Investment Evaluation Summary (IES)

Project Details:

Project Name:	Replace low voltage CONSAC cable
Project ID:	00671
Business Segment:	Distribution
Thread:	Underground System
CAPEX/OPEX:	CAPEX
Service Classification:	Standard Control
Scope Type:	A
Work Category Code:	REUCS
Work Category Description:	Replace LV cables UG CONSAC
Preferred Option Description:	Staged CONSAC cable replacement program [Preferred Option]
Preferred Option Estimate (Dollars $2016/2017):	$13,500,000

	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Unit ($)	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450
Volume	6000.00	6000.00	6000.00	6000.00	6000.00	8000.00	8000.00	8000.00	8000.00	8000.00
Estimate ($)	$2,700,000	$2,700,000	$2,700,000	$2,700,000	$2,700,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000
Total ($)	$2,700,000	$2,700,000	$2,700,000	$2,700,000	$2,700,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000

Governance:

Works Initiator:	Preeti Ravindran	Date:	04/11/2018
Team Leader Endorsed:	Darryl Munro	Date:	15/11/2018
Leader Endorsed:	Nicole Eastoe	Date:	19/11/2018
General Manager Approved:	Wayne Tucker	Date:	22/11/2018

Related Documents:

Description	URL
Replace low voltage CONSAC cable - NPV	http://reclink/R0001195592
TasNetworks Risk Management Framework	http://reclink/R0000238142
TasNetworks Corporate Plan - Planning period: 2017-18	http://reclink/R0000745475
TasNetworks Transformation Roadmap 2025	http://reclink/R0000764285
TasNetworks Business Plan 2017-18	http://reclink/R0000779008
National Electricity Rules (NER)	http://www.aemc.gov.au/Energy-Rules/National-electricity-rules/Current-Rules
Underground System - Distribution Asset Management Plan	http://reclink/R0000301624

Section 1 (Gated Investment Step 1)

1. Overview

1.1 Background

Concentric Neutral Solid Aluminium Conductor (CONSAC) cables are low voltage (LV) cables with the neutral conductor in the form of concentric aluminium sheath acting as a combined neutral and earth connection. These cables are paper insulated and covered with bitumen corrosion proof coating and PVC over sheath.

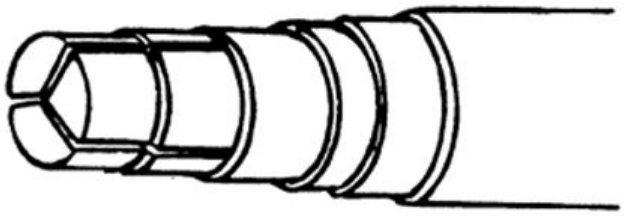

Figure 1 - CONSAC cable

The cables were installed on the distribution network in underground residential subdivisions from 1971 until 1980. Currently, records indicate there are approximately 164 km of CONSAC cable in the system.

As CONSAC cables have neutrals connected directly onto the aluminium sheath, if these are not adequately sealed to prevent moisture ingress, they oxidise. This can eventually cause an open circuit, or broken neutral which can pose a serious public safety risk due to the potential for electric shock and property risk due to the potential for equipment damage at customer's property.

There are on average 31 LV cable failures per year on the distribution network. There were 32 LV cable failures on the network in the 17/18 financial year, of which 11 where CONSAC cable. With CONSAC cable only representing approximately 13 per cent of the network, the number of failures are disproportionately high.

The failure rate of CONSAC cables is an increasing trend as shown in figure 2 below and is presenting an unacceptable level of risk, for which the current program of work is required to be continued for the next 5 years.

