Investment Evaluation Summary (IES)

Project Details:

Project Name:	Translay Protection Scheme Replacement Program
Project ID:	00396
Thread:	Protection and Control
CAPEX/OPEX:	CAPEX
Service Classification:	Standard Control
Scope Type:	A
Work Category Code:	REGAU
Work Category Description:	Replace Ground Mtd Auxiliary Equip
Preferred Option Description:	Option 4: Translay like-for-like replacement, plus staged approach to fibre-optic cabling installation (preferred). Replace in service electromechanical Translay relays with new electromechanical relays and commence installing fibre optic cabling to facilitate numerical relay change-over at a later stage. Advantages: costs in completing this work are sustainable, minimises likelihood of risk exposure, facilitates changeover to numeric relays once electromechanical becomes obsolete. Disadvantages: requires more expenditure than Option 1.
Preferred Option Estimate (Nominal Dollars):	$2,194,002

	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Unit ($)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volume	15	15	15	15	15	15	15	15	15	0
Estimate ($)										
Total ($)	$243,778	$243,778	$243,778	$243,778	$243,778	$243,778	$243,778	$243,778	$243,778	$0

Governance:

Project Initiator:	Tim Sutton	**Date:**	11/03/2015
Thread Approved:	David Ellis	**Date:**	02/11/2015
Project Approver:	David Ellis	**Date:**	02/11/2015

Document Details:

Version Number:	1

Related Documents:

Description	URL

IES	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Protection%20and%20Control/REGAU%20Translay%20Investment%20Evaluation%20Summary.docx
Pilot Wire Benchmarking Study - Western Power	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Protection%20and%20Control/RW025200-EJT-RP-E3-0001%20Pilot%20Cable%20Benchmarking%20Report%20-%20rev%201.pdf
NPV	http://projectzone.tnad.tasnetworks.com.au/business-projects/nis-program/DD17SAM/Deliverables/Protection%20and%20Control/NPV%20REGAU%20(Translay).xlsm

Section 1 (Gated Investment Step 1)

1. Background

TasNetworks' (TN) Critical Infrastructure reliability category refers to a sensitive reliability area within the Hobart Central Business District which comprises a number of important government and private facilities and businesses. Some of these essential services include:

- The Royal Hobart Hospital;
- Tasmania Police Headquarters; and
- The Tasmania Fire Station.

TN's CI zone is outlined in Figure 1 (in green) and comprises approximately 120 MVA of load, connected via a network of ground-mounted distribution substations throughout the city.

TN owns and maintains an aged fleet of electromechanical protection and control assets in this reliability area with an average age of 37.59 years (2013/14). The relays form part of a unit protection scheme known by the tradename, Translay. TN wishes to invest in this aged infrastructure in order to meet the needs of the network, taking into consideration the reliability requirements of the area and the projected load growth. There are 178 Translay relays in this asset fleet, protecting 87 feeder segments.

