# Investment Evaluation Summary (IES)

## Project Details:

| | |
|---|---|
| **Project Name:** | Pole Replacements |
| **Project ID:** | 00661 |
| **Thread:** | Structures |
| **CAPEX/OPEX:** | CAPEX |
| **Service Classification:** | Standard Control |
| **Scope Type:** | B |
| **Work Category Code:** | REPOL |
| **Work Category Description:** | Pole Replacements |
| **Preferred Option Description:** | Replace poles based on condition. Do not replace poles due to poor condition or that have been damaged. |
| **Preferred Option Estimate (Nominal Dollars):** | $79,500,000 |

| | 17/18 | 18/19 | 19/20 | 20/21 | 21/22 | 22/23 | 23/24 | 24/25 | 25/26 | 26/27 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Unit ($)** | $9,230 | $9,230 | $9,230 | $9,230 | $9,230 | $9,230 | $9,230 | $9,230 | $9,230 | $9,230 |
| **Volume** | 810 | 810 | 810 | 810 | 810 | 810 | 810 | 810 | 810 | 810 |
| **Estimate ($)** | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 |
| **Total ($)** | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 | $7,476,300 |

## Governance:

| | | | |
|---|---|---|---|
| **Project Initiator:** | Erin Cook | **Date:** | 26/03/2015 |
| **Thread Approved:** | David Ellis | **Date:** | 02/11/2015 |
| **Project Approver:** | David Eccles | **Date:** | 30/10/2015 |

## Document Details:

| | |
|---|---|
| **Version Number:** | 1 |

## Related Documents:

| Description | URL |
|---|---|
| REPOL NPV | http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Overhead%20Systems%20and%20Structures/REPOL%20Pole%20Replacements/TasNetworks%20NPV%20REPOL.xlsm |
| REPOL IES | http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Overhead%20Systems%20and%20Structures/REPOL%20Pole%20Replacements/REPOL%20Investment%20Evaluation%20Summary.docx |

# Section 1 (Gated Investment Step 1)

## 1. Background

Structures provide support, insulation and adequate clearances between the overhead conductors, overhead switchgear and pole mounted transformers and the ground, vegetation and building infrastructure.

There are four main types of structure are used in the distribution system:

1. Wood poles (natural and treated);
2. Steel and concrete poles (commonly known as Stobie poles);
3. Spun concrete poles; and
4. Steel structures, including:

a. Steel lattice poles;
b. Steel lattice towers;
c. Railway section (RSJ) steel poles;
d. Round steel service poles; and
e. Square section steel service poles.

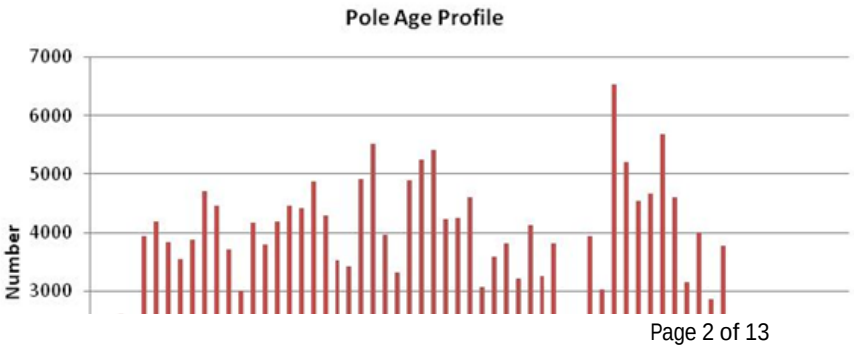
Accessories associated with structures are:

- Stays;
- Stakes;
- Pole Operating Platforms;
- Fauna guards (such as possum guards, cattle/horse guards and bird perches)
- Anti-climbing barriers;
- Easements and way-leaves; and
- Access tracks.

There are some structures that are joint use with other services such as communications cables and road lighting.

