Asset Management Plan

Pole Mounted Transformers

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Authorisations

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Responsibilities

This document is the responsibility of the Network Asset Strategy Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

The approval of this document is the responsibility of the General Manager, Strategic Asset Management.

Please contact the Network Asset Strategy Team Leader with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
- Compliance All group managers.

Disclaimer

Reference documents

R954721 – TasNetworks Strategic Asset Management Plan

R40766 – TasNetworks Asset Management Policy

R909655 – TasNetworks Risk Management Framework

Record of revisions

Revision	Details	Date
4.0	R19 Update	Nov 2018
5.0	Document created with R24 template	Oct 2022

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1. Purpose

The purpose of this document is to describe for pole mounted transformers and related assets:

- TasNetworks' approach to asset management, as reflected through its legislative and regulatory obligations and strategic plans.
- The key projects and programs underpinning its activities.
- Forecast capex and opex, including the basis upon which these forecasts are derived.

2. Scope

This document covers pole mounted transformers in the distribution network.

3. Management strategy and objectives

This asset management plan has been developed to align with both TasNetworks' Asset Management Policy, Strategic Asset Management Plan and Strategic Objectives. This management plan describes the asset management strategies and programs undertaken to manage pole mounted transformers.

For these assets the management strategy focuses on the following objectives:

- Safety will continue to be our top priority and we will continue to ensure that our safety performance continues to improve
- Service performance will be maintained at current overall network service levels, whilst service to poorly performing reliability communities will be improved to meet regulatory requirements
- Cost performance will be improved through prioritisation and efficiency improvements that enable us provide predictable and lowest sustainable pricing to our customers
- Customer engagement will be improved to ensure that we understand customer needs, and incorporate these into our decision making to maximise value to them
- Our program of work will be developed and delivered on time and within budget

4. Description of the asset portfolio

TasNetworks owns and manages approximately 32,000 overhead distribution transformers (pole mounted transformers). About half of the pole mounted transformers are less than 50kVA in size. The physical size and weight of the transformers limits pole mounted transformers to 500kVA in size that can safely be installed on a pole structure. TasNetworks also manages a number of Single Wire Earth Return (SWER) system transformers in relatively remote rural locations where there is light load and installing a three phase system is not economically viable.

Pole mounted transformers can be separated into the following types:

- Single phase and three phase transformers;
- SWER transformers; and
- Isolating transformers.

4.1 Single phase and three phase pole mounted transformers

Pole mounted transformers are devices used to step up or step down voltages within the distribution system. The majority of distribution transformers installed within the distribution system step down voltages from high voltage (HV) (44kV, 33kV, 22kV or 11kV) to low voltage (LV) (400/230V), which the majority of customers use within their electrical installations.

Pole mounted transformers are mounted on a single or double pole structure. The largest single phase transformer is 63kVA. The physical size and weight of the unit limits pole mounted transformers to a maximum size of 500kVA.

Pole mounted transformers contain mineral insulating oil for both electrical insulation of the internal components and cooling.

With the exception of SWER devices, pole mounted transformers have off-load tap changers. These allow the output of the transformer to be adjusted (with the transformer not connected to any load) to vary the level of output voltage by small increments (tap settings) to regulate output voltages to within acceptable limits.

4.2 SWER transformers

SWER systems are used in several relatively remote rural locations within the distribution system where there is light load. In SWER systems, one wire is used as the phase conductor and the earth is used as the return conductor. Isolated SWER systems typically consist of a SWER isolating transformer and one or more SWER transformers. SWER transformers operate at a voltage of 12.7KV.

TasNetworks operates approximately 500km of SWER system across 64 individually isolated circuits. Although significant work is programmed to rationalise SWER assets, it is forecast that much of the current SWER network will remain moving forward.

Un-isolated SWER systems used to be used as those without an isolating transformer separating HV feeder from SWER spur. In this system, the earth return current path is to the transformer neutral point at the distribution zone substation, often many tens of kilometres away. This configuration is not ideal as it does not isolate the SWER network from the main network, and the earth return currents can be of sufficiently high magnitude to operate earth fault protection installed on the main system.

4.3 Isolating transformers

The isolating transformer isolates the earth currents (zero sequence currents) of the SWER system from the three-phase main supply feeder. This limits the exposure to telephone interference and allows the main supply feeder to maintain its sensitive earth fault detection protection.

