx. 15,230 will require replacement and 2,580 will be suitable for reinstatement.

Figure 2 below shows the forecast trend of reactive investment likely to be required for the replacement and reinstatement of poles into the between FY23-FY29.

Figure 2 - Forecast reactive replacement transmission and distribution pole quantities FY23-FY29



A reactive replacement cost, which takes account of the likelihood of damage to adjacent equipment but excludes the economic costs of a pole failure, has been averaged across the fleet of poles to give an annual forecast of reactive funding requirements. To accommodate this eventuality, it is proposed that funding of $126 million (in real FY23 terms) be made available for reactive pole replacement during the FY23 – FY29 period.

Table 4 below, summarises the proposed reactive funding forecast.

All costs are in real FY23 terms.

Table 4 – Reactive replacement forecast (FY23-FY29)

Description	Unit rate per reactive replacement ($)	Forecast quantity of failure interventions		Forecast reactive investment ($M)	
		FY23-FY24	FY25-FY29	FY23-FY24	FY25-FY29
Distribution pole					
Reinstatement	1,100	602	1,767	0.66	1.94
Replacement	7,500	3,553	10,421	26.65	78.16
Sub-total (Distribution)		***4,155***	***12,188***	***27.31***	***80.10***
Transmission					
Reinstatement	2,000	53	160	0.11	0.32
Replacement	14,500	310	942	4.50	13.66
Sub-total (Transmission)		**363**	**1,102**	**4.61**	**13.98**
Sub-total (by FY period)		**4,518**	**13,290**	**31.92**	**94.08**
Total FY23-FY29		**17,808**		**$126M**	

6.4 Scope of Works

6.4.1 Condemned pole

The scope of work covers the replacement or reinstatement of distribution or transmission poles of various types and voltages within Endeavour Energy's distribution network which have been identified as condemned poles by pole inspectors or replaced through an unassisted failure.

Poles are recommended for either replacement or reinstatement primarily by pole inspectors through the regular network inspection cycle and in accordance with MMI0001. A condition assessment at each site determines the priority level applied for replacement: within 48 hours; one month; three months or six months based on the risks it presents.

All new poles shall be constructed to the requirements of the relevant standards in particular mains construction instruction MCI 0005 - Overhead distribution construction standards manual.

The scope of the works should cover only what is required to be undertaken to address a condemned or failed pole. Replacement poles are either concrete or treated wooden poles. Steel poles may also be used in place of concrete poles particularly in situations where access to the pole location is poor.

6.4.2 Reinstated pole

The recommendation to reinstate a pole is made by the pole inspectors after calculating the remaining strength and the load on the pole as per MMI0001.

Reinstated poles which have failed or are in a poor condition indicating imminent failure are to be defected in accordance with MMI0001 and scheduled for replacement.

6.4.3 Privately owned poles

Endeavour Energy inspects all poles within its network including privately owned poles (where there is an inspection agreement in place) and advises the owner accordingly when the poles are condemned and require replacement. It is then the owner's responsibility to arrange for the replacement of their poles. No financial allocation / costs have been included in this CFI for privately owned pole replacements.

7. Regulatory investment test

Within this recommended program of works, each asset has been assessed individually for the risk it presents. Furthermore, this is an on-going program with no material change proposed across the asset type and the highest cost credible option cost at each site falls below the threshold for application of the Regulatory Investment Test for Distribution (RIT-D) (currently $6.0 million). Therefore, the RIT-D is not applicable to this on-going program.

8. Recommendation

It is recommended that over the FY23-29 period, a reactive intervention strategy is to be undertaken for poles within the Endeavour Energy network.

The total cost of these works has been estimated to be $126 million in real FY23 terms and is recommended for inclusion into the optimisation process within the FY23-29 Portfolio Investment Plan.

9. Attachments

Appendix A - Summary of key risk assessment variables and assumptions

10. References

[1] Endeavour Energy, “MMI0001 Pole and Line Inspection and Treatment Procedures, Amendment 17,” November 2016.

[2] Endeavour Energy, “MCI0005 Overhead Construction Standards Manual,” 2017.

[3] Endeavour Energy, “MMI0002 - Distribiution Overhead Defect Handbook,” Asset Planning & Performance, August 2021.

[4] Endeavour Energy, “Company Procedure - GRM 0003 Risk Management, Amendment 13,” September 2017.

[5] Endeavour Energy, “Asset Renewal Plan FY21-FY30,” January 2020.

