SKM: Assessment of Proposed Regulatory Asset Lives

Appendix 19

Tasmanian Networks Pty Ltd

Transend Networks Pty Ltd

Transend Networks

ASSESSMENT OF PROPOSED REGULATORY ASSET LIVES

QH10492 | August 2013

SINCLAIR KNIGHT MERZ

Assessment of Proposed Regulatory Asset Lives

Document title:	Report
Version:	Final
Date:	09 August 2013
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Approved by:	Ryan Dudley
File name:	C:\Users\JButler\Documents\Projects\QH10492 Transend review of asset lives 2013\Deliverables\Reports\Final\QH10492R016.docx

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Purpose of report

The purpose of this report and the associated services performed by Sinclair Knight Merz (SKM) is to present an assessment of the proposed regulatory lives for nominated asset categories for assets comprising the Transend Networks Pty Ltd (Transend) electricity transmission and communications systems in accordance with the scope of services set out in the contract between SKM and Transend.

This report has been prepared on behalf of and for the exclusive use of Transend, and is subject to and issued in connection with the provisions of the agreement between SKM and Transend.

Executive summary

Sinclair Knight Merz (SKM) was engaged by Transend Networks Pty Ltd (Transend) to assess the regulatory asset lives for each asset category of transmission and communications equipment proposed by Transend as part of the regulatory proposal submission for the period 2014-19.

In undertaking this review, SKM relied upon:

- the current Transmission System Maintenance Plan
- asset management plans for transmission network and communications assets
- interviews with relevant Transend staff to discuss asset performance and reliability
- industry guidelines on asset lives
- recent Australian regulatory decisions for transmission utilities

In assessing asset lives, SKM has considered a number of key drivers:

- the design life of the asset
- the operational life that Transend has historically achieved through prudent asset management
- any strategic issues that impact on the useful life of the asset, such as manufacturer or supplier technical support, availability of spare parts and technical obsolescence

SKM has previously reviewed the Transend asset management system as part of an audit for OTTER, and concluded that "*…the asset management plans for … primary and secondary equipment … clearly define the asset management strategies, procedures and required levels of service in accordance with good industry practice. In addition, the condition assessment report reviewed adequately identified contingency plans in the event of an asset failure.*

From the audit, SKM is of the opinion that the performance reporting system is based on a sound and reliable dataset in WASP, and that the reports are free from any material errors. The recording system used by Transend to capture the relevant details for outages is accurate and reliable, and the application of outage responsibility and exclusions is consistent and in accordance with defined exclusions for performance parameters under the Service Target Performance Incentive Scheme managed by the Australian Energy Regulator, and performance reporting to OTTER."[1]

Therefore, SKM was satisfied that the data provided with regards to asset operational lives and age profiles was reliable and robust, and that the anecdotal evidence provide by Transend staff was supported by a comprehensive asset management framework.

Transend has proposed regulatory lives for asset categories using a methodology that limited the number of tranches for each asset category. SKM is satisfied that this approach was reasonable overall, although there are isolated instances where the proposed regulatory life is the best option available rather than being specifically consistent with either a jurisdictional or statutory recommendation. However, SKM does not consider the differences identified in this report are material in nature.

SKM endorses the set of proposed regulatory lives that Transend have produced for the 2014-19 regulatory period, and found good consistency with other electricity utilities and the recommendations of effective lives from the Australian Taxation Office.

[1] SKM, *Independent Appraisal of Asset and Vegetation Management Plans*, final version 1.0, 7 September 2012, p. 3

1. Introduction

SKM was engaged by Transend to assess the regulatory asset lives for each asset category of transmission and communications equipment proposed by Transend as part of the regulatory proposal submission for the period 2014-19.

The asset lives must satisfy any specific requirements of the National Electricity Rules, including consideration of the depreciation profile reflecting the nature of the asset category over the regulatory life of the assets.

Transend requested the following activities to be undertaken and reported on:

- review the appropriateness of the regulatory asset lives proposed by Transend
- endorsement of the review findings as meeting the statutory requirements
- support any changes to the standard asset lives with reference to industry practice, the Tasmanian environment and conditions, and any technological changes and improvements.

2. Methodology

To endorse a set of regulatory asset lives for the asset categories in the Transend transmission system, SKM examined data from both Transend and other Transmission Network Service Providers (TNSPs) in the Australian market.

The methodology included the following activities:

- a review of the effect of asset management strategies currently in place, and any engineering or condition assessments that have been conducted in relation to asset condition
- discussions with Transend staff about condition monitoring data in relation to major plant, together with maintenance records, costs and available spares
- an examination of actual performance data to provide supporting argument for the residual lives nominated in the recent asset valuation
- a comparison of the asset lives adopted by other TNSPs, using data available to SKM from previous project work, or in the public domain

SKM relied upon the current[2] Transmission System Management Plan (TSMP) in use by Transend for comparative purposes. In addition, SKM has referred to a sample of current Asset Management Plans (AMPs) for key asset categories and a comparison with practices of other transmission utilities.

A major focus of the SKM review was on those asset categories where Transend has proposed an alteration from previous regulatory lives, where the proposed life is different to typical industry practices or where the proposed regulatory life differs from those previously approved in earlier Australian Energy Regulator (AER) decisions.

Age profiles shown in this review have been based on data used for an asset valuation for statutory purposes with a reference date of 30 June 2011, and may differ to age profiles shown in the TSMP.

[2] For the period 2011 - 2016

3. Asset lives

An asset life for a transmission network asset is the period of time that an asset can be expected to reliably and efficiently provide the service capability for which it was designed.

Understanding the asset lives for transmission network assets is important to the establishment of a suitable maintenance regime including a planning and recording system together with its impact on capital and operational expenditure forecasts. The asset lives can be determined by technical, strategic and/or economic reasons.

3.1 Lifetime evaluation

The effective life assessment for each transmission network asset categories needs to be reviewed with regard to design, operational, economic and strategic life to fully appreciate the influences of external effects.

The process of an asset aging whilst in service strongly depends upon the operating mode of the equipment and installation conditions, such as:

- temperature
- electrical stress
  - energisation within voltage and frequency limits
  - number and duration of overloads whilst in service
- continuous or periodic operation
- number of overloads whilst in service
- ambient conditions, such as humidity and pollution level
- mechanical stress
  - number and frequency of operations

Some of the key indicators that an asset has reached the end of its service life include:

- increasing deterioration of condition assessment data
- increasing number of in-service failures
- increasing maintenance costs
- operational issues with similar assets of a similar in-service age

However, natural aging of an asset whilst in service is not the sole limiting factor in determining the appropriate regulatory life for an asset category. Other reasons based on consideration of an asset's strategic or economic impact of the performance of the network should be included in establishing the regulatory life, such as:

- design life
- operational life
- strategic life
- economic life

In assessing the proposed regulatory asset class lives, SKM has considered the impacts of these different factors to assess the most appropriate regulatory asset life for each asset type.

3.1.1 Design asset life

The design life of an asset is the typical anticipated service life expected from an asset designed to meet a specific duty under nominal operating conditions according to industry design standards, adopted ISO standards, Australian Standards or any other appropriate design code for the operation of the asset.

It is important to note that the design life represents an average expected life of the asset. Some individual assets will last much longer than the expected design life and others will fail prematurely. It is not uncommon therefore to have “over-age” assets included in any portfolio of assets. However, the relative quantity of “over-age” assets needs to be monitored and controlled to manage the risk that these assets pose.

The engineering design will establish specifications that are designed to allow the asset to withstand, without failure, the most severe conditions likely to occur during the asset’s service. Factors which influence the design life include:

- ambient effects - moisture, pollution levels and other local contaminants
- operating pressures and temperatures
- dynamic effects
- cyclic loading
- number of operations
- thermal effects

3.1.2 Operational asset life

The operational life of an asset is the actual service life achieved and may vary from the design life based on the operating and maintenance conditions that may be specific to a particular site. Some of the factors that may affect the operational life include:

- maintenance strategies and practices
- environmental factors
- operating practices
- risk profile for the asset

The situation and environment in which an individual asset operates can have a significant impact on both the required level of reliability and the rate of asset deterioration. Under certain circumstances, site or equipment specific maintenance regime with reduced maintenance periods or additional maintenance tasks may be required.

Deterioration mechanisms can broadly be grouped as:

- corrosion of external materials such as equipment casings and cabinets
- ingress of moisture, dust, other pollutants and vermin
- cyclic operation and electrical/mechanical shock resulting in deterioration of electrical characteristics

The operational life is typically determined through a condition based assessment.

3.1.3 Strategic asset life

On occasions, changes in external conditions will drive the replacement of assets. Examples of this situation include:

- change in the strategy for network operation, where the equipment is under-rated for the new operating conditions, including capacity, voltage, fault level and thermal current
- changes in jurisdictional or statutory regulations and Acts that may directly impact the operation or use of an asset type
- end of technical support and lack of spare part availability from external suppliers
- lack of knowledge and maintenance capability for old technologies

3.1.4 Economic asset life

The economic asset life is the expected period of time during which an asset is useful to the average owner.

The economic life of an asset could be different than the actual physical life of the asset. Estimating the economic life of an asset is important for businesses so that they can determine when it is worthwhile to invest in new equipment. In addition, businesses must plan so that they have sufficient funds to purchase replacements for expensive equipment once it has exceeded its useful life. Typically, the economic life of an asset will be used in support of a business case for asset replacement or renewal, based on the following:

- lower maintenance costs
- performance improvement against capital costs
- loss reduction through improved asset design

3.2 Taxation effective asset life

The Australian Taxation Office (ATO) published taxation ruling TR2012/2 which was applicable as at 1 July 2012. This ruling discusses the methodology used by the Commissioner of Taxation in determining the effective asset life for calculating depreciation in accordance with the provisions of the *Income Tax Assessment Act 1997*.

The ATO has determined the effective life of a depreciating asset by estimating the period it can be used by an entity for a taxable purpose or for the purpose of producing income:

- assuming it will be subject to wear and tear at a rate that is reasonable for the Commissioner to assume
- assuming it will be maintained in reasonably good order and condition
- having regard to the period within which it is likely to be scrapped, sold for no more than scrap or abandoned

The factors used in consideration of the effective lives include:

- physical life[3] of asset
- engineering information
- manufacturer’s specifications
- industry use of the asset
- use of asset by different industries
- level of repairs and maintenance

[3] period during which the asset has a physical existence

- industry standards
- past experience of users of the asset
- retention periods
- obsolescence
- scrapping or abandonment practices
- leasing periods (where applicable)
- economic analysis of useful period
- conditions in any secondary trading market

SKM has used the ATO effective lives as a comparison for reasonableness of the proposed Transend regulatory asset lives.