**Table 1: Pole types installed in TasNetworks' distribution system (as at Jan 2014)**

| Description | Number Installed (including Private Poles) | Number Installed (Aurora Owned) |
|---|---|---|
| Natural Wood Poles | 5,628 | 4,019 |
| CCA Treated Wood Poles | 234,121 | 198,822 |
| Steel and Concrete (Stobie) Poles | 6,779 | 6,577 |
| Spun Concrete Poles | 86 | 63 |
| Prestressed Concrete | 80 | 80 |
| Steel Lattice Poles | 1,383 | 1,331 |
| Steel Lattice Towers | 339 | 148 |
| Railway Section Steel Poles | 527 | 216 |
| Steel Other | 45,011 | 8,701 |
| Other/Unknown | 449 | 261 |
| **Total** | **294,403** | **220,218** |



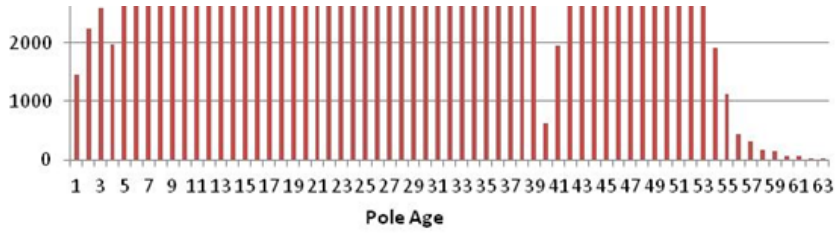



Figure 1 Age profile structures

**Wooden Poles**

**Natural Wood Poles**

Natural wood poles come from an untreated eucalypt sourced from Tasmania. TasNetworks sourced natural wood poles were of the 'ironwood' (Eucalyptus siberius) species procured under contract from the St Mary's district until 1994. These were originally sourced from old growth forest but in later years moved to regrowth.

It was soon discovered that regrowth wood had pole integrity issues due to an increased susceptibility to heart rot. This has resulted in historical failures of natural wood poles with a life as little as seven years.

Natural wood poles have no preservative and therefore the sap wood is prone to deteriorate very quickly especially below ground level. The sapwood is not included in the calculation of pole strength on these poles.

**Copper-Chrome-Arsenate (CCA) Wood Poles**

The treated wood poles used in the distribution system are harvested and treated locally. These poles are typically Natural Durability Class 3 and 4 timbers (as per AS5604 Timber – Natural Durability Ratings), as there are no Natural Durability Class 1 and 2 poles grown within Tasmania.

Natural Durability Class 3 and 4 timbers are less dense and more prone to decay and have a shorter probably life expectancy than the Natural Durability Class 1 and 2 timbers typically used in mainland Australia.

The treatment used on the poles is pressure impregnated Copper-Chrome Arsenate (CCA). The average treatment applied has increased over time, as indicated in Table 2.

**Table 2: Level of CCA treatment**

| | Average Treatment (kg/m3) | Minimum Treatment (kg/m3) |
|---|---|---|
| Pre-1970 | 10 | 6.5 |
| 1971-1980 | 12 | 8 |
| 1981-1994 | 15 | 10 |
| Post-1994 | 24 | 18 |

Wood poles are purchased with a metal pole cap attached over the top of the pole to reduce the ingress of water from the top of the pole through the pole centre assisting pole decay.

CCA wood poles are considered to be cost effective and also afford a significant insulation medium for bare overhead lines.

Analysis has been performed comparing the annual equivalent cost for Class 1 and 2 wooden poles, Class 3 and 4 wooden poles, concrete poles and steel poles. The analysis demonstrates that class 3 and 4 CCA wood poles are the most cost effective option for TasNetworks. Refer to R295175 Structures – Annual Equivalent Calculation.