There are two LV isolating transformers in the system. These particular LV isolating transformers do not step voltage up or down. Its function is to isolate the low voltage network entirely from the power source. Isolation transformers provide isolation primarily to protect against HV earth faults transferring on to the LV earthing system. These transformers are utilised by TasNetworks in rare situations where the earthing conditions are particularly poor. Due to the isolation, the transformer contains no reference to earth, so in the event of a fault there is no path for current to flow to back to the source.

Figure 1: A SWER isolating transformer

4.4 Pole mounted transformer population

The number of pole mounted transformers categorised by type and size are shown in table 1.

Table 1: Pole mounted distribution transformer types

Transformer Size	22kV	11kV	12.7kV SWER	Number Installed
0kVA to <50kVA	11,929	3,789	0	15,718
50kVA to <100kVA	5,094	1,965	0	7,059
100kVA to <500kVA	6,508	1,860	0	8,368
500kVA	421	128	0	549
SWER	0	0	356	356
Isolating transformers	0	0	64	66
Total	**23,952**	**7,742**	**420**	**32,116**

The majority of the pole mounted transformer population are those of small capacity (transformer of less than 100 kVA), which with a small number of SWER transformers mostly supply the rural and remote located customer loads. The larger rating transformers, 100-500kVA and 500kVA, mostly are supplying suburban, commercial, light industrial, public infrastructure loads and increasing private irrigation supplies.

SWER transformers include 12.7kV/ 440-240V power transformers and the SWER Isolating Supply ("Isolators") pole mounted transformer installations that supply SWER overhead line spurs feeding earth return HV supply to the SWER pole mounted substations. SWER supplies are widely dispersed in the Tasmanian Network and in total have approximately 356 SWER substations. Many SWER Isolators are of dual purpose multi-winding design including a low voltage local customer supply winding.

4.5 Pole mounted transformer age profile

The average age of TasNetworks' pole mounted transformer population is 35 years. The age profile of pole mounted transformers is shown in figure 2. The AER benchmark for mean economic life of transformers is 40 years.