3.3 Asset valuation under AASB standards

SKM was engaged by Transend in 2012 to undertake an asset valuation of the electricity transmission network asset to satisfy a requirement from the Tasmanian Auditor-General for a valuation in accordance with Australian Accounting Standards AASB 116 and AASB 136.

The primary purpose of the asset valuation was to conduct a valuation of all of the Transend network assets and components in use at 1 July 2011 to facilitate financial reporting requirements compliant with Australian Accounting Standards for the financial year ending 30 June 2012.

Each asset category was assigned a class life based on Australian and overseas experience, and on a range of acceptable lives usually nominated by the jurisdictional regulator. For the purposes of this valuation, the following standard SKM asset class lives were applied.

Table 1 Asset class lives

Asset Category	Asset Class Lives (years)
Transmission lines	60 years
Circuit breakers	45 years
Current transformers	45 years
Voltage transformers	45 years
Disconnectors	45 years
Capacitor banks	45 years
Power transformers	45 years
Substation switchbays	45 years
Substation buildings and establishment	60 years
Secondary equipment	15 years

4. Statutory requirements

Clause 6A.6.3 of the National Electricity Rules discusses the calculation of depreciation of the transmission network assets. In particular, clause 6A.6.3 (b)(1) states that the depreciations schedules "*… must depreciate using a profile that reflects that nature of the assets or category of assets over the economic life of that asset or category of assets.*"[4] The purpose of depreciation is that it systematically allocates the cost of an asset over the period that the asset provides useful services to consumers.

In the draft 2009-14 regulatory decision for TransGrid, the AER stated:

> "*Regulatory practice has been to assign a regulatory life … to each category of assets that equals its expected economic or technical life. Generally, regulatory, economic and technical lives for an asset coincide.*"[5]

The definition of economic life is the expected period of time during which an asset is considered useful to the asset owner. As discussed in section 3, SKM is of the opinion that the useful period for an asset may be determined by the natural aging whilst in service, operational considerations or strategic influences due to external factors. As such, SKM would endorse the AER opinion that the regulatory and economic asset lives may be similar, although the "technical" life[6] may vary.

Therefore, for the purposes of this assessment, SKM will refer to the proposed asset lives as "regulatory" lives, which will consider both technical and strategic factors. SKM considers the regulatory asset lives align with the "economic life" as required by the National Electricity Rules and in accordance with the AER opinion that regulatory and economic lives are generally coincident. SKM also notes that the Transend asset management plans refer to the "economic life" for each asset category.

4 National Electricity Rules, chapter 6A, p. 753

5 AER, *Draft decision: TransGrid transmission determination 2009-10 to 2013-14*, 31 October 2008, p. 157

6 "Technical" in this instance relates to design and operational lives discussed in section 3

5. Transend operating environment

5.1 Tasmanian environment

5.1.1 Climate/Terrain

SKM considers the range of climatic conditions in Tasmania generally reflects conditions found in other Australian electricity transmission utilities.

Tasmania has a cool temperate climate with four distinct seasons. Summer has relatively mild temperatures in comparison to other Australian States. Autumn experiences changeable weather, where summer weather patterns gradually take on the shape of winter patterns. The winter months are generally the wettest and coolest months in Tasmania, with most high lying areas receiving considerable snowfall. Spring is a season of transition, where winter weather patterns begin to take the shape of summer patterns, although snowfall is still common up until October. Spring is generally the windiest time of the year with afternoon sea breezes starting to take effect on the coast.

Tasmania has been volcanically inactive in recent geological times but has many jagged peaks resulting from recent glaciation. Tasmania is the most mountainous state in Australia. The most mountainous region is the Central Highlands area, which covers most of the central western parts of the state. The Midlands located in the central east, is fairly flat, and is predominantly used for agriculture. Much of Tasmania is still densely forested, and has a great number of rivers

Whilst this terrain may create difficulties in access, construction and maintenance activities for parts of the electricity transmission network, SKM does not consider that these geographical conditions would affect the regulatory lives of assets in these areas.

SKM concluded that, when considering climate and terrain, the Transend network assets should have regulatory lives at least as long as found in other Australian electricity transmission utilities.

5.1.2 Transmission System Configuration

SKM considers that the Transend planning criteria for transmission system reliability and security reflect good industry practice. In addition SKM is of the opinion that the policies and practices for the specification of plant and equipment, and the design, construction, maintenance and operation of the electricity transmission network assets are in accordance with good industry practices.

SKM concluded that, in considering the Transend transmission system configuration, there are no issues specific to the Transend transmission network that would impact the regulatory lives in comparison with other Australian electricity transmission utilities.

5.2 Transend Asset Management System

Transend has adopted the International Infrastructure Management Manual (IIMM) framework for the philosophy and structure of documentation relating to the asset management of the transmission system. The IIMM framework is similar to the often-referenced PAS 55 asset management approach, and provides guidance on the development of asset management standards and plans, and the TSMP, to support the achievement of Transend's strategic performance objectives.

5.2.1 Transmission System Management Plan

The primary purpose of the TSMP is intended as information to regulators, shareholders, consumers, industry and the general public regarding the operating environment for Transend, and the systems and processes used to provide electricity transmission services to meet or exceed performance requirements.

The TSMP is a public part of a suite of documents required as part of Transend licence obligations.

The TSMP outlines the asset management strategy and plans, and associated systems and processes for the management of the electricity transmission network assets throughout their life cycle.

The document is presented in five chapters, and is structured as follows:

- overview of Transend Networks, the Tasmanian power system and regulatory environment
- outline of asset management framework, polices, strategies, systems and processes to support asset function and performance
- commentary on AER Service Target Performance Incentive Scheme (STPIS) service standard parameters and other performance measures as required by OTTER
- outline of the transmission system development, highlighting key development drivers, annual planning process and investment processes
- discussion on existing asset profiles and specific asset management issues and strategies

5.2.2 Asset Management Plans

The asset categories covered by the TSMP include all substation primary and secondary equipment (and all infrastructure), transmission lines and cables and associated easements and access tracks, protection and control, metering, SCADA and telecommunications.

Chapter 5 of the TSMP relates to the existing asset profiles and strategies, outlining the age profiles, and asset management issues for substation primary and secondary equipment, transmission lines and cables, and SCADA and communications.

The primary source data for this chapter are the separate AMPs for each of the asset categories. Each plan highlights:

- how the AMP fits into the Transend asset management document framework
- a description of the asset covered by the plan
- related standards
- condition assessment of the asset category population, highlighting any specific operational issues
- risk analysis and mitigating strategies
- network service obligations
- planned augmentations
- life cycle issues such as maintenance and disposal
- financial summaries of forecast capital and operational expenditures

A list of the current Transend AMPs is provided in Appendix B.

Following a high level review of these documents and interviews with key Transend engineering staff, SKM concluded that the Transend asset management practices are aligned with industry norms and are considered appropriate for sustaining asset class life expectancies.

6. Proposed Regulatory Asset Classes

The assets employed by electricity transmission entities can be allocated into asset classes and asset categories and sub-categories. The level of detail, the number of asset categories that can be effectively employed is dependent on the level of data available regarding population numbers, age and condition and replacement history. SKM has found that the level of disaggregation into sub-asset categories is increasing over time as utilities refine and improve their asset management systems.

Utilities are looking increasingly at extending the service life of existing assets. In many cases this can be achieved by replacing one or more asset categories that may have a shorter service life than the parent asset. This has led to a number of utilities adopting asset categories as the basic unit so that those shorter life components that have been replaced can be recognised in the regulated asset base. Transend has taken this approach.

Transend has structured their proposed regulatory asset lives under 16 Regulatory Asset Classes (RAC). The RACs have up 4 tranches of class lives: long life (60 years); medium life (45 years), short life (9 to 15 years) and very short life (4 to 5 years). These RACs and the proposed asset lives are shown in Table 2 below.

Table 2 Proposed Regulatory Asset Classes

Regulatory Asset Class	RAC	Proposed Regulatory Asset Life	Asset Life Category	Number of Asset Categories
Transmission Lines	TL60	60 years	Long Life	6
	TL45	45 years	Medium Life	8
	TL10	10 years	Short Life	5
Transmission Substations	SS60	60 years	Long Life	5
	SS45	45 years	Medium Life	27
	SS15	15 years	Short Life	10
Protection and Control	PC15	15 years	Short Life	7
	PC04	4 years	Very Short Life	2
Communications	COM45	45 years	Medium Life	9
	COM10	10 years	Short Life	25
	COM05	5 years	Very Short Life	7
Transmission Operations	TO10	10 years	Short Life	3
	TO04	4 years	Very Short Life	1
Other	OT40	40 years	Medium Life	2
	OT09	9 years	Short Life	3
	OT04	4 years	Very Short Life	5
Land	-	Not applicable		2
TOTAL				**127**

Each of these RACs is divided into a varying number of Regulatory Asset Categories (RACT). The total number of RACTs employed is approximately 127 across the 16 RACs. The detailed Regulatory Asset Classes and the categories together with the regulatory asset lives proposed by Transend are presented in Appendix A.

7. Transmission lines

The transmission lines owned by Transend operate at either 220kV or 110kV. With the exception of four circuits at 110kV that comprise underground cable conductor for their full length, and four circuits at 110kV with sections of underground cable, all circuits owned by Transend consist of overhead conductor.[7]

The performance, condition and age in-service of the transmission line influence the prudent levels of maintenance, refurbishment and replacement expenditure. To support the appropriate level of asset management, Transend has proposed that the transmission line assets are separated into several categories as shown in Table 3, with asset lives assigned to reflect the differing asset requirements.