Figure 2: Wood pole that has failed in service

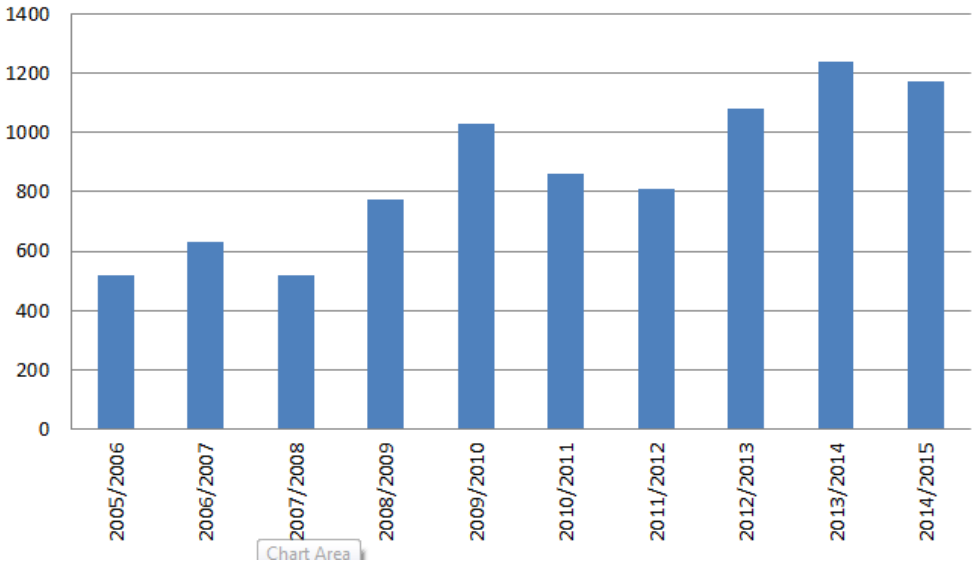



Figure 3: Historical Pole Replacement Volumes

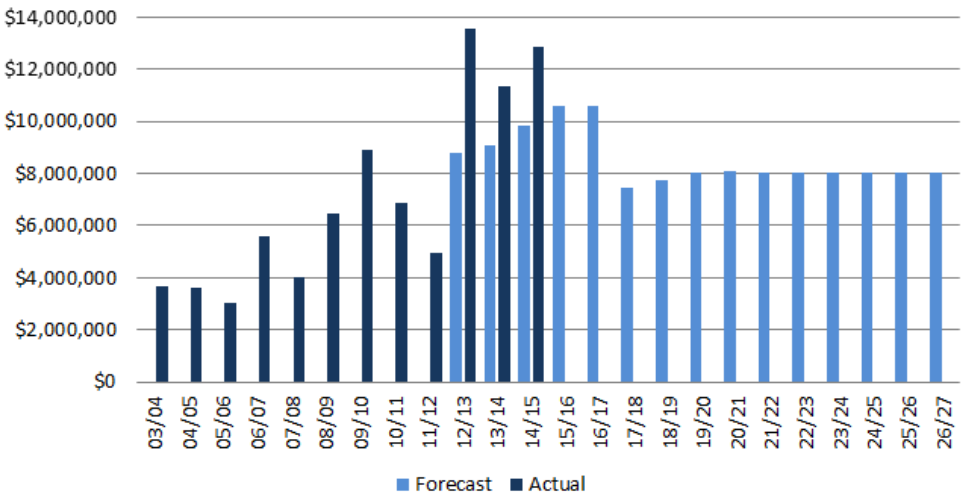



Figure 4: Pole Renewal Expenditure

### 1.1 Investment Need

Wooden poles, whether natural or treated, are prone to natural deterioration. Soft rot attacks the outside of the pole and occurs from the ground line to a depth of 300 to 400 mm below the ground. Heart rot is a fungal attack on the interior of the pole and generally occurs within 300mm of the ground line.

The rate of wood pole deterioration depends on the species of timber, the initial preservative treatment, installation location, soil conditions, method of inspection, drilling, excavation and reinstatement. Decay occurs when both moisture and oxygen are present.