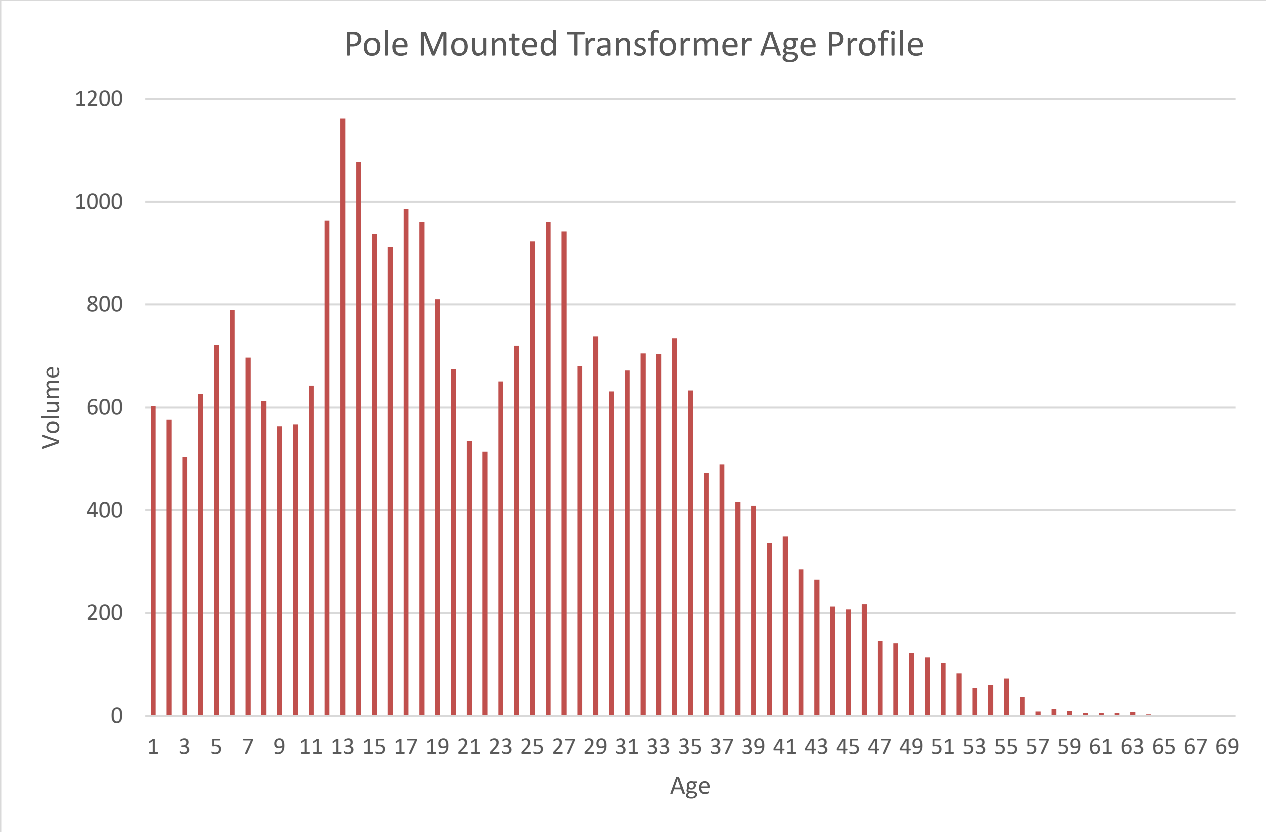

Figure 2: Transformer age profile

5. Associated risk

5.1 Risk management framework

TasNetworks has developed a Risk Management Framework for the purposes of assessing and managing its business risks, and for ensuring a consistent and structured approach for the management of risk is applied.

An assessment of the risks associated with pole mounted transformers has been undertaken in accordance with the Risk Management Framework.

The quantification of risk is supported by the Health Based Risk Management (HBRM) framework. This approach allows the risks of individual assets to be quantified against the defined assessment.

Due to the level of risk identified in some of the assessment criteria a requirement to actively manage these risks has been identified.

5.2 Performance data

TasNetworks monitors distribution assets for major faults through its outage and incident reporting processes. Asset failures resulting in unplanned outages are recorded in the InService outage management tool by field staff, with cause and consequence information being subsequently made available to staff for reporting and analysis.

TasNetworks' Service Target Performance Incentive Scheme (STPIS), which meets the requirements of the Australian Energy Regulator's (AER's) Service Standards Guideline, imposes service performance measures and targets onto TasNetworks with a focus on outage duration and frequency. While the STPIS does not target specific asset classes, good asset performance will have a significant impact on TasNetworks' ability to meet the STPIS targets.

STPIS parameters include:

a) System Average Interruption Duration Index (SAIDI); and
b) System Average Interruption Frequency Index (SAIFI).

Details of the STPIS scheme and performance targets can be found in the "*Electricity distribution network service providers - Service target performance incentive scheme*".

Figure 3 show the historical sum of STIPS resulting from distribution transformer outages. Note this is only broken down to high level, so total includes pole mounted and ground mounted transformers combined.

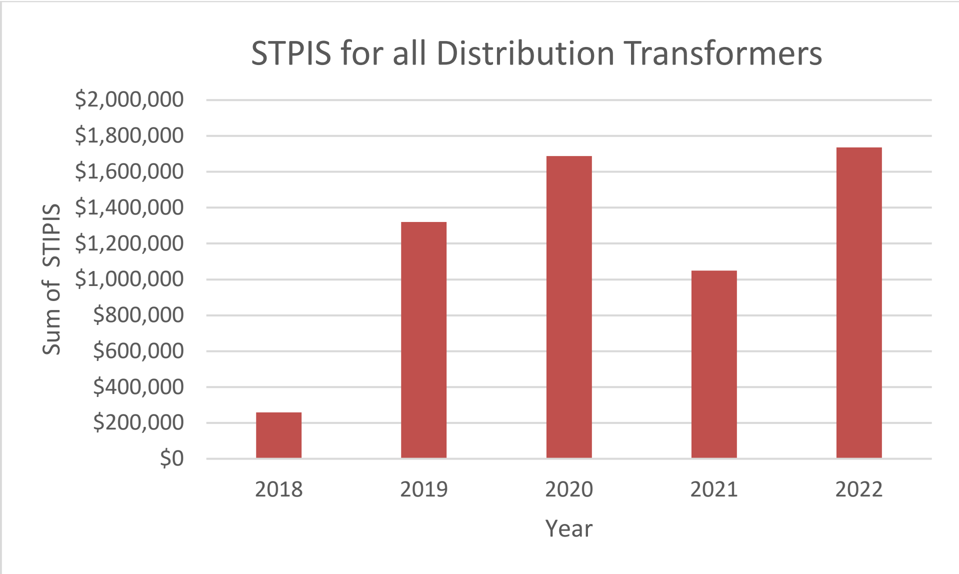

Figure 3: STPIS for all distribution transformers

There is an average of 21 transformer failures per months caused by: condition, overload, internal and external failure of the transformer, breakdown of insulation, extreme weather events or third party collision with support structures. Transformer failures account for around 1.2% of the total STPIS contribution or around 642 hours of outages per year on average. An outage caused by a transformer failure lasts for an average of 9.3 hours.