Table 3 Transmission Line RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Long Life (TL60)	Transmission lines	60
	Conductor	
	Support structure - steel	
	Foundations	
	Access tracks	
	Insulator assemblies - porcelain and glass	
	Earth wire including OPGW	
	Galvanised steel earth wire	
Medium Life (TL45)	Support structure - wood	45
	Insulator assemblies - synthetic/composite	
	Dampers	
	Fall arrest system	
	Access tracks - bridges	
	Transmission cables	
	ADSS (Optical Fibre - All-Dielectric Self Supporting)	
	OPUC (Optical Fibre - Underground Cable)	
Short Life (TL10)	Support structure - protective coatings	10
	Anode	
	Access and ID	
	Markers	
	Weather stations	
	Tension monitors	

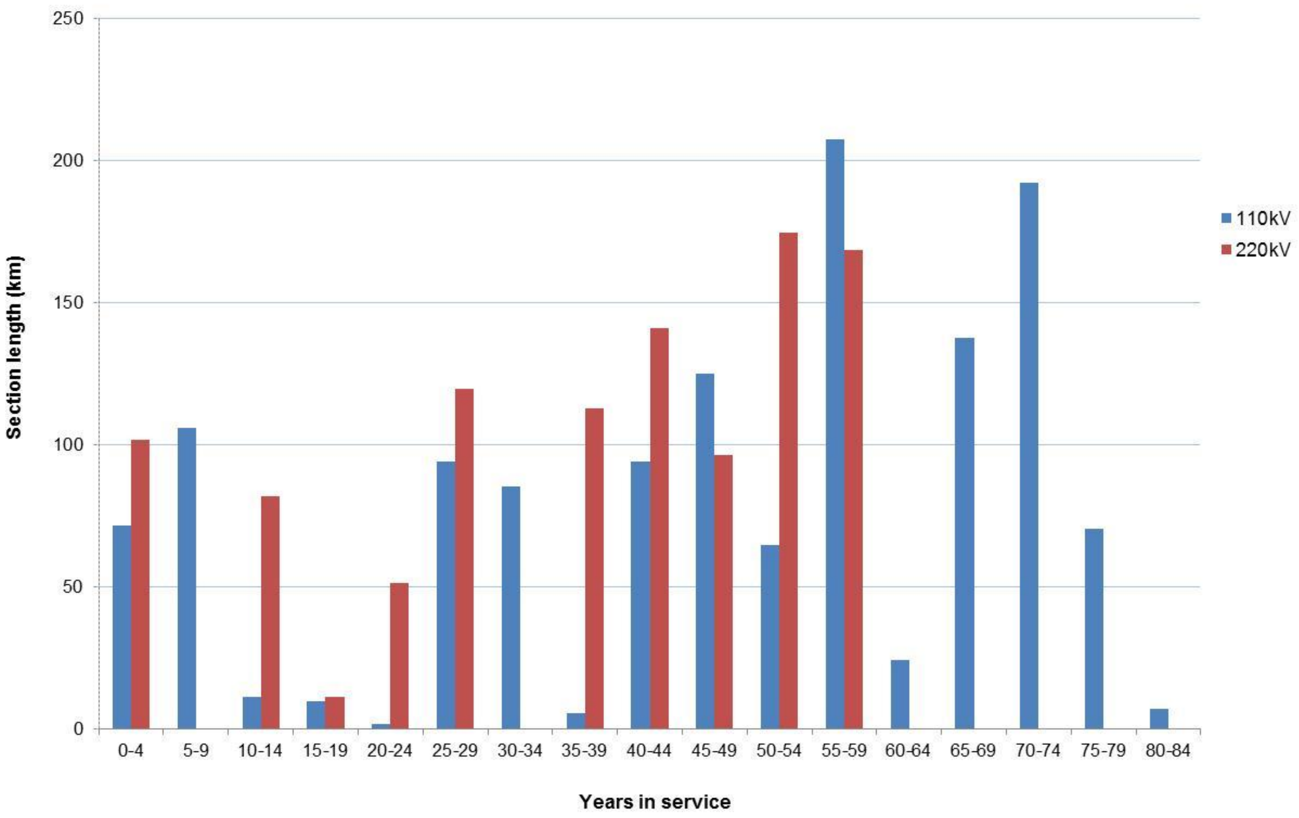
7 *Transmission System Management Plan 2011-2016*, section 5.5.1, p. 62

7.1 Transmission line

The TSMP states that sections of the Transend transmission network are some of the oldest sections in Australia, with 25% of the network (by length) being in excess of 60 years old, and 68% (by length) being more than 40 years old.

These figures are confirmed by the recent asset valuation of 2012, with 23% of the network in excess of 60 years old, and 64% of the network in service for more than 40 years. The following figure illustrates the age profile of 110kV and 220kV transmission lines as at June 2011.

Figure 1 Transmission network age profile



SKM noted that the majority of the 110kV lines in excess of 60 years used hard drawn copper conductor, and was due for retirement.

The longer in-service ages for the transmission lines is in part due to the favourable climatic conditions in Tasmania, and SKM considers this illustrates that the asset management strategies that Transend are employing are maximising the operational life for the lines to an average of 60 years.

The industry standard for transmission line asset life is 60 years, and the ATO tax ruling[8] recommends an effective life of 47½ years. Based on the demonstrated asset performance and with consideration of the ATO effective life, SKM considers the proposed regulatory life of 60 years to be reasonable and comparable to other Australian electricity transmission utilities.

[8] Taxation Ruling TR20102/2, p. 143

7.2 Support structures

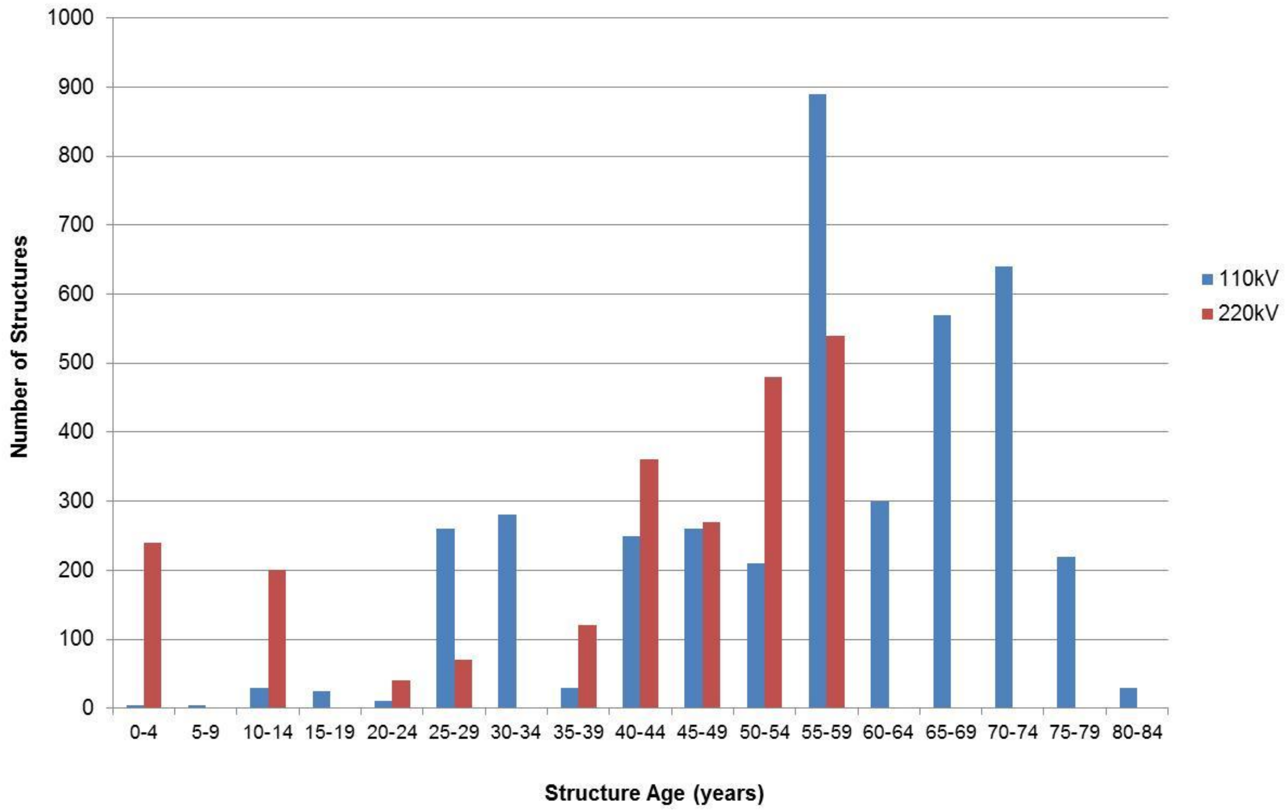
The asset management of support structures is described in the Transmission Line Support Structures AMP[9], which includes the age profile, performance, inspection, defects and risk analysis for all support structures.

The support structures predominately used by Transend are galvanised steel lattice towers, with relatively small numbers of steel and wood poles.

7.2.1 Support structures - steel

The age profile as at June 2011 for galvanised steel lattice towers is shown in Figure 2.

Figure 2 Galvanised steel lattice towers age profile



Approximately 45% of the 110 kV galvanised steel lattice support structures are greater than 60 years of age, while approximately 20% of the 220 kV support structures will exceed 60 years of age in the 2014-19 regulatory control period.

A comparison against other TNSPs shows that Transend's average 110 kV steel lattice support structure age of approximately 55 years is the highest in Australia, and is significantly higher than the Australian average of approximately 45 years.

At an average age of approximately 40 years, Transend's 220 kV lattice support structures are also the oldest in Australia.

Due to their environmental exposure, the degradation rate of steel structures typically increases with age, and hence the requirement for inspection, asset refurbishment and/or asset renewal activities is likely to increase

9 *Transmission Line Support Structures Asset Management Plan*, D08/99418, issue 4.0. October 2012

with time. There are no asset specific condition monitoring activities for galvanised steel support structures. All of these support structures undergo routine visual inspections, with any defective assets recorded and prioritised in accordance with the internal defect priority processes for action within the a timeframe appropriate to the severity of the defect. Transend has reported that most of the defects are of a low or medium priority, and relate to corrosion of bolts and cross-members. Programs are in place to rectify lines that are more prone to these defects.

