Investment Evaluation Summary (IES)

Project Details:

Project Name:	Burnie-Waratah H Pole Replacement Program
Project ID:	01425
Business Segment:	Transmission
Thread:	Transmission Lines
CAPEX/OPEX:	CAPEX
Service Classification:	Prescribed
Scope Type:	D
Work Category Code:	RENTL
Work Category Description:	Transmission Lines
Preferred Option Description:	Manage all wood pole structures in conjunction with a targeted steel pole replacement
Preferred Option Estimate (Dollars $2016/2017):	$2,581,250

	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Unit ($)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume	0.29	0.00	0.00	0.30	0.00	0.00	0.26	0.00	0.00	0.15
Estimate ($)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total ($)	$1,268,750	$0	$0	$1,312,500	$0	$0	$1,137,500	$0	$0	$656,250

Governance:

Works Initiator:	Andrew Ling	Date:	09/11/2018
Team Leader Endorsed:	Darryl Munro	Date:	15/11/2018
Leader Endorsed:	Nicole Eastoe	Date:	20/11/2018
General Manager Approved:	Wayne Tucker	Date:	22/11/2018

Related Documents:

Description	URL
Estimate	http://Reclink/R681162
Asset Management Plan	http://Reclink/R32681
NPV	http://Reclink/R1188404
TasNetworks Transformation Roadmap 2025	http://Reclink/R764285
TasNetworks Corporate Plan - Planning period: 2017-18	http://reclink/R745475
TasNetworks Risk Management Framework	http://Reclink/R238142
TasNetworks Business Plan 2017-18	http://Reclink/R779008
National Electricity Rules (NER)	http://www.aemc.gov.au/Energy-Rules/National-electricity-rules/Current-Rules

Section 1 (Gated Investment Step 1)

1. Overview

1.1 Background

Transmission line support structures comprise the physical infrastructure from which insulators, electrical conductors or associated hardware are attached or suspended.

Wood pole structures have been utilised by TasNetworks on a small number of transmission lines, and have generally been used where either a shorter asset life or lower level of reliability can be tolerated.

At June 2017 there were 222 wood pole structures installed on TasNetworks' transmission network, a large number of these were installed in the 1960s resulting in many wood pole structures exceeding their design life of 45 years.

Wood pole structures generally consist of two wood poles treated with copper chromium arsenic (CCA), and a steel cross piece constructed in an 'H' arrangement with guy wires as required.

These structures must be maintained in a serviceable state to mitigate pole failure and the risk of the conductor falling to ground, and to ensure that transmission faults do not pose an unacceptable risk to the public or personnel.

Wood pole structures have an economic life of 45 years, and while economic age is not the predominant driver for asset replacement decisions, it is important to recognise that the probability of failure increases significantly towards the end of an asset's useful life. As such, incremental component renewal is no longer considered viable when a wood pole structure approaches its stated economic life.

TasNetworks routinely tests wood pole cores every three years to determine the remaining sound wood within a pole. It is TasNetworks' policy that any pole found to have insufficient sound wood will be condemned, with replacement to occur within three months.

1.2 Investment Need

Wood pole structures are a vital component of the transmission system and represent an inherent operational and safety risk when condition deteriorates sufficiently.

The most common failure mode for wood poles is structural failure due to wood rot, particularly below ground where the wood pole or wood stay anchor is subjected to moisture and bacteria, but also at the interface between the top of the pole and the pole riser (where fitted).

Structural failure of a wood pole presents a significant risk to security of supply, where a fault outage would be caused through the dropping of a conductor, with a significant duration to make the required repairs to the structure.

Another consequence of a wood pole failure is the structure and live conductors falling to the ground and potentially initiating a bushfire, injuring the public, or causing damage to third party property.

At January 2018 the Burnie-Waratah 110kV transmission line had 87 wood pole structures aged 51 years still remaining in service, which is exceedance of their economic age of 45 years. It is forecast that 51 wood poles will be condemned in the 2019-24 regulatory period due to poor condition and end of life.

1.3 Customer Needs or Impact

TasNetworks has undertaken a range of activities to gather feedback, and to understand the issues and concerns that are important to our customers. We have a range of customer, from very large customers directly-connected to

our transmission network to large and small customers connected through our distribution network. TasNetworks continues to undertake customer engagement as part of business as usual and through the voice of the customer program. This engagement seeks in depth feedback on specific issues relating to:

- TasNetworks' Business Vision 2025;
- TasNetworks Grid Vision scenarios, including key load, generation and interconnection scenarios;
- New technologies and the future network;
- Customer's preferences on service, price and reliability;
- Regulatory Framework including incentive schemes;
- Forecast expenditure programs; and
- Transmission Pricing Strategies and Methodologies.