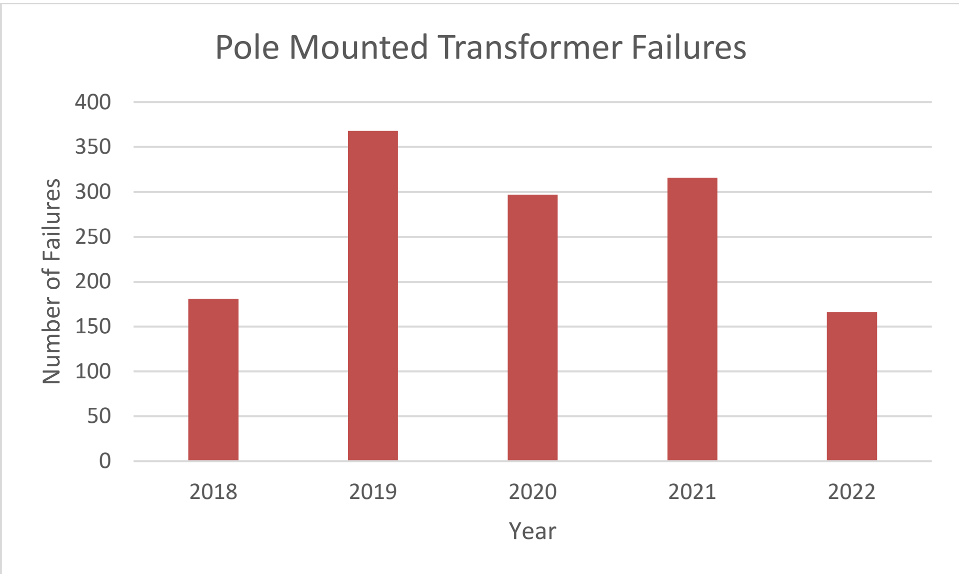

Figure 4: Pole Mounted Transformer failures

5.3 Asset risks

The risks associated with pole mounted distribution transformers are summarised in Table 2. Apart from the risks associated with the inadequate earthing systems of the transformers and the disposal of transformers oil, the risks associated with the pole mounted transformer population remain within TasNetworks' stated risk appetite.

5.3.1 Transformer Failures

Failures may occur due to the condition of the transformer, overloading, internal or external failure, breakdown of insulation, and extreme weather events such as storms or bushfires. Transformers are replaced when they fail on a like for like basis.

Transformers may also be replaced prior to total failure when periodic network inspections find them to be significantly leaking oil or where other signs of deterioration indicates the asset present a network or safety risk.

There is no specific transformer inspection program, but the asset inspectors who undertake pole serviceability inspections and aerial helicopter patrols inspectors also do visual inspections of pole mounted hardware and equipment. Transformers that show evidence of failing condition and/or substantial oil leaks (such that functionally failed) will be replaced as per the direction provided in the Asset Inspection Training Manual.

5.3.1.1 Standardisation

To mitigate the risk of a major failure of a pole mounted transformer, TasNetworks has, as far as practical, standardised on the design and construction of pole mounted transformers.

While the failure rates for power transformers are relatively low, the consequences of such a failure are relatively high. Through the introduction of standardised transformer designs and construction, the consequences of a failure are minimised.

5.3.1.2 Failure point awareness

Studies[1] have shown that there are a limited number of reasons that account for the majority of transformer failures. These include bushing failures, tap-changer failures, winding failures and failures of cable boxes and terminations.

Particular attention is paid to these failure points and all are directly addressed in the transformer specifications to ensure an appropriate level of reliability is achieved.

5.3.1.3 Quality control measures

To mitigate the risk of inadequate quality control during manufacturing, TasNetworks requires pole mounted transformer manufacturers to have AS/NZ ISO 9001 certification and conform to its requirements. The additional need for the intending supplier to have demonstrated a three year Australian market supply experience, as this can minimise the risk of developmental product warranty defects, dispersed in the fleet. TasNetworks also requires sample routine tests, as well as certain type tests, to be performed on transformers to prove the batch quality of manufacture prior to dispatch from the manufacturer's works.