This program has two components:

- Replace condemned pole; and
- Replace Poles MRBA Storms

**Replace Condemned Pole**

The aim of this program is to replace poles that are classified as condemned by TasNetworks' pole inspection program. These condemned poles require replacement within a set period not exceeding 4 months.

The driver for this program is public safety. TasNetworks is responsible to ensure that a pole at the end of its life is removed from service before it fails.

Approximately 25% of impaired poles are replaced the others are staked. The volumes are based on historical data and condition information that is gathered about the poles during audits (safety factor, amount of rot).

There are no major changes to this program and expenditure in the next regulatory period is based on the:

Current trend of condemning poles; and

Age profile of current poles with significant increases in poles >40 years old during the determination period

**Replace Poles MRBA (extreme events such as storms)**

This is a reactive work program to cover the capitalisation of pole replacements undertaken under fault during major events such as during a storm or bushfire.

The work is initially performed under the fault and emergency budget and later transferred to this program.

This is a pre-existing program and there are no major changes to this program and the proposed expenditure is to remain consistent with historical spend.

### 1.2 Customer Needs or Impact

TasNetworks continues to undertake consumer 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:

- how it prices impact on its services
- current and future consumer energy use
- outage experiences (frequency and duration) and expectations
- communication expectations
- STPIS expectations (reliability standards and incentive payments)
- Increasing understanding of the electricity industry and TasNetworks

Consumers have identified safety, restoration of faults/emergencies and supply reliability as the highest performing services offered by TasNetworks.

Consumers also identified that into the future they believe that affordability, green, communicative, innovative, efficient and reliable services must be provided by TasNetworks.

This project specifically addresses the requirements of consumers in the areas of safety and affordability.

### 1.3 Regulatory Considerations

This project is required to achieve the following capital and operational expenditure objectives as described by the National Electricity Rules section 6.5.7(a) and 6.5.6(a). 6.5.7 (a) Forecast capital expenditure (2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services; (4) Maintain the safety of the distribution system through the supply of standard control services.

## 2. Project Objectives

The objective of this program is to replace poles identified from the pole inspection program or damaged by storms or damaged by

3rd party.

# 3. Strategic Alignment

### 3.1 Business Objectives

Strategic and operational performance objectives relevant to this project are derived from TasNetworks 2014 Corporate Plan, approved by the board in 2014. 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.
- We care for our assets, delivering safe and reliable networks services while transforming our business.

### 3.2 Business Initiatives

The business initiatives that relate to this project are as follows:

- Safety of our people and the community, while reliably providing network services, is fundamental to the TasNetworks business and remains our immediate priority
- We care for our assets to ensure they deliver safe and reliable network services

The strategic key performance indicators that will be impacted through undertaking this project are as follows:

- Price for customers – lowest sustainable prices
- Zero harm – significant and reportable incidents
- Sustainable cost reduction – efficient operating and capital expenditure

# 4. Current Risk Evaluation

The following section details the business risks specific to this project, as identified in TasNetworks Risk Management Framework as at March 2015.

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 follows:

| Risk Category | Risk | Likelihood | Consequence | Risk Rating |
|---|---|---|---|---|
| Financial | Excessive payout of reliability incentive schemes (STPIS, GSL, NCEF) from declining network reliability | Unlikely | Moderate | Medium |
| | Pole failure results in catastrophic bushfire, insurance providers refuse to cover TasNetworks for future events | Unlikely | Severe | High |
| | Pole failure results in serious injury or fatality | Possible | Major | High |
| Customer | Localised interruption to supply | Almost certain | Minor | Medium |
| Regulatory Compliance | Increased number of unplanned outages leads to systemic NCEF | Possible | Moderate | Medium |