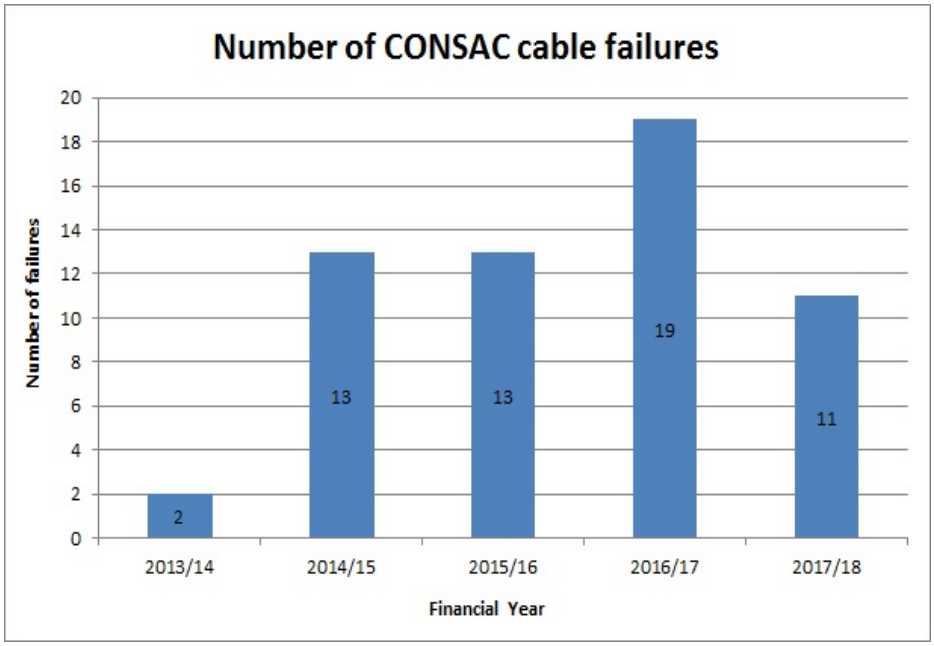

Figure 2 - CONSAC cable failures per financial year

The age profile of the CONSAC cable fleet also increases the likelihood of failure. The fleet is continuing to age and as a result it is anticipated that the failure rate will also continue to increase.

The primary driver of this program is to reduce the public risk from a broken neutral that has the potential to result in an electric shock or equipment damage at customer's property. The secondary driver is to reduce the failure rate for these cables so that it is comparable to other cables. A reduction in the failure rate will reduce the operational expenditure associated with the repair of these cables under fault.

As the primary failure mode of CONSAC cables leads to a broken neutral, the introduction of CablePI somewhat reduces the risk associated with CONSAC cable failures.

CablePI is a device used by residential customers and businesses to detect broken neutrals. In the hierarchy of control, it provides the lowest level of

control. Whilst CablePI is an effective control, TasNetworks considers that additional higher order controls need to be put in place to manage the risk appropriately.

Historically the business has replaced CONSAC cables in areas where multiple failures had been experienced. It is thought that local jointing practices, soil type and other environmental conditions were contributing to the failures as the failures were clustered in geographical areas.

1.2 Investment Need

Replacement of low voltage CONSAC cable to reduce the likelihood of electrical shocks and equipment damage occurring as a result of defective cables.

1.3 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 its 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); and
- 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.

1.4 Regulatory Considerations

This project is required to achieve the following capital expenditure objectives as described by the National Electricity Rules section 6.5.7(a):

(3) to the extent that there is no applicable *regulatory obligation or requirement* in relation to:

(i) the quality, reliability or security of supply of *standard control services*; or

(ii) the reliability or security of the *distribution system* through the supply of *standard control services*,

to the relevant extent:

(iii) maintain the quality, reliability and security of supply of *standard control services*; and

(iv) maintain the reliability and security of the *distribution system* through the supply of *standard control services*; and

(4) maintain the safety of the *distribution system* through the supply of *standard control serv*ices.

2. Project Objectives

The objective of this project is to continue the replacement of the low voltage CONSAC cable on the distribution network to reduce the likelihood of electrical shocks and equipment damage occurring as a result of defective cables.

The replacement of the cables is required to be proactive and not only reactive after a fault due to:

- increasing age profile of the fleet; and
- increasing failure rate, as the age profile of the CONSAC cable fleet also increases the likelihood of failure.

These factors can increase the likelihood of shocks and damage to equipment occurring. Replacing cables in stages will reduce likelihood of a failure causing harm to a member of the public and damage to equipment at customer's property.

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 network 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; and
- 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.

If TasNetworks does not replace CONSAC on the distribution network there is a risk that a cable fault could result in shocks to a member of the public or equipment damage at customer's property.

The business risk associated with these assets has been evaluated as Low by using the TasNetworks Risk Management Framework.

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	Equipment damage at customer's property	Possible	Negligible	Low
Safety and People	Electric shocks to member of the public	Possible	Minor	Low

5. Preferred Option:

The preferred option is the staged CONSAC cable replacement on the distribution network where:

- A section of CONSAC cable has previously failed;
- Locations with defective installations have been identified; and
- CONSAC cable is connected to assets that are scheduled in for replacement, e.g. replacement of ground mounted substations.

5.1 Scope

Cable sections would be replaced when they meet the criteria defined in section 5 above.

The scope would entail replacement of CONSAC cable with new low voltage PVC insulated cable in stages.

- Replace 6 km of CONSAC cable annually from 2019/2020 to 2023/2024;
- Replace 8 km of CONSAC cable annually from 2024/2025 to 2028/2029;
- Replace 10 km of CONSAC cable annually from 2029/2030 to 2033/2034;
- Replace 12 km of CONSAC cable annually from 2034/2035 to 2036/2037; and
- Replace 8 km of CONSAC cable in 2037/2038.

In addition to the cable, replacement of other supporting infrastructure would be required to connect it to the distribution network e.g. turrets, cabinets and reconnection of customer mains.

5.2 Expected outcomes and benefits

Staged CONSAC cable replacement will reduce the likelihood of electric shocks and damage to equipment occurring from defective CONSAC cable installations.

A secondary benefit is the improved reliability of the network, due to replacement of substandard CONSAC cables from the network, which will reduce the failure rate of the LV cable fleet.