[1] Peterson, A. and Austin, P., "Impact of recent transformer failures and fires – Australian and New Zealand experience"

5.3.2 Transformer Earths

Substandard earthing connections pose a risk both in terms of the safety risk if an earth fault does not clear (possible electric shock or bushfire start) and a regulatory risk with compliance to AS2067.

The Australian Standard AS2067 outlines a probabilistic approach to the performance of an earthing system. TasNetworks undertakes an overhead transformer earth inspection program to determine the condition and performance of the assets and identify sites for repair or replacement. This program will ensure the compliance to AS 2067 Substations and High Voltage Installations Exceeding 1 kV a.c as well as ENA EG 0 Power System Earthing Guide. Compliance with this standard will appropriately manage the performance of the earthing systems and the risk of electric shock to the public. This will additionally reduce the risk of a faulty earthing system causing a bushfire in the event of a fault.

To comply with AS2067, in terms of having in place an adequate earthing system, transformer earth testing and replacement programs are generally undertaken by DNSP's. A 10 year inspection program of overhead transformer earths, with SWER earths being tested more frequently, is consistent with current standard practice across Australian distribution utilities.

5.3.3 Oil Management

The uncontrolled risk associated with the disposal of transformers and transformer insulating oil is very high, but once controlled the risk is low. To reduce the environmental risks associated with pole mounted transformer insulating oil handling and disposal, TasNetworks has adopted strict management measurements for the management of Polychlorinated Biphenyls (PCBs) in transformer oil.

TasNetworks' general specification for distribution pole mounted transformers also stated that transformers are to contain less than 720 litres of oil. In addition, each transformer shall be supplied with new mineral insulating oil that meets the requirements of AS1767 or IEC 60296. The oil shall be certified to contain PCBs at not detectable concentrations.

To mitigate the risks associated with PCB contamination, TasNetworks has implemented a program to manage transformer oil containing PCBs. This program is managed according to TasNetworks' documents, TNM-SY-0114, Strategy for PCB management.

5.3.4 Lightning Protection

Due to Tasmania being an island state the majority of transformers installations are exposed to salt pollution, in order to ensure longevity in this corrosion prone environment the preferred protective coating to the exterior and interior surface is galvanised and unpainted.

To offer an adequate level of lightning protection all new transformers irrespective of size are supplied with approved high voltage (HV) surge diverters, mounted on brackets that are incorporated in the design.

The Interim Guidelines for Fire Protection of Electricity Substations ENA DOC 18-2015 identifies fire precautions for pole mounted transformer distribution substations, including public safety, personnel safety, proximity to adjacent property, equipment design and siting to minimise hazard exposures to adjoining fire hazards including bushland and vehicle impact.

5.3.5 H-Structures

The structural failure of an H-structure has the potential to cause serious injury but the probability of occurrence is considered unlikely. H-structures are generally replaced when one of the supporting poles is condemned (as part of the normal pole inspection program). Sites are prioritised based on condition (identified through asset inspections) and locations for public safety issues. The H-structures themselves are managed as structures in the structures asset portfolio, when required the transformer will be replaced under the Replace OH Transformer program RETXL. H-structures are no longer installed, the replacement solution is a single pole substation or in some instances the installation of a ground mounted substation if the load is large.

Figure 5 shows an example of a transformer H-structure in an urban area.

Figure 5: Transformer H-structure

Table 2: Summary of asset risks

Risk Identification		Risk Analysis (Inherent)				
Asset	**Risk Description**	**Category**	**Likelihood**	**Consequence**	**Risk Rank**	**Treatment Plan Yes / No**
Transformer Earth	Poor and missing earths pose a risk of a faulty earthing system causing: • an electric shock to public in the event of a fault • a bushfire in the event of a fault Regulatory risk if practices not compliant to AS2067	Safety and People	Possible	Severe	High	Yes
		Regulatory Compliance	Likely	Major	High	
		Environment and Community	Unlikely	Severe	High	
Oil Management	Risk of transformer failure causes localised damage to surrounding environment (e.g oil spill into adjacent waterways) Regulatory risk of non-compliance to environmental legislation	Regulatory Compliance	Likely	Major	High	Yes
		Environment and Community	Likely	Major	High	

6. Whole of life management plan

6.1 Preventive and corrective maintenance (opex)

6.1.1 Transformer earthing inspection and testing - AIOTX

Reliability-centered maintenance (RCM) analysis undertaken in 2012 identified a risk from substandard earthing connections. This is both in terms of the safety risk if an earth fault does not clear, and a regulatory risk with compliance to AS2067. The drivers for this program are managing business risks and compliance with regulatory requirements.

