Ausgrid

Revised Proposal

Attachment 5.13.M.1

Poles program CBA summary

January 2019

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Poles program CBA summary

Introduction

Ausgrid has reviewed the risks associated with poles by undertaking a quantitative risk assessment. This document covers the outcomes of cost benefit analysis and should be reviewed in conjunction with the cost benefit analysis (CBA) modelling methodology report[1].

Scope

This model covers the following RIN categories:

- POLES - < = 1 kV; WOOD - REPLACEMENT OF STAKED POLE
- POLES - > 1 KV & < = 11 KV; WOOD - REPLACEMENT OF STAKED POLE
- POLES - > 11 KV & < = 22 KV; WOOD - REPLACEMENT OF STAKED POLE
- POLES - > 22 KV & < = 66 KV; WOOD - REPLACEMENT OF STAKED POLE
- POLES - > 66 KV & < = 132 KV; WOOD - REPLACEMENT OF STAKED POLE
- POLES - < = 1 kV; WOOD - REPLACEMENT OF UNSTAKED POLE
- POLES - > 1 KV & < = 11 KV; WOOD - REPLACEMENT OF UNSTAKED POLE
- POLES - > 11 KV & < = 22 KV; WOOD - REPLACEMENT OF UNSTAKED POLE
- POLES - > 22 KV & < = 66 KV; WOOD - REPLACEMENT OF UNSTAKED POLE
- POLES - > 66 KV & < = 132 KV; WOOD - REPLACEMENT OF UNSTAKED POLE

This model relates to pole replacement only and does not include pole staking.

Analysis Outcome

The analysis was completed using historical data up to and including FY18. The CBA models forecast risk from FY19 onwards. The quantities included in FY19 are reflective of Ausgrid's committed program in this year.

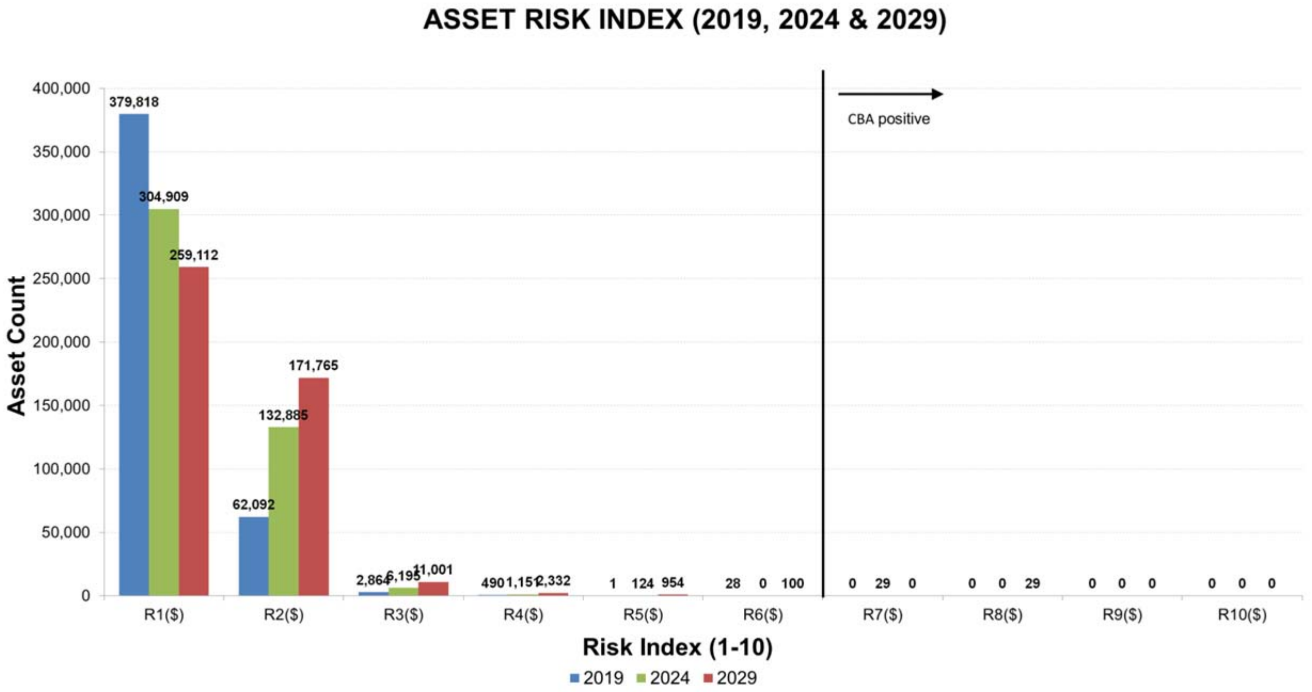
Based on the analysis completed, the model output is supporting the replacement of 22,358 poles by the end of FY24. This includes 3,209 poles committed for replacement during FY19 and a total of 19,149 poles during FY20 to FY24.

In forming this decision Ausgrid considered three options and performed sensitivity analysis as described later in this document. Ausgrid is recommending Option 1 for the reactive replacement of poles - this aligns with Ausgrid's historical practise of primarily replacing poles only when condition issues are identified during the pole inspection process.