Through the engagement, customers have identified that we are meeting most customers' needs from an overall reliability perspective, but for some their needs and expectations are changing especially in regards to safety, restoration of faults/emergencies and reliability of supply. Customers identified TasNetworks needs to provide for their future needs including: affordability, environmentally sustainable, communicative, innovative, efficient and reliable services.

This project specifically addresses the requirements of our customers in the areas of safety, restoration of faults/emergencies and reliability of supply.

This program may affect TasNetworks' prescribed customers in the following ways:

- some customers may be affected by line outages; and
- land owners will be contacted prior to entering a property.

Failure to address the drivers of this project will lead to negative impacts on customers, through decreased reliability of service.

1.4 Regulatory Considerations

This project is required to achieve the following capital expenditure objectives as described by the National Electricity Rules section 6A.6.7.

This project is required to achieve the following capital expenditure objectives:	Yes/No
Meet the expected demand for prescribed transmission services.	No
Comply with all applicable regulatory obligations associated with the provision of prescribed transmission services.	No
Maintain the quality, reliability and security of supply of prescribed transmission services.	Yes – failure of a wood pole will affect the security of supply.
Maintain the reliability, safety and security of the transmission system through the supply of prescribed transmission services.	Yes – failure of a wood pole structure will bring live conductors to the ground, potentially causing a public safety and security of supply event.

2. Project Objectives

This project proposes to mitigate the presented by wood pole failure, which could result in:

- potentially significant safety incidents, due to fallen wood pole structures and conductors; and
- decreased circuit reliability.

3. Strategic Alignment

3.1 Business Objectives

Strategic and operational performance objectives relevant to this project are derived from TasNetworks 2017-18 Corporate Plan, approved by the board in 2017. This project is relevant to the following areas of the corporate plan:

- We understand our customers by making them central to all we do;
- We enable our people to deliver value; and
- We care for our assets, delivering safe and reliable networks services while transforming our business.

3.2 Business Initiatives

The business initiatives reflected in TasNetworks Transformation Roadmap 2025 publication (June 2017) for transition to the future that have synergy with this project are as follows:

- Voice of the customer: We anticipate and respond to your changing needs and market conditions.
- Network and operations productivity: We'll improve how we deliver the field works program, continue to seek cost savings and use productivity targets to drive our business.
- Electricity and telecoms network capability: To meet your energy needs and ensure power system security, we'll invest in the network to make sure it stays in good condition, even while the system grows more complex.
- Predictable and sustainable pricing: To deliver the lowest sustainable prices, we'll transition our pricing to better reflect the way you produce and use electricity.

4. Current Risk Evaluation

The qualitative risk evaluation summarised in section 4.1 below shows the untreated risk associated with a do nothing option. It equates to a worst case scenario of inherent risk associated with a particular asset. A lower level of likelihood and / or consequence may be applied as part of the sensitivity analysis when calculating the total risk cost as part of the quantitative options analysis.

With a potentially severe consequence as a result of a wood pole structure failure the risk rating can not be reduced below medium.

Continuation of this program will maintain the risk rating at medium by maintaining a rare likelihood of a wood pole structural failure.

4.1 5x5 Risk Matrix

TasNetworks' business risks are analysed utilising the 5x5 corporate risk matrix, as outlined in TasNetworks Risk Management Framework.

Relevant strategic business risk factors that apply are as follows:

Risk Category	Risk	Likelihood	Consequence	Risk Rating
Customer	Wood H pole structure failure may result in loss of supply to customers on the radial transmission line.	Unlikely	Moderate	Medium
Environment and Community	Wood H pole structure failure may result in a bushfire event through a dropped conductor and subsequent loss of culturally significant property/vegetation.	Rare	Severe	Medium
Financial	Wood H pole structure failure may result in loss of supply to customers on the radial transmission line and subsequent network performance scheme penalties.	Unlikely	Negligible	Low
Network Performance	Wood H pole structure failure may result in loss of supply to customers or load shedding.	Rare	Minor	Low
Regulatory Compliance	Wood H pole structure failure may result in loss of supply to customers and inability to supply load.	Rare	Minor	Low
Reputation	Failure to replace wood pole structures may lead to a pole failure and subsequent safety or loss of supply event resulting in negative media exposure.	Rare	Negligible	Low
Safety and People	Failure to replace wood pole structures may lead to a pole failure resulting in serious injury or death.	Rare	Severe	Medium

5. Preferred Option:

Option 1 is the preferred option as it is the least cost option that satisfies the objectives outlined in this IES. The preferred option will consist of the procurement of steel poles, and the replacement of wood pole structures identified as being at risk of failure as part of 3 yearly inspections in line with the asset management plan.