The earthing systems for distribution pole mounted transformers are replaced based on performance using a probabilistic risk based methodology. This probabilistic approach is concerned with the voltages that members of the public or operators may be exposed to under fault conditions. Metallic surfaces that can be touched by members of the public in close proximity to a pole earth will require assessment, and could drive an augmentation of the transformer earthing system in order to ensure public safety.

This transformer earthing inspection and testing program will audit the condition of distribution pole mounted transformer earth connections, and identify any transformer installation where the earthing needs to be repaired, replaced or augmented. This audit will ensure pole mounted transformers and associated equipment is safely earthed and determines the current condition of transformer earths to justify and prioritise future replacement programs. The CAPEX program Replace Transformer Earths (RETXE) will then perform any remedial works necessary to rectify earthing found to be non-compliant.

Priority will be given to earths on aged transformers, as their condition is more likely to have deteriorated, and on SWER transformers due to their unique configurations. The document AIOTX Earthing Inspection Guideline provides details of this program methodology.

6.1.2 Oil management - AROIL

The drivers for this program are compliance with regulations and managing business operating risks (safety).

TasNetworks is required to dispose of oil and oil-contaminated assets in accordance with Australian Standards. This program funds TasNetworks' oil farms who manage the removal and disposal of oil from redundant oil-filled assets.

TasNetworks has over 30,000 transformers, over 300 oil filled switchgear and ground mounted oil filled assets in service in the distribution system. The 30,000 distribution pole mounted transformers each contain between 45 and 500 litres of oil. When the asset fails or reach the end of their useful life the oil has to be removed and disposed of.

The primary objective is to recover oil from assets that reached the end of their useful life along with response to oil spills, test for PCBs and dispose according to environmental requirements (including obtaining permits and arranging transport) and dispose of oil free equipment.

There are no major changes to this program and the proposed expenditure is to remain consistent with historical spend.

6.1.3 Summary of opex expenditure

Table 3: Summary of opex programs and expenditure (Budget forecasts)

Project/Program	Func. Area	Program Data										
		Financial year	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**	**FY28**	**FY29**
Transformer earthing inspection and testing	AIOTX	Expenditure ($m)	$1.05	$1.05	$1.05	$1.05	$1.0	$1.0	$1.0	$1.0	$1.0	$1.0
Oil management	AROIL	Expenditure ($m)	$0.738	$0.738	$0.738	$0.738	$0.70	$0.70	$0.70	$0.70	$0.70	$0.70

6.2 Reliability and quality maintained (capex)

6.2.1 Replace transformers - RETXL

TasNetworks operates a replace upon functional failure strategy for pole mounted transformers. Consistent with other distribution companies, distribution pole mounted transformers are primarily replaced on failure.

Failures may occur due to the condition of the transformer, overloading, internal or external failure, breakdown of insulation, and extreme weather events such as storms or bushfires. Transformers may also be replaced prior to total failure when periodic network inspections find them to be significantly leaking oil or where other signs of deterioration indicates the asset present a network or safety risk. Old transformers in poor condition may also be replaced opportunistically during other maintenance work on the pole.

The majority of this program is a reactive work program to cover the capitalisation of transformer replacement under fault. The work is initially performed under the fault and emergency budget and later transferred to this program. Most of the transformer replacements in the distribution networks are done under fault.

Investment evaluation and option analysis show that replace upon functional failure strategy for distribution pole mounted transformer replacements remains the preferred option when compared to age based and an intensive condition based replacement. The nature of pole mounted transformers (sealed tanks installed at top of pole structures) make intensive condition monitoring / testing impractical and the assets aren't designed for in-service testing. Condition monitoring does however occur for external components such as corrosion, pollution, bushing seals and leaks.

Whilst there is no specific transformer inspection program, asset inspectors who undertake pole serviceability inspections and aerial helicopter patrol inspectors complete visual inspections of pole mounted hardware and equipment. A follow up audit is then undertaken by an appropriately experienced person who determines if the transformer is to be removed or if it is safe to leave in service for another inspection cycle.

Volumes for this program are based on historical failure numbers with taking into account the age profile of transformers, assuming that transformers are more likely to fail once they reach end of asset life. Figure 6 shows the historical volume for transformer replacements for this program (this purely failed & poor condition transformers, excludes any capacity upgrades). This program does not include the replacement of transformers in service that are upgraded or removed for network augmentation reasons such as a capacity increase.