Risk Index

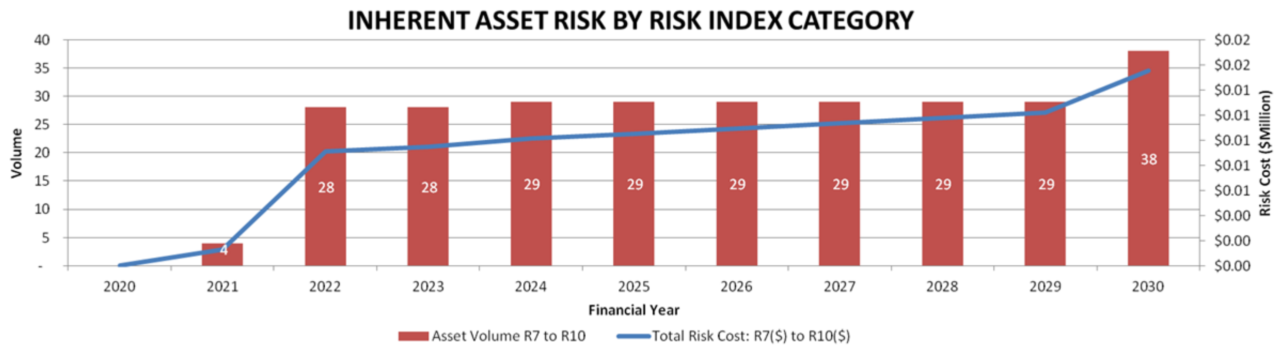
The normalised risk index below considers the probability of failure, consequence of failure and the annualised replacement cost.

[1] Attachment 5.13.M.0 – Repex program CBA modelling methodology



There are no poles which are cost benefit positive during FY20 to FY24 following replacement of 3,209 poles during FY19.

The inherent risk of poles that are cost benefit positive is shown in the figure below.



While it is inherently understood that pole failures can lead to a significant safety risk exposure, particularly to the public, the low risk shown in the Risk Index is reflective of Ausgrid's strong history in managing this asset class. The low Incident Conversion Rates (ICR) capture Ausgrid's strong recent history in managing this asset class utilising condition based replacement.

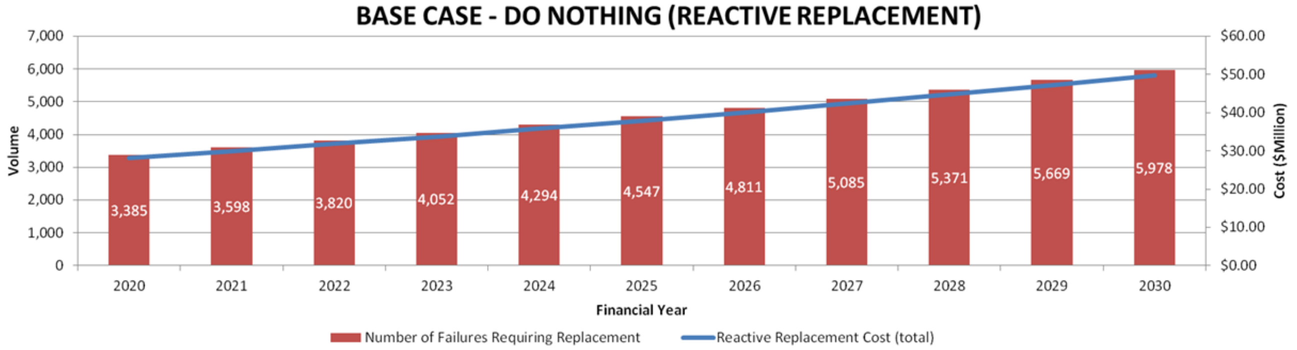
The historical failures included in the probability of failure modelling include both condition based and functional failures. An effective condition based replacement approach is captured within the failure forecast and therefore within the base case (reactive replacement) option.

Option One – Base case (reactive replacement)

Under a base case scenario, if Ausgrid were to adopt a reactive replacement strategy, the minimum replacement quantity during FY20 to FY24 is 19,149 poles. The table below shows the quantity of assets which will require reactive replacement in the year that they are forecast to fail.

Financial Year	FY20	FY21	FY22	FY23	FY24
Quantity for replacement	3,385	3,598	3,820	,4052	4,294

This quantity represents the minimum required replacement volume with no proactive strategy adopted.



Option Two – Replace where cost benefit positive

Given the model shows no poles as cost benefit positive during FY20 to FY24, this option is not considered as supported.

Option Three – Replace all cost benefit positive by the end of the period

Given the model shows no poles as cost benefit positive during FY20 to FY24, this option is not considered as supported.

Data input

		Data Source
Population	445,293	SAP – Asset Register
Object Types	POLE	SAP – Asset Register
Conditional & Functional Failures / Time Period	38,178 failures 6 years	SAP – Defect Records
Asset standard life	52.07 years	RAB life
WACC	3.90%	Regulated Rate

Planned Replacement Cost

A weighted average for the period per asset was used in this model.