Option 1 addresses all the requirements to mitigate the risk of asset failure by replacing those assets that are deemed to be in poor condition. This decreases the risk to public safety, and the risk to the environment. This option is typical of best industry practice relating to asset management.

The NPV analysis demonstrates that Option 1 is economically preferred over Option 0 and Option 2.

The benefit of implementing this option is that TasNetworks can maintain its assets to meet service level agreements, comply with appropriate Australian standards, maintain its current acceptable level of risk exposure, and meet performance targets.

5.1 Scope

Continue the established wood pole replacement program and replace condemned wood pole structure with either one (suspension) or two (strain) new steel poles.

5.2 Expected outcomes and benefits

The expected outcomes and benefits of the preferred option are as follows:

- Reduce business risk by replacing condemned wood poles;
- Alignment with strategic asset management plans;
- Achieve reliable transmission line wood pole performance consistent with prescribed service standards;
- Compliance with relevant Australian standards; and
- Meet performance objectives identified in Transend Networks Corporate Plan

5.3 Regulatory Test

The asset replacements within this program do not require a Regulatory Investment Test for Transmission (RIT-T) as per the requirements of the NER.

6. Options Analysis

Completion of options analysis has been undertaken using a modified Net Present Value (NPV) tool, to include Risk Cost. Risk Cost represents the expected annual cost of risk events ($ million) associated with the failure of asset. The business as usual case (BAU) base case definition applied in the options analysis is aligned to AER repex planning guideline. The NPV outcomes for all options considered, is relative to the BAU base case. The NPV tool has also been modified to include a Basis of Preparation. This enables increased transparency of the methodology and analysis undertaken, outlining methodology, key inputs, key assumptions. The Risk Cost methodology is represented as below:

Annual Asset Risk Cost = Probability of Asset Failure (PoF) * Asset units (No) * Likelihood of Consequence of Failure (LoC) * Cost of Consequence (CoC).

The analysis of all options is aligned with the Australian Energy Regulators application note for asset replacement planning, to ensure alignment of our approach. The risk cost categories, likelihood and consequence ratings are aligned with TasNetworks Corporate Risk Framework. The categories can also be mapped to the AER's repex planning guideline.

AON, TasNetworks corporate insurer provided Cost of Consequence (CoC) and Likelihood of Consequence (LoC) data. We have also analysed our assets and sought additional benchmarked data to develop Likelihood of Failure, Likelihood of Consequence and Cost of Consequence when it can be obtained.

The summary of costs outlined in section 6.3 below indicate the planned capital expenditure for repex over the 2019-24 period.

6.1 Option Summary

Option description	
Option 0	No planned capital investment - reactive pole replacement only
Option 1 (preferred)	Manage all wood pole structures in conjunction with a targeted steel pole replacement
Option 2	Manage all wood poles in conjunction with a deferred targeted steel pole replacement

6.2 Summary of Drivers

Option	
Option 0	Option 0 is the continuation of the wood pole inspection and maintenance operational program only, with no large scale preventative replacement works. Corrective and emergency wood pole replacement will be carried out on a pole for pole basis when required as an operational cost. The implementation of this option will result in TasNetworks replacing any deteriorated wood poles with new wood poles. This option will continue to mitigate the risk of a pole failure; however the utilisation of wood poles (rather than steel poles) will continue to expose TasNetworks to the risk of pole rot and eventual failure, together with the ongoing cost of pole testing. Wood poles will also result in TasNetworks failing to manage the risk of significant asset failure in the event of a bushfire.