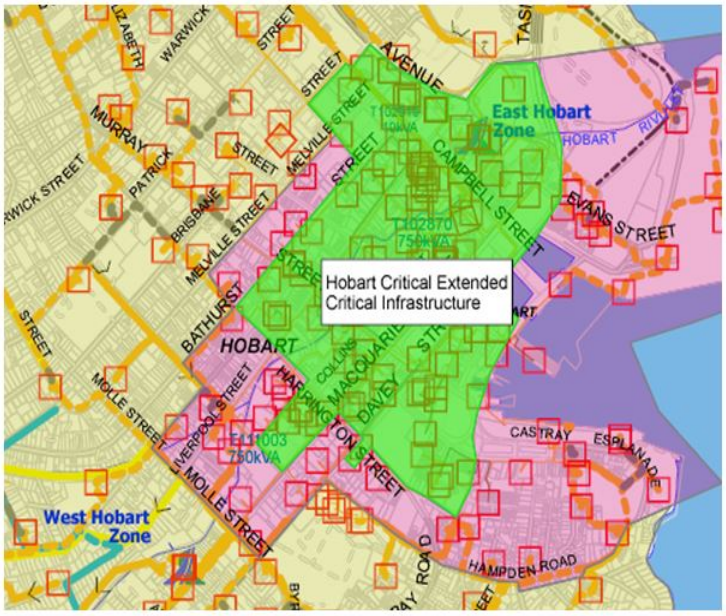

Figure 1: Hobart Critical Infrastructure Zone

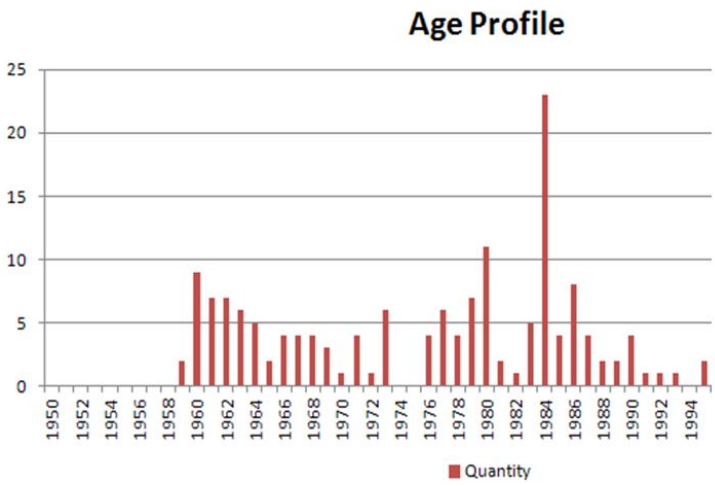

Figure 2: Age profile of Translay assets

1.1 Investment Need

TN's Translay assets are approaching their forty-year end of life, and whilst there have been no relay failures to date, the number of failures is expected to sharply rise with wear-out failures as characterised by the bathtub failure phenomenon. The copper pilot network which serves as the inter-relay communications medium is also showing signs of deterioration with channel failures common on approximately 50 % of a recent sample size of 40 distribution substations.

The Translay system requires targeted replacements over the forthcoming regulatory period to ensure the ongoing protection of the associated primary equipment and the maintenance of the current reliability levels over the next ten years.

Throughout Australia, it is common among DNSPs to replace electromechanical protection relays at the end of their life for the following reasons:

- Tolerance drift reaches its outer limits;

- Electromechanical relays are incapable of providing internal self-test functionality (if a relay falls into a failed state it will remain undetected until called upon to operate, or found by an inspection/testing regime);
- Manufacturer supportable life ends; and
- New functionality is required.

The main driver for TN's replacement program is age-based replacement and the benefits associated with refurbishing protection assets along-side a targeted switchgear replacement program in the associated primary assets (recently underway).

1.2 Customer Needs or Impact

TasNetworks continues to undertake a 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); and
- Increase 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, restoration of faults/emergencies and supply reliability.

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). (4) maintain the safety of the distribution system through the supply of standard control services.

2. Project Objectives

The objective of this project is to refurbish aged Translay protection relays to ensure the ongoing safety of the primary equipment, and the scheme's ongoing operability over the next regulatory period.

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; and

• 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

Do nothing is not an acceptable option to TN's risk appetite. If the Translay protection was not systematically replaced, its eventual failure could result in severe damage to plant, equipment and personnel. The level of risk identified is such that a treatment plan is required to reduce the risks to a tolerable level, in line with 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 follows:

Risk Category	Risk	Likelihood	Consequence	Risk Rating
Customer	Outage effects on customer	Possible	Major	High
Environment and Community	Environmental damage	Unlikely	Major	Medium
Financial	Penalties resulting from reliability events in the critical infrastructure area	Possible	Minor	Low
Network Performance	Damage to plant and equipment with asset failure	Possible	Moderate	Medium
Regulatory Compliance	Penalties resulting from reliability events in the critical infrastructure area	Possible	Moderate	Medium
Reputation	Outage effects on customer	Possible	Moderate	Medium
Safety and People	Damage to personnel and/or the general public	Unlikely	Major	Medium