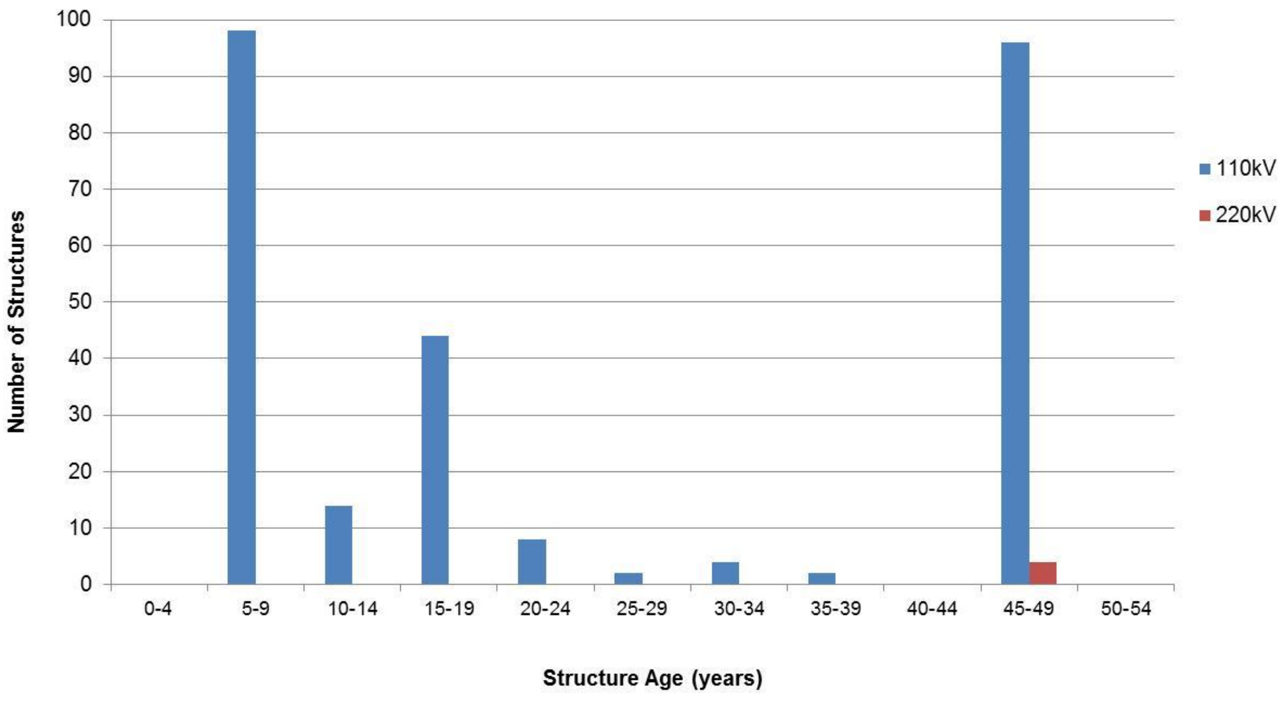
The regulatory life proposed for this asset category is in the long life asset class, and this is considered appropriate when compared with other utilities. A regulatory life of 60 years was approved for Transend by AER in the previous regulatory determination.

SKM considers the wider experience Transend has with 110kV structures demonstrates that a regulatory life of 60 years is a reasonable reflection of the performance of the asset class to date.

7.2.2 Support structures - wood

The age profile for the wood pole population as at June 2011 is shown in Figure 3.

Figure 3 Wood pole age profile



The average age of the relatively small wood pole population is approximately 24 years. Transend has advised that routine tests of wood pole cores are conducted every three years to determine the remaining sound wood within a pole, with the next test due in the summer of 2013–14. It is Transend's policy that any pole found to have insufficient sound wood will be condemned, with replacement to occur within 3 months. The AMP states that most defects are due to rotting, particularly around pole risers.

The current experience with wood poles is that an operational life of between 35 and 50 years is expected, which SKM considers is consistent with the age profile for these assets, and with electricity industry norms. The effective life from the ATO taxation ruling is 45 years.

SKM considers the proposed regulatory life of 45 years for wood support structures is reasonable and appropriate, and consistent with the asset life approved by the AER in the previous regulatory decision.

7.3 Insulator assembly

The transmission line insulator assemblies AMP[10] defines the strategies for the management of insulator assemblies, taking into account past asset performance, good electricity industry practice and the need for prudent investment to optimise the asset life-cycle.

Transend has approximately 43,000 insulator assemblies in service of which 69% are glass (which is the preferred material for new transmission lines) while 30% are porcelain. There are also a relatively small number of synthetic insulators in the transmission network. Table 4 shows a summary of the disc insulator population.

Table 4 Disc insulator population

Material	Number in service	% of population
Glass	258,873	69.0%
Porcelain	113,868	30.3%
Synthetic	2,524	0.7%
Total	375,265	100.0%

7.3.1 Glass and porcelain insulators

The AMP states that "*… Transend utilises porcelain and glass disc insulators, synthetic long rod and stand-off insulators, and porcelain post insulators on its transmission network. Glass disc insulators are the preferred design for new transmission lines due to their low overall life cycle cost. The majority of Transend's insulator assemblies are either glass or porcelain disc insulators. The most common failure modes for these insulators include corrosion of the steel pin (particularly where zinc collars have not been installed), and degradation of the cement used to join the insulator disc with its cap and pin.*"[11]

The preferred insulator assembly used by Transend is glass, as these have no condition monitoring costs, and typically require only regular inspection to identify any defects due to lightning strikes or deterioration of the steel pin. The glass is tempered and will shatter when they fail, and therefore provide field personnel with a clear and visible indication of the failed insulator disc, facilitating swift identification and commencement of repair activities.

Porcelain insulator assemblies have historically been utilised extensively, and upon failure would normally be replaced with a similar porcelain insulator assembly. These insulators are able to withstand attempts at vandalism more effectively than glass insulators. However, porcelain insulators are not preferred for new transmission lines, as failure often manifests itself in a small puncture of the insulator disc that is often visibly undetectable by field personnel, requiring costly condition monitoring.

The age profile as at June 2011 for the glass and porcelain insulator strings shown in the following figures are extracts from section 2.3 of the AMP. These illustrate the current performance of these types of insulator assemblies, with:

- 60% of the 110kV glass disc insulator population being over 45 years of age
- 40% of the 220kV glass disc insulators will be over 45 years of age by the year 2019
- 75% of 110kV porcelain insulator strings, 45% of 220kV porcelain disc insulators are over 45 years of age
- 60% of 110kV porcelain insulator strings are over 65 years of age

[10] *Transmission Line Insulator Assemblies Asset Management Plan*, D08/99660, issue 3.0, October 2012

[11] ibid., p. 7

Figure 4 Glass disc insulator age profile

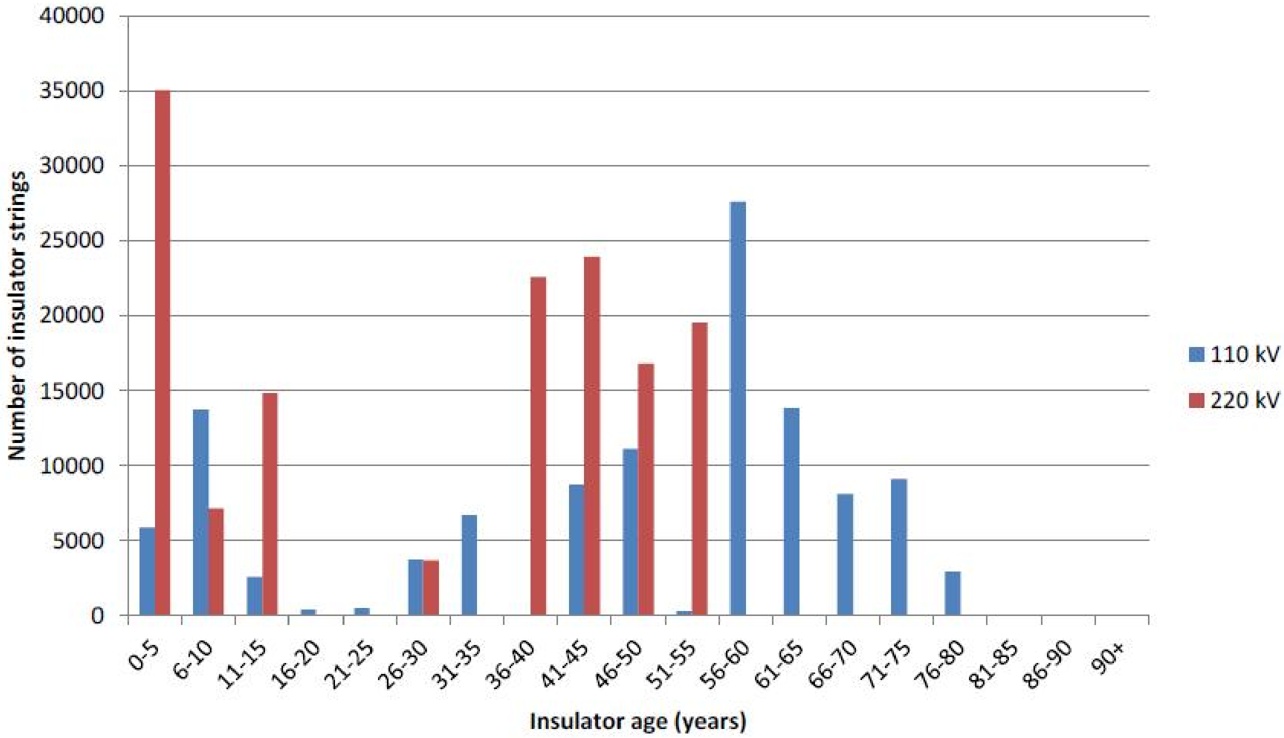
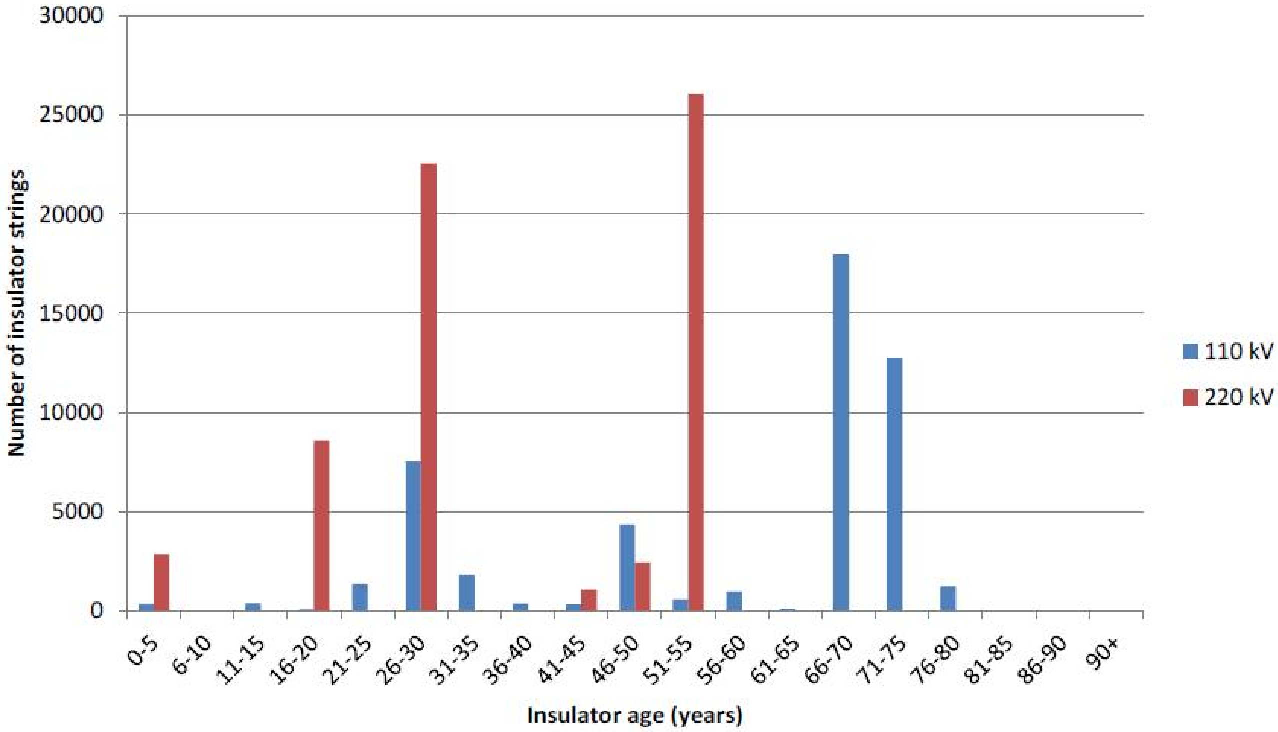