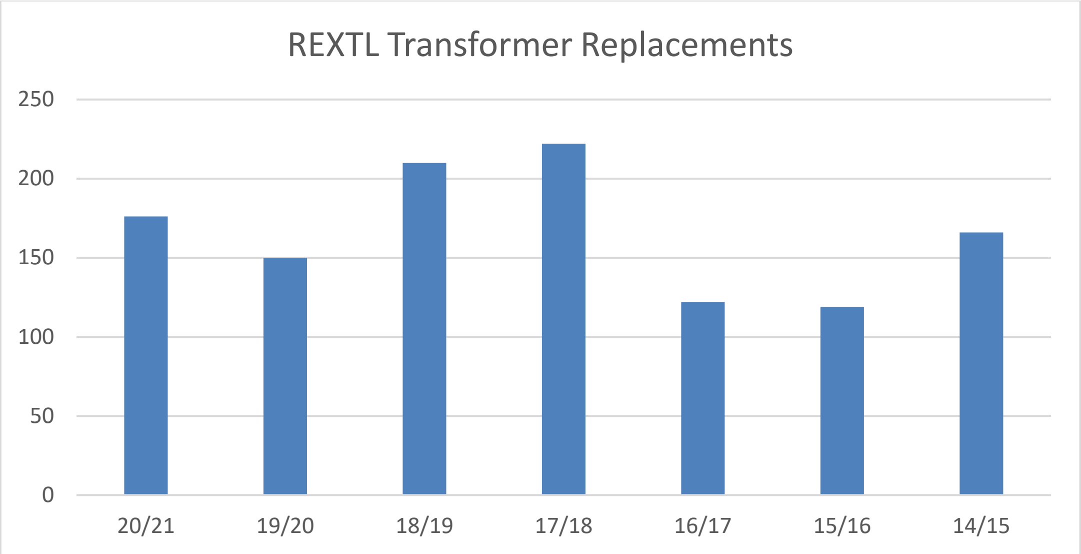

Figure 6: Historical pole mounted transformer replacements.

6.2.2 Replace transformer earths - RETXE

The driver for this project is managing business operating risks and compliance with regulations.

Inadequate earthing places the operators, members of the public and the system at risk. The aim of this program is to proactively replace transformer earths that are in poor condition or damaged and reactively replace transformer earths that are stolen or vandalised. The transformer earth inspection program is used to determine the condition of the assets, identify and prioritise sites for repair, replacement or augmentation and will determine the future scale of this program.

Transformer earths are replaced, augmented or repaired for any of the following reasons:

1. The earths are in poor condition – found through the asset inspection and monitoring program (AIOTX);
2. The copper earths have been stolen (are missing) – identified through AITOX or other inspection programs; and
3. The conditions around the pole earth result in unsafe step or touch hazards to the public.

Copper earthing conductors deteriorate over time due to the oxidisation of the copper in contact with the soil and may have degraded connections following sub-standard installation.

Copper earthing conductor is a target for theft as the salvage prices for copper are significant. There have been instances in the past where the copper conductor associated with the pole earthing system has been stolen from various locations. From the 2009/2010 financial year onwards there has been a significant increase in the amount of copper earth thefts. As a result, standard practice for TasNetworks is to have the earths covered and stapled to the pole when they are replaced at sites targeted by copper thieves. Figure 7 below shows TasNetworks records of reported stolen earths.

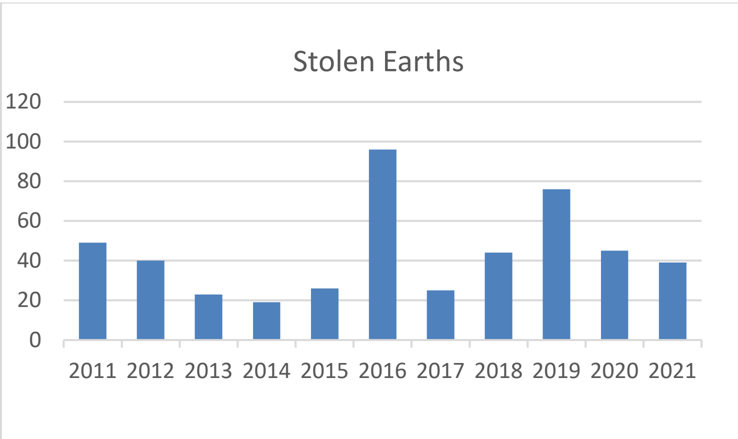

Figure 6: Volume of stolen earths

The earthing installation and inspection programs completed by TasNetworks in the past have operated in a deterministic manner, aiming for a target earthing system resistance. A more appropriate application of the Australian Standard AS2067 takes a probabilistic approach to the safety of an earthing system. This probabilistic approach is concerned with the voltages that members of the public or operators may be exposed to under fault conditions. Metallic surfaces that can be touched by members of the public in close proximity to a pole earth will require assessment, and could drive an augmentation of the transformer earthing system in order to ensure public safety.