Section 1 Approvals (Gated Investment Step 1)

Project Initiator:	Tim Sutton	**Date:**	11/03/2015
Line Manager:		**Date:**	
Manager (Network Projects) **or** **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 the Translay relays like-for-like based on age profile and a nominal forty year life cycle, along with a fibre-optic cable installation to facilitate eventual numeric relay replacement at a later stage.

5.1 Scope

- Over the next 10 years 144 Translay relays will become due for replacement. These have been averaged out across the period to 15 per year (approximately).
- Replace these electromechanical relays with like-for-like equivalents based on the above number.
- While mobilised, install fibre-optic connections between Translay substations to facilitate a transition to numeric relays at a later stage (there are ongoing support issues associated with the older electromechanically relays and a later transition is inevitable).
- Commission the new relays to coincide with the switchgear replacement program being run in parallel across the Critical Infrastructure reliability area.

5.2 Expected outcomes and benefits

This project will maintain the integrity of the Translay system at minimal cost to the customer whilst ensuring the assets can effectively be transitioned to their modern equivalents at a later stage.

5.3 Regulatory Test

6. Options Analysis

6.1 Option Summary

Option description	
Option 0	Option 0: Do nothing. Maintain existing maintenance and inspection cycles with no alteration to the substation. Advantages: lowest cost solution. Disadvantages: does not reduce the risk associated with Translay asset failure.
Option 1	Option 1: Translay like-for-like replacement. Replace in service electromechanical Translay relays with new electromechanical relays. Advantages: costs in completing this work are sustainable, minimises likelihood of risk exposure. Disadvantages: does not facilitate a transition to numeric relays at a later stage (there are ongoing support issues associated with the older electromechanically relays and a later transition is inevitable), does not manage risk for the long term.
Option 2	Option 2: Replacement of Translay with numerical relays and fibre-optic cabling. Replace entire Translay system with numerical equivalent with fibre optic communications. Advantages: eliminates risk of asset failure, provides additional relay capability such as self-testing/monitoring. Disadvantages: significant costs to undertake this option, possible delivery issues due to level of complexity and resourcing.
Option 3	Option 3: Decommission Translay and rely on back-up over-current/earth fault protection at feeder level.

	Retire entire Translay system and rely on upstream protection to protect the Critical Infrastructure zone. Advantages: second most cost-effective solution. Disadvantages: reliability reduction resulting in poorer performance and increased penalties.
Option 4 (preferred)	Option 4: Translay like-for-like replacement, plus staged approach to fibre-optic cabling installation (preferred). Replace in service electromechanical Translay relays with new electromechanical relays and commence installing fibre optic cabling to facilitate numerical relay change-over at a later stage. Advantages: costs in completing this work are sustainable, minimises likelihood of risk exposure, facilitates changeover to numeric relays once electromechanical becomes obsolete. Disadvantages: requires more expenditure than Option 1.

6.2 Summary of Drivers

Option	
Option 0	Prevent asset damage to plant and equipment - does not address risk. Maintain current levels of reliability - does not address risk. Minimum cost to the customer - does not address. Meeting future needs of the network - does not address.
Option 1	Prevent asset damage to plant and equipment - addresses risk. Maintain current levels of reliability - partially addresses risk. Minimum cost to the customer - addresses. Meeting future needs of the network - partially addresses.
Option 2	Prevent asset damage to plant and equipment - addresses risk. Maintain current levels of reliability - addresses risk. Minimum cost to the customer - does not address risk. Meeting future needs of the network - addresses.
Option 3	Prevent asset damage to plant and equipment - partially addresses risk. Maintain current levels of reliability - does not address risk. Minimum cost to the customer - addresses. Meeting future needs of the network - does not address.
Option 4 (preferred)	Prevent asset damage to plant and equipment - addresses risk. Maintain current levels of reliability - addresses risk. Minimum cost to the customer - addresses. Meeting future needs of the network - addresses.