Figure 5 Porcelain disc insulator age profile



The management of this ageing asset category has been effective. Since 2009-10 only one P1 (high priority) insulator assembly defect has been identified on the Transend network and there have been reductions in the number of lower priority defects detected. Only 7 insulator failures have been experienced in the Transend network due to poor condition since 1990. External International Transmission Operations & Maintenance Study (ITOMS) benchmarking also shows that the Transend transmission line assets have been performing above average.

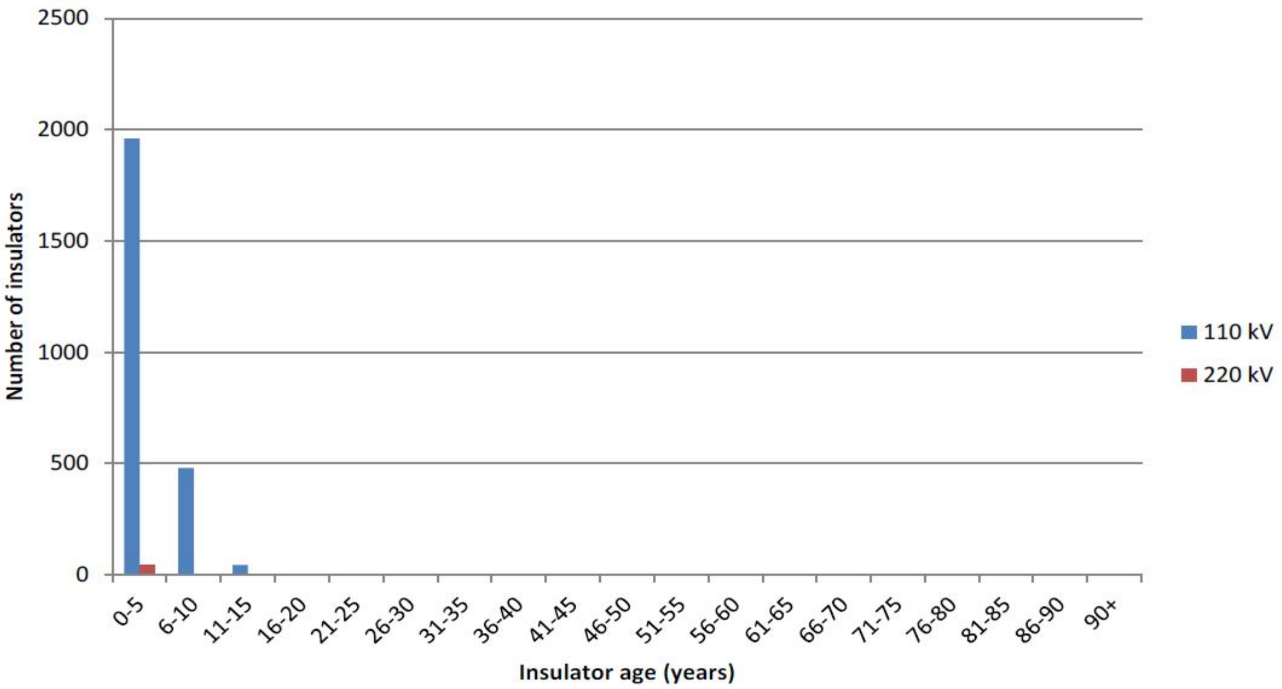
The Transend asset replacement strategy has a targeted list of insulators to be replaced. Those insulator assemblies selected for replacement in the 2014-19 regulatory period have an average age of approximately 64 years. The data presented by Transend in the Insulator Assemblies AMP shows an asset that is relatively aged but performing well, but is also highlights that the risk assessment is a high. It is therefore important that Transend maintain cyclic inspections and targeted replacement and insulator washing programs to ensure that this risk is mitigated.

The AMP states that the economic life for insulator assemblies is 45 years in accordance with previous advice[12] and the ATO effective life from taxation ruling TR2012/2 is 47½ years. Based on the evidence provided in the AMP relating to the age profile and asset management strategies, and the anecdotal evidence provided by Transend staff responsible for the maintenance and replacement programs, SKM is satisfied that the proposed regulatory life of 60 years for glass and porcelain insulator assemblies is reasonable and appropriate. This is consistent with the asset life nominated by the AER in the previous 2009-14 regulatory decision, and other industry standards (refer Appendix C).

7.3.2 Synthetic insulators

From Table 4, there is a small population of synthetic insulator assemblies in-service. The AMP notes that "*… synthetic insulators are not widespread and the majority have been in service for less than 15 years. Transend has not observed any systemic condition problems with these insulators.*"[13] The age profile as at Jun 2011 is shown in Figure 6.

Figure 6 Synthetic insulator age profile



[12] SKM, *Assessment of Economic Lives for Transend Regulatory Asset Classes*, 29 April 2008

[13] *Transmission Line Insulator Assemblies Asset Management Plan*, D08/99660, issue 3.0, October 2012, p. 7

There are currently no condition assessment tests available to the electricity transmission industry to determine the condition of a synthetic insulator assembly. Transend is therefore relying upon visual inspections to identify any defects. As shown in Figure 6, the current population is relatively young and there are no systemic operational issues that have been identified.

Anecdotal evidence provided by Transend staff suggested that a transmission line built under contract recently in the north-east region of Tasmania has used synthetic insulator assemblies with a design life of 25 years. Transend has no practical experience to determine if the operational life of the synthetic insulators, with appropriate visual inspection and preventative maintenance practices, will exceed this design life.

SKM notes that the 3 tranches of regulatory lives that Transend have applied to transmission line assets only provide for long (60 years), medium (45 years) and short (10 years). As the age profile and performance of the current population has exceeded the short life, SKM considers that it is prudent, in the absence of direct experience with maintenance and performance, for Transend to classify the synthetic insulator assemblies as medium life; that is, a regulatory life of 45 years. This is consistent with the current economic life specified in the AMP and appropriate in comparison with other industry utilities and standards for insulator assemblies in general.

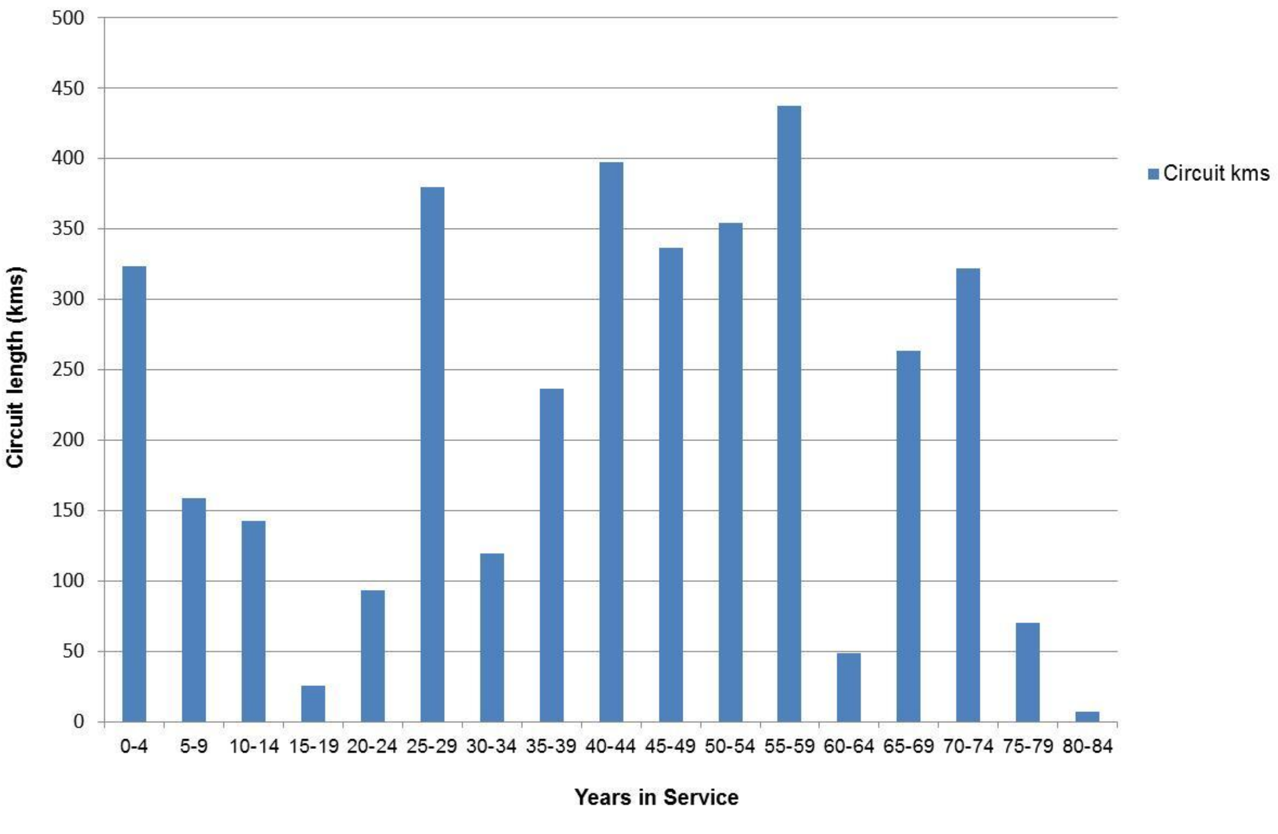
7.4 Conductor assembly

The conductor assemblies are covered by transmission line conductor assemblies AMP, which includes asset management strategies for conductors, dampers, and earth wires.