6.2.3 Details of future capex projects/programs

Table 4: Program/project details

Project/Program description	Functional area	Document Id. (IES)	Link to HBRM initiative
Replace transformers	RETXL	R2026386	RETXL Investment Summary (copperleaf)
Replace transformer earths	RETXE	R2025911	RETXE Investment Summary (copperleaf)

6.3 Spares management

Spares holding are assessed during the asset management plan review cycle and minimum and maximum stock levels and spares holdings are amended in alignment with TasNetworks' spares policy.

When transformers either fail prematurely during service, and repair is not economically feasible, or the electrical and mechanical condition of the power transformer has deteriorated to such an extent, then it is considered appropriate to retire a particular transformer. Replacement transformers are sources for the stock pool.

Spare transformers for specialty and/or slow lead times, such as legacy instrument transformers and isolators, need a risk managed approach otherwise they require a Just-In-Time approach in their current contract resupply. When necessary, TasNetworks' System Spares Policy details the minimum spares holdings for specific criticalities and timely restoration of supply.

6.4 End of life management

Transformers are disposed of via the TasNetworks Oil Farm, at Rocherlea.

6.4.1 Disposal of transformers containing PCBs

Polychlorinated biphenyls (PCBs) were used in transformers and capacitors amongst other things from the 1930s to the 1970s. However, they were shown to be toxic and carcinogenic and were banned in Australia in the 1970s.

Whilst records indicate that no distribution transformers were purchased with PCB insulating material, contamination has occurred over time where oil management was undertaken using equipment also used for oil management of PCB-contaminated assets (such as Extra High Voltage instrument transformers). This has led to a number of transformer sites with PCB contamination. Of the pole mounted transformers returned to TasNetworks' oil facilities in the past 4 years, on average 7% have been classified as PCB contaminated.

TasNetworks currently has a range of documents which set out the controls pertaining to the risk posed by PCB. These documents reflect the requirements of the following:

- Australian and New Zealand Environment and Conservation Council (ANZECC) Polychlorinated Biphenyls Management Plan;
- TAS Environmental Management and Pollution Control Act 1994; and
- NEPM standards Act.

However, the documentation alone does not fully address the ricks. As a result of documents being out of date, potentially inadequate, and/or poorly understood or implemented. There has been a push in the last year for the development of a PCB asset rick register and to further develop TasNetworks' PCB management strategy and plan.

Currently, all pole mounted transformers are classified as 'Small Items' by EM M09 Management of PCBs, i.e. containing less than 1,000 litres of oil. As such if any is identified as containing PCBs above the threshold concentration, they are:

- Collected at the end of their useful life and managed as scheduled PCB waste – if not in a priority area (as defined in EM-M09); or
- Removed within two years of identification and managed as scheduled PCB waste – if in a priority area (as defined in EM-M09). The current contractor is responsible for the disposal and submission of the Sustainability Report.

7. Related standards and documentation

The following documents have been used to either in the development of this management plan, or provide supporting information to it:

1. Australian Standard AS2067 Substations and High Voltage Installations exceeding 1 kV a.c
2. ENA EG 0 Power System Earthing Guide
3. ENA DOC 007 -2006 Specification for pole mounting distribution transformers
4. ENA DOC 18-2015 The Interim Guidelines for Fire Protection of Electricity Substations
5. Australian Energy Regulator's (AER's) Service Standards Guideline
6. Peterson, A. and Austin, P., "Impact of recent transformer failures and fires – Australian and New Zealand experience"
7. Australian and New Zealand Environment and Conservation Council (ANZECC) Polychlorinated Biphenyls Management Plan
8. Tasmanian Environmental Management and Pollution Control Act 1994
9. NEPM standards Act
10. AIOTX Earthing Inspection Guideline
11. TasNetworks Overhead Switchgear Asset Management Plan
12. TasNetworks Overhead Line Support Structures Asset management Plan