| | | | | |
|---|---|---|---|---|
| | breaches | | | |
| Network Performance | Localised interruption to supply | Almost certain | Minor | Medium |
| Reputation | Pole failure results in bushfire with significant media coverage | Possible | Moderate | Medium |
| | Pole failure results in catastrophic bushfire with significant media coverage | Unlikely | Major | Medium |
| | Pole failure results in serious injury or fatality with significant media coverage | Unlikely | Major | Medium |
| Environment and Community | Pole failure results in bushfire with some loss to property | Possible | Major | High |
| | Pole failure results in catastrophic bushfire with widespread loss of property and potential fatality | Unlikely | Severe | High |
| Safety and People | Pole failure results in injury or death to member of the public | Unlikely | Severe | High |

### 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 follows:

| Risk Category | Risk | Likelihood | Consequence | Risk Rating |
|---|---|---|---|---|
| Customer | Localised interruption to supply | Likely | Negligible | Low |
| Environment and Community | Pole failure results in bushfire with some loss to property | Unlikely | Major | Medium |
| Financial | Payout and legal fees from pole failure resulting in serious injury or fatality | Unlikely | Moderate | Medium |
| Network Performance | Localised interruption to supply | Almost Certain | Negligible | Medium |
| Regulatory Compliance | Increased number of unplanned outages leads to systemic NCEF breaches | Almost Certain | Minor | Medium |
| Reputation | Pole failure results in bushfire with significant media coverage | Possible | Minor | Low |
| Safety and People | Pole failure results in injury or death to member of the public | Unlikely | Severe | High |

## Section 1 Approvals (Gated Investment Step 1)

| | | | |
|---|---|---|---|
| **Project Initiator:** | Erin Cook | **Date:** | 26/03/2015 |
| **Line Manager:** | | **Date:** | |
| **Manager (Network Projects)<br>or<br>Group/Business Manager (Non-network projects):** | | **Date:** | |
| [Send this signed and endorsed summary to the Capital Works Program Coordinator.] | | | |

| **Actions** | | | |
|---|---|---|---|
| **CWP Project Manager commenced initiation:** | | **Assigned CW Project Manager:** | |
| **PI notified project initiation commenced:** | | **Actioned by:** | |

# Section 2 (Gated Investment Step 2)

## 5. Preferred Option:

The preferred option is to replace poles as they are deemed condemned by our pole inspection program. Not proceeding with this option may result in death or serious injury to a member of the public from pole failures. It is recommended that poles are replaced based on condition rather than age. As age has not proven to be the determining factor on condition, environmental factors have shown to have more effect.

### 5.1 Scope

As of February 2015 TasNetworks owns and maintains 220,218 poles in Tasmania. The condition of these poles are inspected on a 5 year cycle (excluding natural wood poles which are on a 3.5 year cycle). When a pole is deemed condemned by an asset inspector, it is replaced under this program. The scope of work will include the renewal of unserviceable structures or supports and may be generated by; a) Inspections undertaken by Asset Inspectors and recorded in WASP. b) Requests from RAMs or Asset Investment and Performance c) Field crews attending faults. Condemned poles are to be renewed within the time period allocated. Poles should be replaced with the equivalent size pole and pole top arrangement. If the pole includes a transformer then the rating of the replacement pole should be suitable for that sized transformer.

### 5.2 Expected outcomes and benefits

The expected outcomes of this program are continued safe and reliable running of the network. Replacing pole based on their condition presents the lowest life cycle cost while reducing environmental and safety risk as well as reducing fault response and customer outages.

### 5.3 Regulatory Test

## 6. Options Analysis

**Option Summary**

**Option 0: Do Nothing**

Do not replace poles due to poor condition or that have been damaged

**Advantages:**

- Lowest cost solution

**Disadvantages:**

- Does not reduce the likelihood of injury or fatality due to a failing pole.
- Does not reduce the likelihood of exposure of the public to energised electrical equipment or being hit by a failed pole.
- Customers will be exposed to increased unplanned outages. If poles are not replaced after failure, it is likely TasNetworks would be unable to service some customers.