Cost	Data Source
$8,335	2020-24 Revised Regulatory Proposal (FY19 real direct costs +25% of indirect costs)

Weibull parameters

The Weibull parameters have been developed by applying asset age to failure correlation using Ausgrid historical data relating to failures and assets.

β_{good}	4.1634	$\beta_{average}$	4.1686	β_{poor}	4.1737
n_{good}	70.4252	$n_{average}$	70.0573	n_{poor}	69.6923
$b_{(intercept)}$	-17.7135				

Adjustments factors

Probability of Failure (PoF)	• Actual Failure Data • Age • Previous staking • Previous termite attack • Pole diameter • Last recorded pole strength
Probability of Consequence (PoC)	• Proximity to school • Voltage of circuit on pole • Spatial risk score (based on factors including bushfire risk and people / traffic exposure)

Model calculated failures

	2020	2021	2022	2023	2024
Failures	6,770	7,195	7,639	8,104	8,588

Sensitivity

Ausgrid tested the sensitivity of the applied grossly disproportionate factor by applying a range of 6, based on the public safety risk. Due to this model being based on reactive replacements, there was no change to the model outcome.

Modelled inherent incident consequences

In determining the probability of severity, Ausgrid has utilised available information to determine the rate of occurrence of an event by each severity. These values were then tested for sensitivity.

Safety
Worker Safety ICR – 0.028% (Ausgrid recorded ICR)
Public Shock ICR – 0.016% (Ausgrid recorded ICR)

Severity	Cost of Consequence	Probability of Consequence	Grossly DF	Probability of Severity	Years until event
Severe	$ 4,469,292	0.0000031	10	0.007	50
Major	$ 446,929	0.0000062	8	0.014	25
Moderate	$ 44,693	0.0000165	6	0.036	10
Minor	$ 4,469	0.0000311	4	0.071	5.0
Insignificant	$ 447	0.0003802	2	0.871	0.4

Average **safety** consequence per asset: $168 per event.

Ausgrid have proposed that an inherently a fatality would occur due to a failure of a pole every 50 years based on the population and industry experience. Doubling or halving the probability of severity does not change the outcome of the program to being planned rather than reactive during FY20 to FY24.

Fire
ICR – 0.006% (Ausgrid's recorded ICR)

Severity	Cost of Consequence	Probability of Consequence	Grossly DF	Probability of Severity	Years until event
Severe	$ 66,000,000	0.0000010	10	0.017	150
Major	$ 6,600,000	0.0000016	8	0.025	100
Moderate	$ 660,000	0.0000062	6	0.100	25
Minor	$ 66,000	0.0000156	4	0.250	10
Insignificant	$ 6,600	0.0000379	2	0.608	4.1

Average **fire** consequence per asset: $804 per event.

Ausgrid have proposed that an inherently severe fire would occur due to a failure of a pole every 150 years based on the population and industry experience. Doubling or halving the probability of severity does not change the outcome of the program to being planned rather than reactive during FY20 to FY24.

Environment
ICR – 0%

Severity	Cost of Consequence	Probability of Consequence	Grossly DF	Probability of Severity	Years until event
Severe	$ 10,193,119	n/a	1	n/a	n/a
Major	$ 4,558,501	n/a	1	n/a	n/a
Moderate	$ 1,019,312	n/a	1	n/a	n/a
Minor	$ 101,931	n/a	1	n/a	n/a
Insignificant	$ 10,193	n/a	1	n/a	n/a

Average **environment** consequence per asset: $ n/a.

Ausgrid have considered that there are negligible environmental consequences relating to poles (excluding when the pole is supporting oil filled equipment). There have been no recorded environmental impacts (excluding fire) as a result of these assets.

Loss of supply
Ausgrid's failure data has been reviewed to estimate the proportion of failures resulting in unserved energy and reasonable switching / restoration times.

Outage Type	Sub-transmission	LV	HV	Data Source
Proportion of failures resulting in	0.6%	0.6%	0.6%	OMS Data

unserved energy				
VCR	$40.73/kWh	$40.73/kWh	$40.73/kWh	AEMO / AER
Automatic protection time/Proportion load	1 min / 100%	0 min / 0%	1 min / 0%	Network Design
Switching time/Proportion load	1 hrs / 0%	1 hrs / 0%	1 hrs / 100%	Estimated
Restoration/repair time/Proportion load	4 hrs / 0%	4 hrs / 100%	4 hrs / 0%	Estimated
Time without supply	0.006 hrs	0.024 hrs	0.006 hrs	Calculated

Average **loss of supply** consequence per asset: $420 per event.

Finance

		Data Source
Annual deferral benefit of reactive	$313	20% increase on planned replacement cost applied at the WACC
Repair cost	$129	FY13-FY18 actuals (Direct '19)
Proportion replaced	50%	SAP – Asset Register
Weighted replacement/repair cost	**$221**	Calculated
Maintenance original asset per annum	$20	Based on historical maintenance
Maintenance replacement asset per annum	$5	Based on historical maintenance
Maintenance benefit per asset per annum	**$15**	Calculated

Average **financial** consequence/benefit per asset: $236 per event.

AVERAGE TOTAL CONSEQUENCE per asset: $1,628 (including POC x C($))