5.3 Regulatory Test

The RIT-D is not required for the CONSAC cable replacement project.

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 indicates the planned capital expenditure for repex over the 2019-24 period.

6.1 Option Summary

Option description	
Option 0	Do Nothing. Reactive Replacement
Option 1	Continue existing Business As Usual (BAU) - Replace 6 km of CONSAC cable annually
Option 2	Defer existing BAU - 6 km/year CONSAC cable replacement program for 5 years

Option 3 (preferred)	Staged CONSAC cable replacement program [Preferred Option]

6.2 Summary of Drivers

Option	
Option 0	All CONSAC cable installations remain in service with only repairs and replacement of cable between turrets undertaken when defects identified. Advantages: • Lowest capital cost solution. Disadvantages: • Does not reduce the likelihood of electric shocks and damage to equipment from defective CONSAC cables. • Increase in operational expenditure as failure rates increase. • Resourcing required to accommodate reactive events. • Does not address safety and property risk.
Option 1	Replacement of 6 km of CONSAC cable annually with new PVC insulated cable. Advantages: • Reduces the likelihood of electric shocks and damage to equipment from defective cables. • The likelihood of a failure causing harm to a member of the public and damage to equipment reduces over time, with it being completely eliminated in 27 years. Disadvantages: • Capital expenditure required.
Option 2	Defer 6km/year CONSAC replacement program for 5 years. Advantages: • No capital expenditure required for 5 years. • The likelihood of a failure causing harm to a member of the public and damage to equipment reduces over time, with it being completely eliminated in 32 years. Disadvantages: • Does not reduce the likelihood of electric shocks and damage to equipment from defective CONSAC cables. • Increase in operational expenditure as failure rates increase. • Resourcing required to accommodate reactive events. • Does not address safety and property risk.
Option 3 (preferred)	Replacement of CONSAC cable with new PVC insulated cable in stages. • Replace 6 km of CONSAC cable annually from 2019/2020 to 2023/2024; • Replace 8 km of CONSAC cable annually from 2024/2025 to 2028/2029; • Replace 10 km of CONSAC cable annually from 2029/2030 to 2033/2034; • Replace 12 km of CONSAC cable annually from 2034/2035 to 2036/2037; and • Replace 8 km in 2037/2038. Advantages: • Reduces the likelihood of electric shocks and damage to equipment from defective cables. • The likelihood of a failure causing harm to a member of the public and damage to equipment reduces over time, with it being completely eliminated in 19 years. • This is the most cost effective option to reduce the business risks to a manageable level. Disadvantages: • Capital expenditure required.

6.3 Summary of Costs

Option	Total Cost ($)

Option 0	$0
Option 1	$13,500,000
Option 2	$0
Option 3 (preferred)	$13,500,000

6.4 Summary of Risk

Option 0: Do Nothing. Reactive replacement

Public safety risk remains at 'Low' with the potential to increase further over time as the failure rate increases.

Option 1: Continue existing BAU - Replace 6 km of CONSAC cable annually

The likelihood of a failure causing harm to a member of the public and damage to equipment reduces over time, with it being completely eliminated in 27 years.

Option 2: Defer existing BAU - 6 km/year CONSAC cable replacement program for 5 years

The likelihood of a failure causing harm to a member of the public and damage to equipment reduces over time, with it being completely eliminated in 32 years.

Option 3: Staged CONSAC cable replacement program [Preferred Option]

The likelihood of a failure causing harm to a member of the public and damage to equipment reduces over time, with it being completely eliminated in 19 years.

6.5 Economic analysis

Option	Description	NPV
Option 0	Do Nothing. Reactive Replacement	-$31,552,456
Option 1	Continue existing Business As Usual (BAU) - Replace 6 km of CONSAC cable annually	-$24,919,464
Option 2	Defer existing BAU - 6 km/year CONSAC cable replacement program for 5 years	-$24,012,771
Option 3 (preferred)	Staged CONSAC cable replacement program [Preferred Option]	-$22,685,441

6.5.1 Quantitative Risk Analysis

A quantitative risk analysis has been completed including the cost of risk as described in section 6 above. The most positive option has been selected as the preferred option.

A sensitivity analysis was also undertaken using different WACC (%), value of customer reliability ($/MWh), value of customer interruption ($/MWh), capital cost and operational and maintenance cost.

6.5.2 Benchmarking

Minimising the safety risk that CONSAC cable presents to the public is considered a high priority to other Distribution Network Service Providers (DNSPs) around Australia with replacement programs in place at multiple DNSPs.

The replacement programs are generally reactive replacement.

6.5.3 Expert findings

Not applicable.

6.5.4 Assumptions

Cable replacements have been distributed uniformly across the years, whereas in practice they will be prioritised by geographical areas experiencing more failures.

All costs are in 2016/17 dollars.

Other assumptions are included in the NPV spreadsheet as listed in the reference documents (http://reclink/R0001195592) .