**Option 1: Replace poles based on condition**

Replace poles due to poor condition or that have been damaged

**Advantages:**

- Costs in completing this work are sustainable
- Minimises likelihood of exposure to the public

**Disadvantages:**

- Cannot completely eliminate the risk of poles failing in service

**Option 2: Replace poles based on age**

Replace poles once they reach 45 years old.

**Advantages:**

- Will maintain an age base of poles 45 years or less

**Disadvantages:**

- Significant costs to undertake this option
- Does not do enough to reduce the likelihood of a failed pole causing injury or fatality. By replacing poles purely by age there is still a high risk of poor condition poles less than 45 years old failing.
- Environmental factors have shown to have a greater influence on condition rather than age. Therefore age alone is not a good proxy for condition or time till failure.

### 6.1 Option Summary

| Option description | |
|---|---|
| Option 0 | Do nothing. Do not replace poles due to poor condition or that have been damaged. |
| Option 1 (preferred) | Replace poles based on condition. Do not replace poles due to poor condition or that have been damaged. |
| Option 2 | Replace poles based on age. Replace poles once they reach 45 years old. |

### 6.2 Summary of Drivers

<table>
<tr><th>Option</th><th></th></tr>
<tr><td>Option 0</td><td>
<table>
<tr><th>Minimise risks to public safety</th><th>Minimise outage frequency and duration</th><th>Deliver the most cost effective solution</th></tr>
<tr><td>The risks to public safety from pole failure are high.</td><td>There will be a higher incident of unplanned outages due to pole failure</td><td>This option has the lowest upfront costs. Additional costs to the Business are incurred in the form of NECF and STPIS payments. As this option does not address the risk to public safety it is highly likely to involve further costs due to incidents and legal proceedings.</td></tr>
</table>
</td></tr>
<tr><td>Option 1 (preferred)</td><td>
<table>
<tr><th>Minimise risks to public safety</th><th>Minimise outage frequency and duration</th><th>Deliver the most cost effective solution</th></tr>
<tr><td>The risks to public safety from pole failure are low, but cannot remove the risk entirely.</td><td>There will be a lower incident of unplanned outages due to pole failure.</td><td>This is the lowest cost option that addresses the risk to public safety.</td></tr>
</table>
</td></tr>
<tr><td>Option 2</td><td>
<table>
<tr><th>Minimise risks to public safety</th><th>Minimise outage frequency and duration</th><th>Deliver the most cost effective solution</th></tr>
<tr><td>The risks to public safety from pole failure are lower than Option 0 but still does not adequately address public safety.</td><td>There will be a lower incident of unplanned outages due to pole failure compared to Option 0 but a higher number of outages compared to Option 1.</td><td>This is the highest cost option. This option necessitates the premature replacement of some assets. Additional costs to the Business in the form of NCEF and STPIS payments are lower than for</td></tr>
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| | | | |
|---|---|---|---|
| | | | Option 0 but will be higher than Option 1. |

### 6.3 Summary of Costs

| Option | Total Cost ($) |
|---|---|
| Option 0 | $0 |
| Option 1 (preferred) | $79,500,000 |
| Option 2 | $289,600,000 |

### 6.4 Summary of Risk

The below table shows the residual risks with the preferred option in place. The preferred option reduces the residual risk from the uncontrolled risk rating. The residual risk ratings are reduced to Medium or lower, which is within TasNetworks' risk appetite.