7.4.1 Overhead conductor

Figure 7 shows the age profile for the conductor as at June 2011.

Figure 7 Conductor age profile



The conductor predominately used in the Transend transmission network is:

- Aluminium conductor steel reinforced galvanised (ACSR/GZ)
- All aluminium alloy conductor (AAAC)
- Hard drawn copper (HD Cu)

These three conductor types constitute approximately 98% of the total circuit kilometres. Most of the HD Cu circuits are at least 45 years old, with the oldest being 80 years old. The preferred conductor type for new construction used by Transend is AAAC due to it representing a good balance between strength, weight, cost and current carrying capacity.

For the age profile shown in Figure 7, the periods between 0 and 24 years is AAAC, the middle period between 25 and 54 years is predominately ACSR/GZ, whilst the older assets are HD Cu conductors.

ITOMS benchmarking shows that the Transend service performance for conductor assemblies has been better than the ITOMS study participant's average for 220kV transmission line assets. Similarly, 110kV transmission line assets have shown a path of continual and significant improvement as benchmarked against ITOMS study participants. This is a strong indication that the asset management strategies that Transend has in place are effective and being implemented in line with good industry practice.

Transend has identified specific examples of conductor deterioration due to corrosion in the AMP, but generally conductor is achieving operational life in line with other Australian electricity transmission utilities. The general industry regulatory life for conductor is 50 to 60 years (refer Appendix C) and the ATO effective life is 47½ years; both of which are comparable to the nominated economic life of 60 years in the AMP. Based on the anecdotal evidence from Transend staff, and the reported performance of the conductor in the Transend transmission network, SKM considers that the proposed 60 years regulatory life is reasonable and appropriate.

7.4.2 Earth wires

At present, Transend does not have separate records available for aluminium overhead, optical fibre (OPGW) or galvanised steel earth wire.

The transmission line conductor assemblies AMP recommends 60 years as the effective life for aluminium overhead and OPGW and 45 years for galvanised steel earth wire. Based on discussion with Transend staff, the general experience is that all earth wire, including galvanised steel, is achieving an operational life of 60 years, particularly where the environment could be considered as benign. It was also noted that galvanised steel earth wire is no longer used in new constructions, and is replaced by either aluminium or OPGW when required.

Therefore, SKM is of the opinion that the proposed regulatory life of 60 years for is appropriate and reasonable.

7.4.3 Dampers

As for earth wire, Transend does not have age profile data for vibration dampers. The transmission line conductor assemblies AMP recommends an economic life of 45 years.

Transmission line dampers are designed to dynamically counteract aeolian and other vibration within a conductor span. As such, over their lifetime they will experience mechanical wear and will deteriorate to the extent that they can no longer protect the conductor against the effects of vibration. At that point in time damper replacement is normally required.

In assessing life-cycle issues, Transend *"…has not identified any significant design issues with its dampers, however due to their requirement to absorb energy generated by conductor vibration, they are susceptible to wear, particularly in windy regions and where aeolian vibration is more prevalent. Damper replacement is* *necessary where dampers are assessed as being at end of life and are unable to perform their protective duty."*[14]

Experience from Transend staff is that vibration dampers have an operational life of approximately 45 years. There is no general Australian electricity industry asset life for vibration dampers as not all utilities have assigned asset lives in a detailed breakdown as has Transend. The ATO taxation ruling TR2012/2 for transmission line fittings is 47½ years.

SKM considers that the proposed regulatory life of 45 years is reasonable and appropriate in light of the practical experience Transend has had with vibration dampers in their network, and with consideration of the effective life nominated by the ATO.

7.4.4 Optical fibre

Similarly to earth wire, Transend does not currently have records of ages for optical fibre installed in the transmission network. The transmission line conductor assemblies AMP recommends an economic life of 45 years for ADSS optical fibre conductor.

The AMP does not identify any particular issues with the optical fibre conductor. This type of conductor is identical to that used for the communications network (refer section 11.1.1).

The anecdotal advice provided by Transend staff suggested that ADSS was achieving an operational life of approximately 45 years. The recommended effective life from the ATO is 25 years, whilst the general industry standard asset life is approximately 45 years.

SKM considers that the proposed regulatory life of 45 years is reasonable and appropriate for optical fibre cables, and consistent with the asset life approved by the AER in the previous Transend regulatory decision

7.5 Monitoring equipment

Transend uses a number of electronic and IT systems and tools to facilitate management and operation of its transmission infrastructure, including remote weather monitoring stations for use in determining dynamic circuit rating. Transend uses weather data from 14 weather stations and 16 conductor tension monitors on 10 transmission circuits

This monitoring equipment is largely electronic in nature, and therefore Transend has proposed a short regulatory life of 10 years. The ATO taxation ruling TR2012/2 provides little guidance, with the effective life for "electricity transmission - control, monitoring, communications and protection systems" being 12½ years. SKM is of the opinion that this relates more to substation-based monitoring and protection systems, whilst the monitoring equipment on transmission lines will be installed in exposed environments and subject to climatic conditions. It is reasonable to expect a reduced life for such installations.

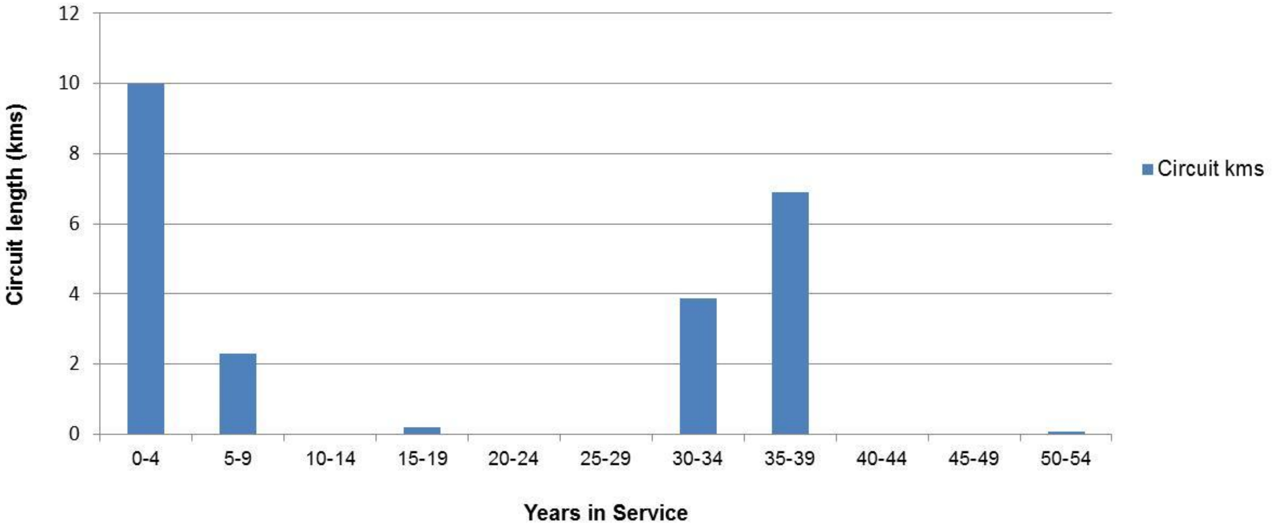
SKM considers a regulatory life of 10 years to be reasonable and appropriate, and consistent with the regulatory life approved by the AER in the previous Transend regulatory decision.

[14] *Transmission Line Conductor Assemblies Asset Management Plan*, D08/99101, issue 5.0, June 2013, section 7.1, p. 38

7.6 Transmission cable

The age profile as at July 2012* is shown in Figure 8.

Figure 8 Transmission cable age profile



There is approximately 24km of 110kV transmission cable in the transmission network with 5 main feeders between substations:

- Creek Road to North Hobart
- Rokeby terminal station to Rokeby substation
- Trevallyn to Mowbray
- Mowbray to St Leonards (commissioned July 2012)*
- Norwood to St Leonards (commissioned July 2012)*

The proposed regulatory life is 45 years, which is consistent with the asset life approved by the AER in the previous Transend regulatory decision, and general industry standards (refer Appendix C).

Transend has not reported any major performance issues with the transmission cable, and asset management is detailed in the power cable AMP.[15]

SKM considers the proposed regulatory life of 45 years to be reasonable and appropriate.

7.7 Other asset categories

7.7.1 Fall arrest system

In accordance with NENS 05-2003 *National Fall Protection Guidelines for the Electricity Industry*, all personnel are required to use the "double attached" climbing technique when climbing or working on steel lattice towers. This technique requires the worker to wear a safety harness with is attached to 2 lanyards. As the worker climbs the tower, at least 1 of the lanyards is to be connected to the support structure at any time. SKM notes that NENS 05-2003 specifies the use of the system, but does not discuss testing of the equipment, nor does it recommend an expected operational life.

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[15] *Power Cable Asset Management Plan*, D09/9131, issue 2.0, July 2009

The fall arrest system used by workers gaining access to the transmission line towers is similar to that used on the communications towers, and advice provided by manufacturers suggested that fall arrest equipment should have an operational life of approximately 25 years, with the attachments subjected to annual checking.

Given that Transend has adopted a 3 tranche approach for proposing regulatory lives for transmission line assets, the fall arrest system is expected to have an operational life in excess of the short life (TL10). With consideration of this, SKM considers a regulatory life of 45 years is considered reasonable and appropriate, and consistent with the ATO recommended effective life of 47½ years.

7.7.2 Access tracks

The nature of access tracks to the sites is dependent upon statutory and/or jurisdictional requirements that may exist for the area in which the communications station is located. Transend staff advised that some recent transmission line projects have required the installation of a class 4 road, which is an unsealed road suitable for all-weather access.[16]

SKM noted that the requirement for a class 4 road has only be in place during the past decade, but it is apparent that future access tracks will be required to be constructed to the same standard. Whilst the ATO taxation ruling TR2012/2 recommends an effective life of 47½ years, SKM considers that the longer proposed regulatory life of 60 years is more appropriate for this more substantial construction.