Appendix A - Summary of key risk assessment variables and assumptions

General variables and assumptions

Parameter	Value	Description/Justification	Source/Assumptions
Population	311,312	Number of Endeavour Energy owned transmission and distribution poles in service	Endeavour Energy's Ellipse database
Average annual conditional failures	2,000	The expected number of conditional pole failures seen in a year. Average over the past 5 years	Endeavour Energy's defect data via Ellipse workorders
Average annual functional failures	7	The expected number of functional pole failures seen in a year. Average over the past 5 years	Endeavour Energy's Outage Management System
Asset age	Varies for each pole	Calendar age based on the poles in-service date compared to the year of assessment	GIS and Ellipse asset data
Discount rate (WACC)	3.26%	Weighted average cost of capital for EE	Regulated rate. Applied to all risk and investment values used in the cost-benefit assessment
Base year of investment	FY23	All investments for budgeting purposes are expressed in real FY23 dollars	For inclusion into the FY23 PIP after optimisation
Calculation horizon	175 years	The timeframe over which the cost-benefit analysis is performed	Risk Model Framework v1.0 (v6.0 algorithm)
Maintenance Costs	$10-$50 per pole per annum	Maintenance costs include overhead and groundline inspections throughout the serviceable life of the pole as well as additional costs for pre summer bushfire inspections if pole is located within a bushfire vulnerable area	Endeavour Energy Mains Maintenance Instruction MMI0001 Pole and line inspection and treatment procedures
Reactive intervention cost	**Distribution Replacement** $7,500	The cost associated with a reactive distribution pole replacement	Based on actual costs of previously delivered works
	Distribution Reinstatement $1,100	The cost associated with a reactive distribution pole re-instatement	Based on actual costs of previously delivered works
	Transmission Replacement $14,500	The cost associated with a reactive transmission pole replacement	Based on actual costs of previously delivered works
	Transmission Reinstatement $2,000	The cost associated with a reactive transmission pole re-instatement	Based on actual costs of previously delivered works

Fall factor	0.0044	Likelihood of pole failure resulting in pole falling on ground	Based on historical failure data from Endeavour Energy's Outage Management System
Pole reinstatement factor	14.5%	The number of poles predicted for reinstatement after conditional failure	Based on historical trends from Endeavour Energy's Ellipse database

Weibull Parameters

Parameter	Value	Description/Justification	Source/Assumptions
$\mathbf{Shape}_{conditional}$	Timber: 3.6 Steel: 3.6 Concrete: 3.6	The shape parameter, also known as the Weibull slope, used for calculating probability of failure for reactive forecasting.	The generalised wear-out function shape for a normal distribution is 3.6 and is consistent with Endeavour Energy's historical failure data.
$\mathbf{Scale}_{conditional}$	Timber: 76.9 Steel: 67 Concrete: 138	The scale parameter used for calculating probability of failure for reactive forecasting.	Developed by applying asset age to failure correlation using Endeavour Energy's historical failure and asset data. Timber poles have a MTTF of 69 years and average of 2000 failures per year. Steel poles have a MTTF of 60 years and average of 3 failures per year. Concrete poles have a MTTF of 124 years and average of 4 failures per year.
$\mathbf{Shift}_{conditional}$	Timber: 0 Steel: 0 Concrete: 0	The shift parameter which gives a failure-free period at the start of the asset's life.	As there is no guaranteed failure free period for timber, steel and concrete poles and therefore a shift parameter of 0 has been used.
$\mathbf{Shape}_{\mathbf{functional}}$	3.6*	The shape parameter, also known as the Weibull slope, used for calculating probability of failure for reactive forecasting.	The generalised wear-out function shape for a normal distribution is 3.6 and is consistent with Endeavour Energy's historical failure data.
$\mathbf{Scale}_{functional}$	372*	The scale parameter used for calculating probability of failure for reactive forecasting.	Developed by applying asset age to failure correlation using Endeavour Energy's historical failure and asset data. Average number of functional failures per year is 7.
$\mathbf{Shift}_{functional}$	0*	The shift parameter which gives a failure-free period at the start of the asset's life.	As there is no guaranteed failure free period for timber, steel and concrete

Parameter	Value	Description/Justification	Source/Assumptions
			poles and therefore a shift parameter of 0 has been used.

** Due to limited functional failure data, standard normalised Weibull parameters have been used for all pole types.*

Bushfire risk inputs

Parameter	Value	Description/justification	Source/assumptions
Bushfire - LoC	Varies by pole	Likelihood that a pole failure will result in a bushfire	Based on historical fire start data.
Bushfire - CoF	Total Bushfire Risk Cost	Likelihood and consequence of bushfire start evaluated by the Bushfire Model based on the Phoenix RapidFire simulation prepared for EE's network by the University of Melbourne in 2020.	Pole spatial information input into the Bushfire FME model. The model assesses the CoC of a bushfire started by each pole. Other inputs to the model: - Vegetation LoC - CoC for Low, High, Very High, Severe, Extreme, Catastrophic fire risk days

Environmental risk inputs

Parameter	Value	Description/justification	Source/assumptions
N/a			

Financial risk inputs

Parameter	Value	Description/justification	Source/assumptions
Pole length	Varies by pole	Length of pole	Based on voltage classification of pole and the average pole lengths used for each voltage classification
Lot distance	Varies by pole	Distance from pole to property	NSW Lot Database
Direction - LoC	0.25	Likelihood of pole falling in the direction of property	Estimated value
Building Damage - CoC	$78,018	10% of average cost of buildings within EE franchise area	Estimated value