| Risk Category | Risk | Likelihood | Consequence | Residual Risk |
|---|---|---|---|---|
| Financial | Excessive payout of reliability incentive schemes (STPIS, GSL, NCEF) from declining network reliability | Unlikely | Moderate | Medium |
| | Pole failure results in catastrophic bushfire, insurance providers refuse to cover TasNetworks for future events | Rare | Severe | Medium |
| | Pole failure results in serious injury or fatality | Rare | Major | Medium |
| Customer | Pole failure results in localised interruption to supply | Possible | Minor | Low |
| Regulatory Compliance | Pole failure results in increased number of unplanned outages leads to systemic NCEF breaches | Unlikely | Moderate | Medium |
| Network Performance | Pole failure results in localised interruption to supply | Possible | Minor | Low |
| Reputation | Pole failure results in bushfire with significant media coverage | Unlikely | Moderate | Medium |
| | Pole failure results in catastrophic bushfire with significant media coverage | Rare | Major | Medium |
| | Pole failure results in serious injury or fatality with significant media coverage | Unlikely | Major | Medium |

| | | | | |
|---|---|---|---|---|
| Environment and Community | Pole failure results in bushfire with some loss to property | Unlikely | Major | Medium |
| | Pole failure results in catastrophic bushfire with widespread loss of property and potential fatality | Rare | Severe | Medium |
| Safety and People | Pole failure results in injury or death to member of the public | Rare | Severe | Medium |

## 6.5 Economic analysis

| Option | Description | NPV |
|---|---|---|
| Option 0 | Do nothing. Do not replace poles due to poor condition or that have been damaged. | $0 |
| Option 1 (preferred) | Replace poles based on condition. Do not replace poles due to poor condition or that have been damaged. | -$32,800,000 |
| Option 2 | Replace poles based on age. Replace poles once they reach 45 years old. | -$11,650,000 |

### 6.5.1 Quantitative Risk Analysis

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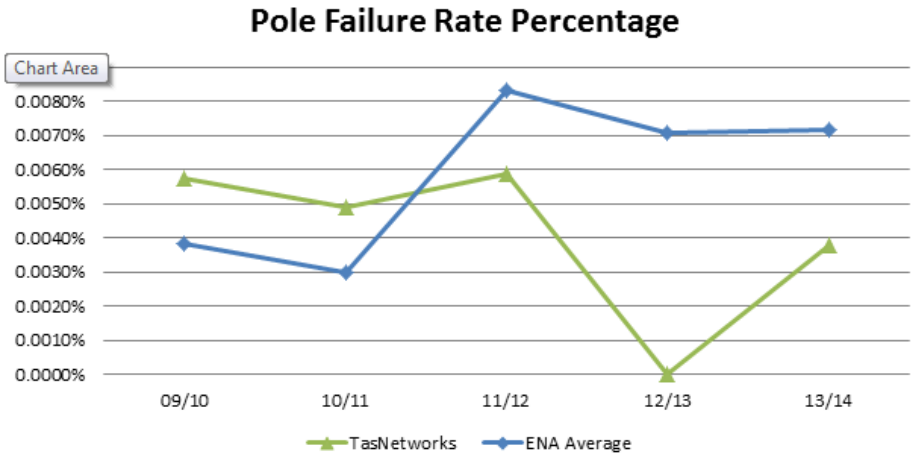
### 6.5.2 Benchmarking

The ENA Power Pole & Crossarm Forum hold an annual Pole Failure Survey to capture unassisted pole failure rates around the country. In the past TasNetworks unassisted pole failure rate has been consistently sitting just below the average pole failure rates around the country. The spike in 12/13 of no TasNetworks owned unassisted pole failures is due to the jump in pole replacements that year due to a change in the rule regarding pole safety factor lead to poles being condemned prematurely, the rule has since been changed back as condemning at that rate was not sustainable.




### 6.5.3 Expert findings

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### 6.5.4 Assumptions

-

## Section 2 Approvals (Gated Investment Step 2)

| | | | |
|---|---|---|---|
| **Project Initiator:** | Erin Cook | **Date:** | 26/03/2015 |
| **Project Manager:** | | **Date:** | |

| **Actions** | | | |
|---|---|---|---|
| **Submitted for CIRT review:** | | **Actioned by:** | |
| **CIRT outcome:** | | | |