7.7.3 Bridges

The details of bridges on access tracks are not stored in WASP, and therefore the only evidence that Transend could provide with regards to anticipated operational life is anecdotal. Historically, bridges were fairly inconsequential constructions that were only intended to provide light vehicle access to the transmission line. However, with the requirements for more substantial road construction (refer section 0), bridges are now of a steel construction governed by new design standards and rated by the maximum tonnage that can be carried.

Whilst there is no specified design life for the modern bridge construction, Transend expects that these will achieve at least 45 years in service. Therefore, SKM considers the proposed regulatory life of 45 years to be reasonable and appropriate.

7.7.4 Anode

The purpose of the sacrificial anode is to mitigate or arrest corrosion of the galvanised steel support structures. By their nature, these anodes should have a shorter regulatory life than the steel tower. SKM has reviewed a conference paper[17] detailing practical experience with anodes, and noted that the operational service life is dependent upon the type of anodes and the soil type into which the anode is installed, but that an operational life of 15 years is achievable.

Based on this advice, SKM is satisfied that, using the Transend 3 tranche approach, the proposed regulatory life for anodes is 10 years. This is consistent with the ATO recommended effective life of 12½ years.

[16] *Tasmanian Forest Practices Code*, 2000, section B.2, p. 8

[17] Kirkpatrick, E.L, *Paper 227: Cathodic protection of power line structure foundations*, March 1988, p. 7

7.7.5 Support structure - protective coatings

Transend has advised that Denso corrosion protection and sealing products are used to protect steel lattice tower members and steel poles at ground level. These products include a variety of tapes and paints.

SKM has researched the Denso product advice, and found that the design life for hand applied tape wraps for different structural steelwork and pipework is in the range of 15 to 30 years. The ATO recommended effective life for support structure preparation and painting is 10 years.

With consideration of the product advice that is available from the supplier, and the ATO effective life, SKM is satisfied that the regulatory life for these protective coatings would be less than the medium life (TL45) tranche, and therefore it is considered reasonable to allocate a regulatory life of 10 years for these coating assets.

7.7.6 Access and signage

The transmission line support structures AMP states that "*… Transend has recently identified a new type of sign with a significantly longer life (up to 30 years) than those previously installed on transmission line structures (up to 7 years). Transend is currently trialling these signs and, if successful, will utilise these signs in the future.*"[18]

The most common failure mode for warning signs is fading due to UV exposure.

With consideration of advice received from Transend staff, and the AMP, SKM considers that the proposed regulatory life of 10 years is reasonable and appropriate.

[18] *Transmission Line Support Structures Asset Management Plan*, issue 4.0, October 2012, section 3.3.6, p. 32

8. Transmission substations

As at June 2011, Transend owned and operated 48 substations, 8 switching stations, and 2 transition stations. These substations have primary plant that operates at voltages in the range 6.6kV to 220kV. The TSMP states that "*… the diversity of make, type, age and technology of the equipment installed to support the wide range of operating voltages significantly increases the complexity of asset management. In particular, operations and maintenance management, contingency plans and spares policy are affected by the diversity … Transend's approach to justifying operating and capital expenditure on substation assets is not driven by age but condition. However, generally older equipment is less reliable and requires more maintenance than modern equivalent assets.*" [19]

Transend has proposed that the transmission substation assets are separated into several categories as shown in Table 5, with asset lives assigned to reflect the differing asset requirements.

Table 5 Transmission Substation RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Long Life (SS60)	Foundations	60
	Structures	
	Grounds	
	Oil containment system	
	Crane	
Medium Life (SS45)	Switchgear	45
	Power transformer	
	Instrument transformers	
	Reactors	
	Capacitor banks	
	Surge diverters	
	Switchyard bays	
	Buildings	
	Fences and gates	
	Earthing systems	
	Earthing transformer	
	Busbar and conductor	
	Switchboard panels	
	String insulators	
	Power cables	
	Station service transformers	
	Generator	
	AC supply system	
	DC supply system - switchboard	
	Air supply system	

[19] *Transmission System Management Plan 2011-2016*, section 5.2.1, p. 46

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Short Life (SS15)	Security system	15
	Heating, ventilation, air-conditioning	
	Photo-voltaic solar supply system	
	DC supply system - batteries and battery chargers	
	Fire protection systems	
	Operational equipment	

8.1 Switchgear

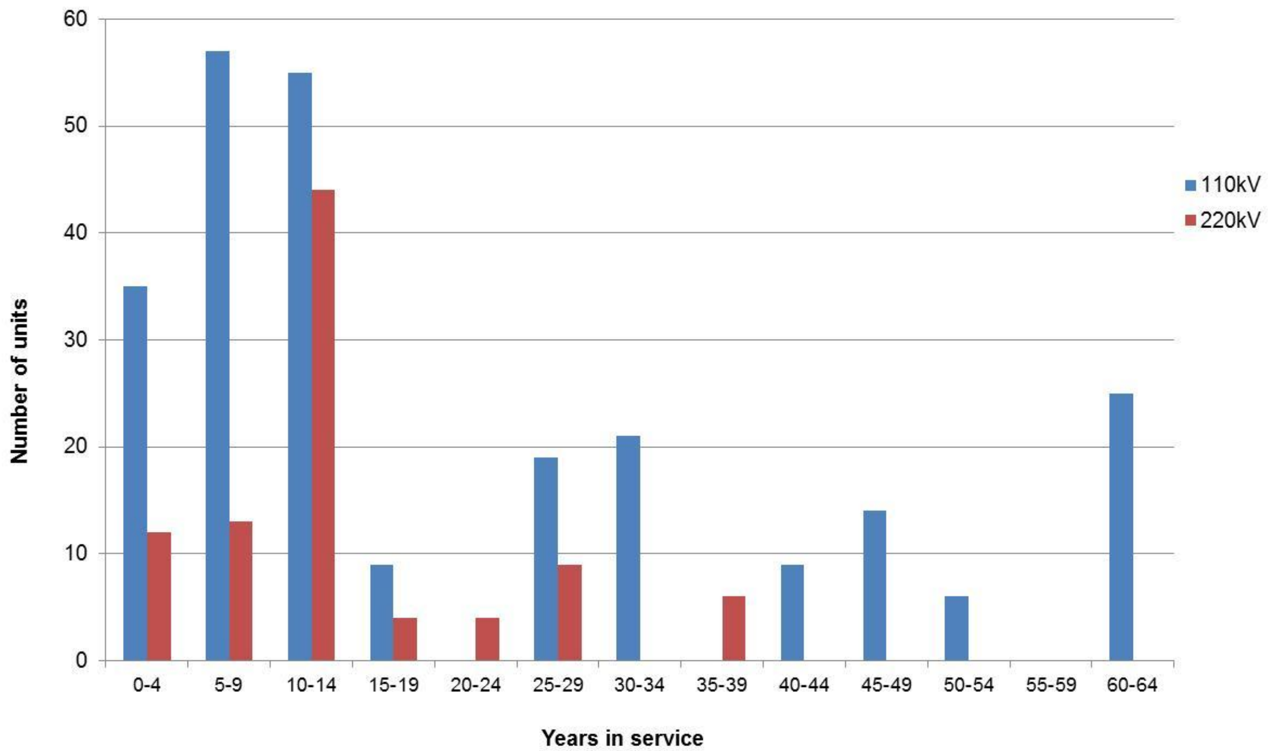
The primary switchgear consists of circuit breakers, disconnectors, and earth switches. Dead-tank circuit breakers are also equipped with integral current transformers. Transend has a separate AMP for each of these asset types. Transend has adopted a practice of retaining assets in service for as long as the asset remains useful, which has required close monitoring and more frequent condition assessment of the equipment.

Each of the AMPs include specific strategies to address any identified performance, condition, design and capacity issues, and an assessment of the risk profile.

8.1.1 Circuit breakers

Figure 9 shows the age profile as at June 2011 for the 110kV and 220kV circuit breakers in the transmission network. This includes consideration of the 110kV GIS circuit breakers currently in use at Risdon substation.

Figure 9 HV circuit breaker age profile



The average age of the 110kV population is approximately 21 years, and 14 years for the 220kV units. The overall average age of the circuit breaker assets is approximately 19 years.

The majority of 110kV circuit breakers shown in the “60-64 years in service” in Figure 9 were located in Creek Road substation and Tarraleah switching station. As at June 2013, Transend has a major redevelopment project of Creek Road substation and Tarraleah switching station underway, which will see these aged circuit breakers replaced.

Transend has asset management strategies and practices in place which are in line with good industry practice, and includes a comprehensive condition monitoring regime to provide an assessment of circuit breaker electrical condition. The program to replace models/makes of circuit breakers that have been identified with maintenance and/or performance issues is in progress, and is targeting completion of these units by 2014.

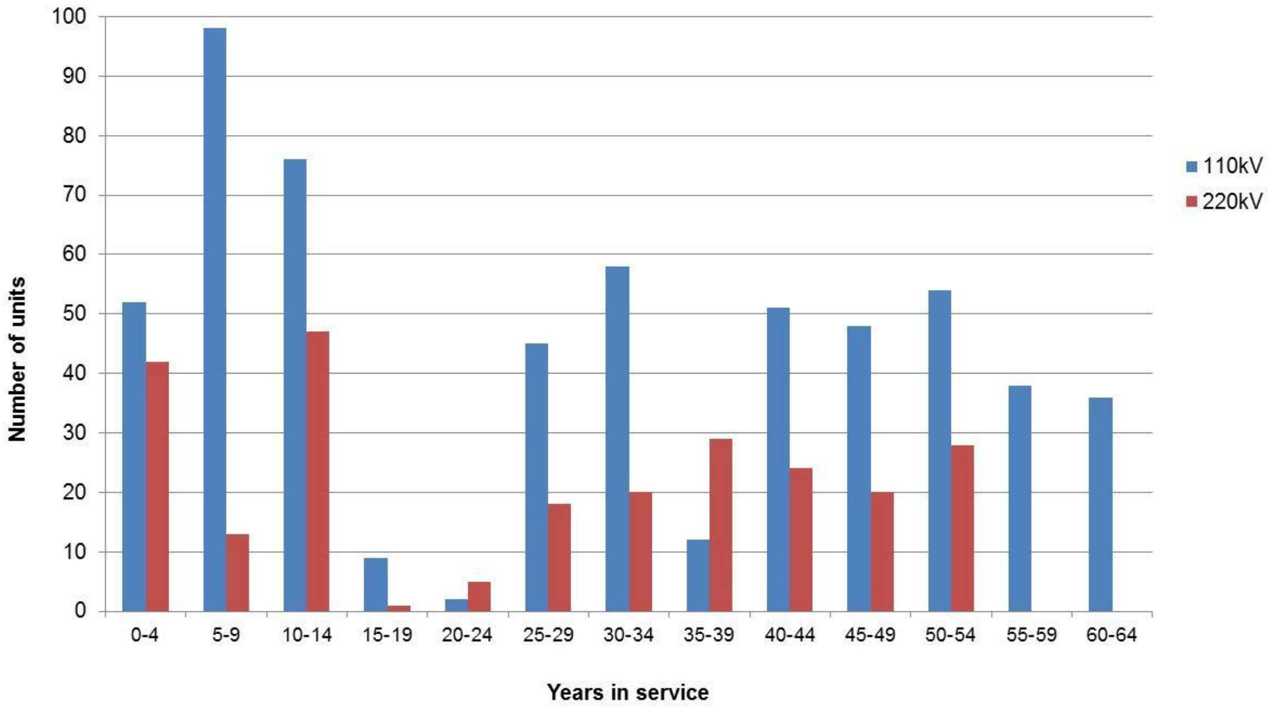
The proposed regulatory life of 45 years is consistent with the life approved by the AER in the previous regulatory decision, and also comparable to industry standards (refer Appendix C) which generally allow for an asset life in the range of 40-45 years. The ATO taxation ruling TR2012/2 effective life is recommended as 40 years.