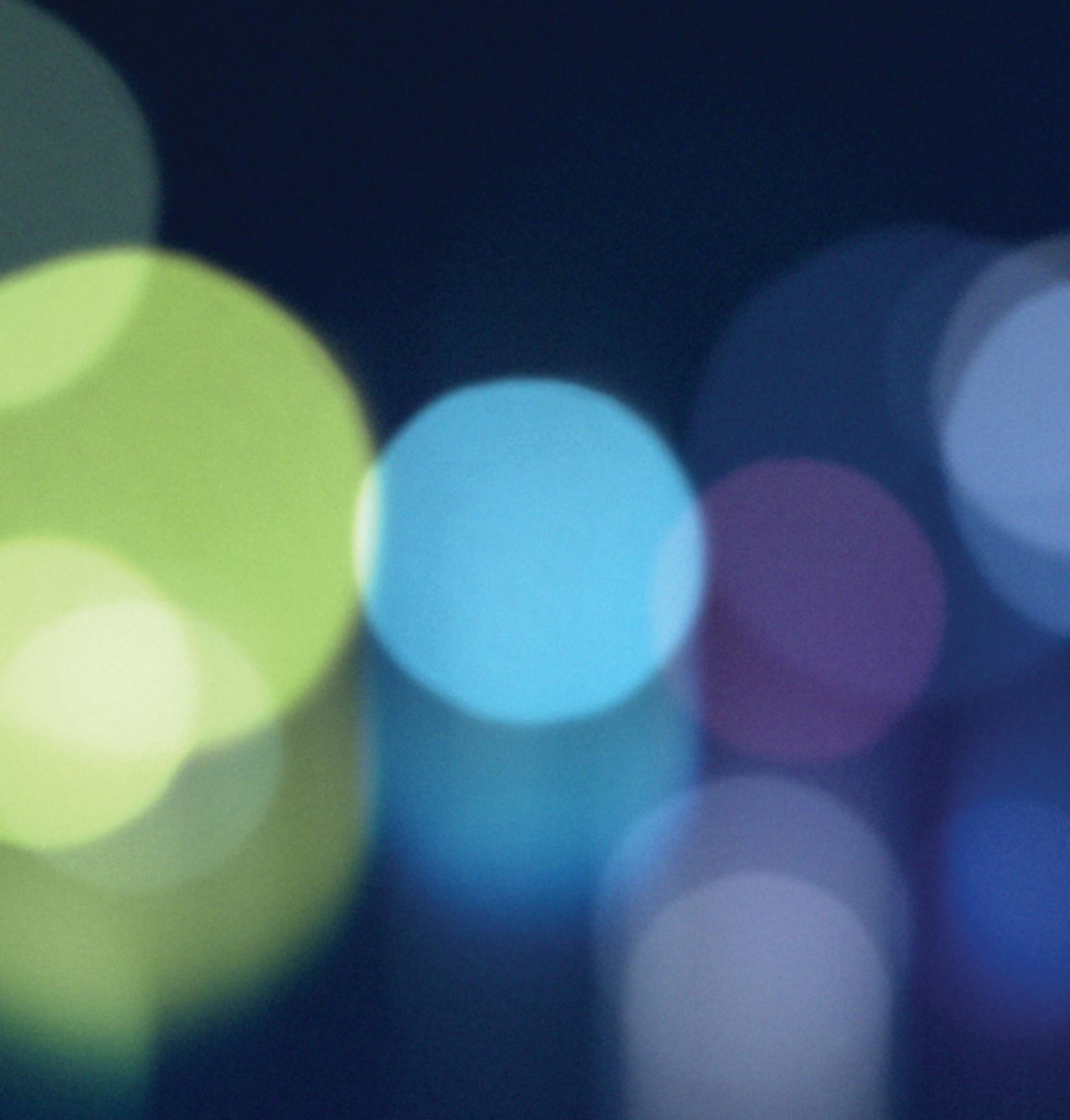
Safety risk inputs

Parameter	Value	Description/justification	Source/assumptions
Value of a fatality	$5,100,000	Value of statistical life (VoSL)	EE Copperleaf Value Model – based on Office of Best Practice Regulation published values
Value of injury	$255,000	5% of VoSL	EE Copperleaf Value Model – based on Office of Best Practice Regulation published values

Parameter	Value	Description/justification	Source/assumptions
Vehicular Accident - LoC	1%	Likelihood of vehicular accident occurring due to pole falling	Estimated value
Pedestrian Accident - LoC	3.33%	Likelihood of a pole falling and impacting a pedestrian in a high traffic area	Based on classification, calculated exposure probability
	0.556%	Likelihood of a pole falling and impacting a pedestrian in a medium traffic area	Based on classification, calculated exposure probability
	0.0116	Likelihood of a pole falling and impacting a pedestrian in a high low traffic area	Based on classification, calculated exposure probability

Reliability risk inputs

Parameter	Value	Description/justification	Source/assumptions
Load on pole	TR – Varies by pole	50% of maximum transmission feeder load multiplied by 5% due to feeder back-up	EE transmission feeder loads
	HV – Varies by pole	Load of HV feeder	Power Factory load flow simulations
	LV – Varies by pole	Load of closest distribution substation	EE distribution substation loads
VCR	Varies by pole	Based on HV feeder	AER published values
Duration of interruption	4 hours	Duration of time until affected customers are restored	Based on historical data from EE's Outage Management System



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