6.3 Summary of Costs

Option	Total Cost ($)
Option 0	$0
Option 1	$1,488,258

Option 2	$3,638,016
Option 3	$459,396
Option 4 (preferred)	$2,194,002

6.4 Summary of Risk

This section outlines an overall residual asset risk level, for each of the options.

Option	Risk Assessment
Option 0	Medium
Option 1	Medium
Option 2	Low
Option 3	Medium
Option 4 (preferred)	Low

6.5 Economic analysis

Option	Description	NPV
Option 0	Option 0: Do nothing. Maintain existing maintenance and inspection cycles with no alteration to the substation. Advantages: lowest cost solution. Disadvantages: does not reduce the risk associated with Translay asset failure.	$0
Option 1	Option 1: Translay like-for-like replacement. Replace in service electromechanical Translay relays with new electromechanical relays. Advantages: costs in completing this work are sustainable, minimises likelihood of risk exposure. Disadvantages: does not facilitate a transition to numeric relays at a later stage (there are ongoing support issues associated with the older electromechanically relays and a later transition is inevitable), does not manage risk for the long term.	-$1,105,710
Option 2	Option 2: Replacement of Translay with numerical relays and fibre-optic cabling. Replace entire Translay system with numerical equivalent with fibre optic communications. Advantages: eliminates risk of asset failure, provides additional relay capability such as self-testing/monitoring. Disadvantages: significant costs to undertake this option, possible delivery issues due to level of complexity and resourcing.	-$2,702,885
Option 3	Option 3: Decommission Translay and rely on back-up over-current/earth fault protection at feeder level. Retire entire Translay system and rely on upstream protection to protect the Critical Infrastructure zone. Advantages: second most cost-effective solution. Disadvantages: reliability reduction resulting in poorer performance and increased penalties.	-$341,311

Option 4 (preferred)	Option 4: Translay like-for-like replacement, plus staged approach to fibre-optic cabling installation (preferred). Replace in service electromechanical Translay relays with new electromechanical relays and commence installing fibre optic cabling to facilitate numerical relay change-over at a later stage. Advantages: costs in completing this work are sustainable, minimises likelihood of risk exposure, facilitates changeover to numeric relays once electromechanical becomes obsolete. Disadvantages: requires more expenditure than Option 1.	-$1,630,046

6.5.1 Quantitative Risk Analysis

Not applicable.

6.5.2 Benchmarking

A benchmarking study for Western Power by Jacobs Group (Australia) Pty Ltd, entitled “Pilot Cable Benchmarking Study” was considered as part of this proposal (February 2015).

The benchmarking survey was issued to a number of entities including:

- Transmission utilities;
- Distribution utilities;
- Relay vendors;
- Cable manufacturers; and
- Joint box manufacturers.

One of the key findings from the study was that nation-wide, pilot wire protection schemes are being upgraded on the basis of age, maintenance costs, equipment supply and support limitations, and reliability. New technologies such as numerical relays with fibre optic communications are a standard replacement for older electromechanical pilot wire systems.

Maintaining the functionality and operability of such protection systems is considered a high priority to Australian DNSPs. Similar strategies to that proposed herewith have been adopted by mainland utilities for their regulatory submissions.

6.5.3 Expert findings

Not Applicable.

6.5.4 Assumptions

- Asset replacements have been distributed uniformly across the ten year planning period, whereas in practice they will be prioritised by age in accordance with the age profile of the asset.
- All costs are in 2014/15 dollars.

Section 2 Approvals (Gated Investment Step 2)

Project Initiator:	Tim Sutton	**Date:**	11/03/2015
Project Manager:		**Date:**	

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