	Rejected – This option is rejected as it has a higher lifecycle cost in comparison to Options 1 and 2 and does not mitigate the safety risks due to H-pole failure and risk of asset damage as a result of bushfires.
Option 1 (preferred)	Option 1 seeks to continue TasNetworks' established wood pole replacement program. Option 1 involves the replacement of structures containing wood poles identified as being at risk of failure, with either one (suspension) or two (strain) new steel poles. By reducing the likelihood of a wood pole failure this option fully addresses TasNetworks' safety, business and environmental risks identified in this IES. Option 1 is aligned with the Asset Management Plan, TasNetworks' Risk Register, and the performance objectives set by the business in the Corporate Plan. The age of the existing wood H pole structures and forecast condemning rates will see 51 wood H pole sturctures replaced in the 2019-24 regulatory period. Preferred – This option has the lowest lifecycle cost and sufficiently mitigates the safety risks due to H-pole failure and risk of asset damage as a result of bushfires.
Option 2	This option is the same as Option 1, except that new wood poles would be utilised in 2024-29 as an operational cost, with new steel poles to be used in 2024-29 as part of a capital replacement program. Rejected – This option is rejected as it has a higher lifecycle cost in comparison to Options 1 and does not sufficiently mitigate the safety risks due to H-pole failure and risk of asset damage as a result of bushfires.

6.3 Summary of Costs

Option	Total Cost ($)
Option 0	$0
Option 1 (preferred)	$2,581,250
Option 2	$0

6.4 Summary of Risk

With a potentially severe consequence as a result of a wood pole structure failure the risk rating can not be reduced below medium. Delaying or ceasing programmed expenditure on at risk wood pole structures results in the risk of failure increasing from rare to an unlikely and results in the overall risk rating increasing to high. This increase in overall risk is not acceptable to TasNetworks and is not aligned with the asset management plan or corporate plan.

Option No.	Option description	NPV	Reason for selection/rejection
0	No planned capital investment - reactive pole replacement only	-$4,843,764	Rejected – This option is rejected as it does not mitigate the safety risks due to H-pole failure and risk of asset damage as a result of bushfires, and transmission line wood H pole structures have a higher lifecycle cost in comparison to steel poles in Options 1 and 2.

1	Manage all wood pole structures in conjunction with a targeted steel pole replacement	$331,880	Preferred – This option sufficiently mitigates the safety risks due to H-pole failure and risk of asset damage as a result of bushfires and has the lowest lifecycle cost of the options.
2	Manage all wood poles in conjunction with a deferred targeted steel pole replacement	-$1,930,049	Rejected – This option is rejected as it does not sufficiently mitigate the safety risks due to H-pole failure and risk of asset damage as a result of bushfires.

6.5 Economic analysis

Option	Description	NPV
Option 0	No planned capital investment - reactive pole replacement only	-$4,843,764
Option 1 (preferred)	Manage all wood pole structures in conjunction with a targeted steel pole replacement	$331,880
Option 2	Manage all wood poles in conjunction with a deferred targeted steel pole replacement	-$1,930,049

6.5.1 Quantitative Risk Analysis

A Quantitative Risk Analysis has been completed for this investment.

For this NPV the historical condemning rate based on the population of wood poles has been exponentially extrapolated to predict the number of failures in the remaining wood poles. This modelling predicts that the last wood H pole is likely to be condemned at age 64 which is considered consistent with the oldest remaining wood pole in the distribution network.

Based on consequence cost information from TasNetworks' insurer there is a 1 in 35 chance of a minor impact on property, safety and environment and community which have been modelled in the NPV.

6.5.2 Benchmarking

TasNetworks participates in various formal benchmarking forums with the aim to benchmark asset management practices against international and national transmission companies. Key benchmarking forums include:

- International Transmission Operations & Maintenance Study (ITOMS); and
- Australian Energy Regulator (AER) Regulatory Information Notices (RIN).

TasNetworks also works closely with transmission companies in other key industry forums such as CIGRE (International Council on Large Electric Systems), to compare asset management and performance.

Neither benchmarking forum report specifically on wood pole transimisison lines. For ITOMS these costs rolled up into CAPEX and OPEX per structure for reporting purposes. Compared to other Transmission Network Service Providers (TNSPs) who participate in ITOMS TasNetworks CAPEX and OPEX per structure is below the peer average with CAPEX expenditure per structure consistently amongst the lowest.

6.5.3 Expert findings

Nil.

6.5.4 Assumptions

The major assumptions used in the NPV analysis are as follows:

- NPV analysis is carried out for a 25 year period (2019 to 2044);
- A discount rate of 3.59 per cent is used;
- There will be an annualised saving of $11k per year after condemned wood poles have been replaced due to reduced wood pole inspection requirements;
- It is assumed that if a wooden H-Pole is not replaced within 4 years of condemning that it will fail;
- Based on the condemming rate for aged wood H-poles, 51 will be replaced in 2019-2024;
- All remaining poles (36) will be replaced in 2024-2029.