SKM considers the asset management arrangements that Transend has in place are being effective in minimising the life-cycle costs for the circuit breakers and maximising their performance and in-service life. The condition assessment scheme is in line with good industry practices, and should assist to achieve the maximum operational life for the circuit breakers. The current population has a relatively young age, during to replacement programs to remove circuit breakers that have either reached the end of their operational life, or have known issues. SKM is satisfied that the proposed regulatory life of 45 years is reasonable and appropriate, and in line with general industry expectations.

8.1.2 Disconnectors

Figure 10 shows the age profile for disconnectors as at June 2011.

Figure 10 Disconnector age profile



The average age for the 110kV disconnectors is approximately 29 years, and 26 years for the 220kV units. The overall average age is slightly less than 29 years. Approximately 29% of the 110kV disconnectors and 17% of the 220kV disconnectors have been in service beyond the expected operational life of 45 years.

In the 2011-2016 TSMP, Transend notes the following key issues[20] to be addressed:

- poor condition of a number of 110kV disconnectors
- a total of 282 disconnectors that have either reached or are approaching the end of their useful service life
- obsolete design leading to reliability and maintenance issues
- substantial number of disconnectors that no longer have manufacturer support
- considerable spares management due to large number of different disconnector types
- large number of disconnectors that cannot be remotely operated

The TSMP outlines a number of strategies for addressing these issues, including an ongoing replacement program to deal with the design, reliability and performance issues.

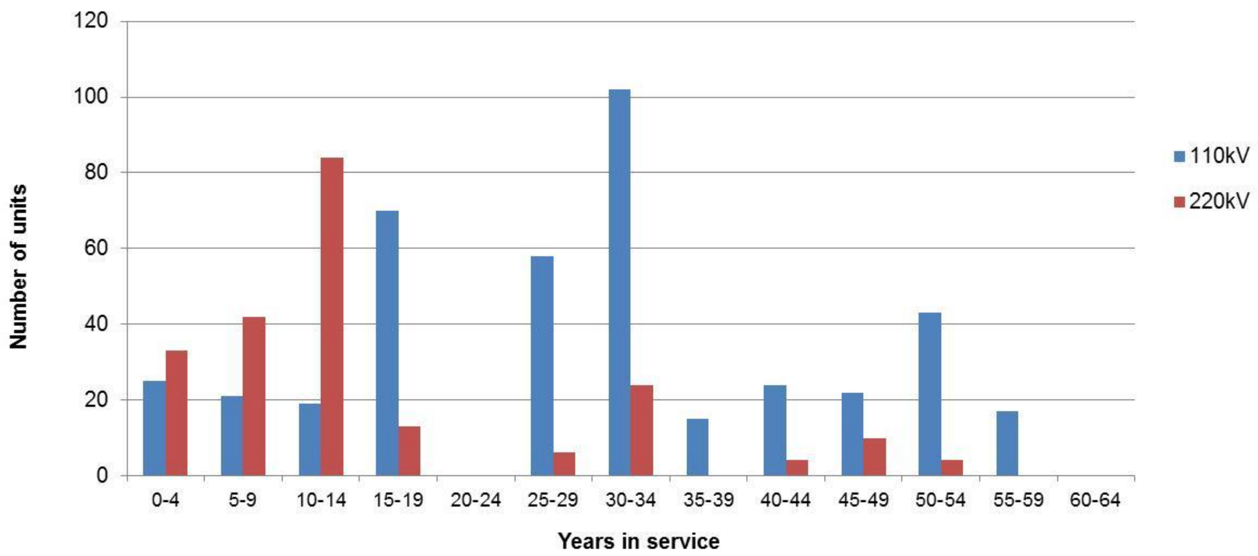
Whilst Transend has a significant number of disconnectors that have been in service for more than 45 years, SKM considers that the strategic issues highlighted with regards to manufacturer support, reliability and functionality suggest that the effective operational life for these units is 45 years in line with general industry expectations (refer Appendix C). Therefore, SKM agrees with the proposed regulatory life of 45 years for disconnectors, which is consistent with the life approved by AER in the previous 2009-14 regulatory decision, and comparable to the ATO taxation ruling TR2012/2 recommended effective life of 40 years.

8.2 Instrument transformers

8.2.1 Current transformers

The age profile for the post-type current transformer population is shown in Figure 11.

Figure 11 Current transformer age profile



20 section 5.3.3, p. 51

The average ages for the 110kV and 220kV current transformers are 29 and 15 years respectively. The population average age is 24 years. There are approximately 20% of the 110kV current transformers in service beyond the expected operational life of 45 years.

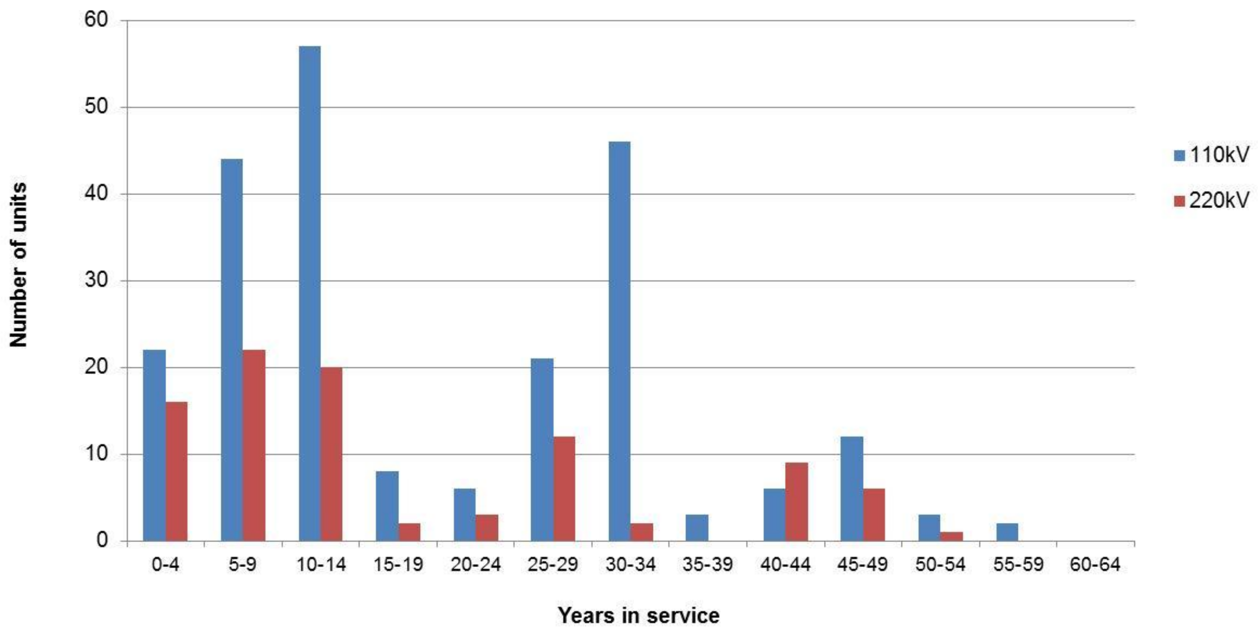
The 2011-2016 TSMP highlights that there are 49 different types of current transformer from 16 different manufacturers in the network, which is resulting in spares management and contingency planning issues. Transend currently has a replacement program in place to address the design, reliability, performance and standardisation issues that have been identified. Condition assessment and maintenance practices have been revised where appropriate to improve the reliability of the current transformers.

SKM recognises that there are both functional and strategic issues that are affecting the operational life of the current transformers, and these are considered by Transend in their life-cycle approach to these units. The general industry standard for current transformer asset life is in the range of 40-45 years (refer Appendix C) and the AER have approved 45 years as the regulatory life in the previous 2009-14 regulatory decision. Therefore, SKM considers the proposed regulatory life of 45 years for current transformers, and similar assets, to be reasonable and appropriate and consistent with the performance of the asset population, and comparable to the ATO recommended effective life of 40 years.

8.2.2 Voltage transformers

Figure 12 shows the age profile for the 110kV and 220kV voltage transformers.

Figure 12 Voltage transformer age profile



The population is relatively young, with an overall average age of approximately 19 years. This is largely due to the transmission line voltage transformer installation program over the past 5 years. The Transend 2011-2016 TSMP states that "*… given the relatively low average age … overall performance levels of the population should not be adversely affected by age-related issues*."[21]

There is a replacement program in place for the old units (in-service age beyond 45 years) and units that have identified performance or logistic issues.

[21] section 5.3.5, p. 53

The general industry standard asset life for voltage transformers in 40-45 years (refer Appendix C) and the recommended effective life from the ATO is 40 years.

SKM considers that the asset management program that Transend has in place for the voltage transformers has been effective in managing the performance and reliability of the current population, and has effective asset replacement strategies to address any specific issues that may be identified through condition monitoring programs. Therefore, SKM considers the proposed regulatory life of 45 years to be reasonable and appropriate.

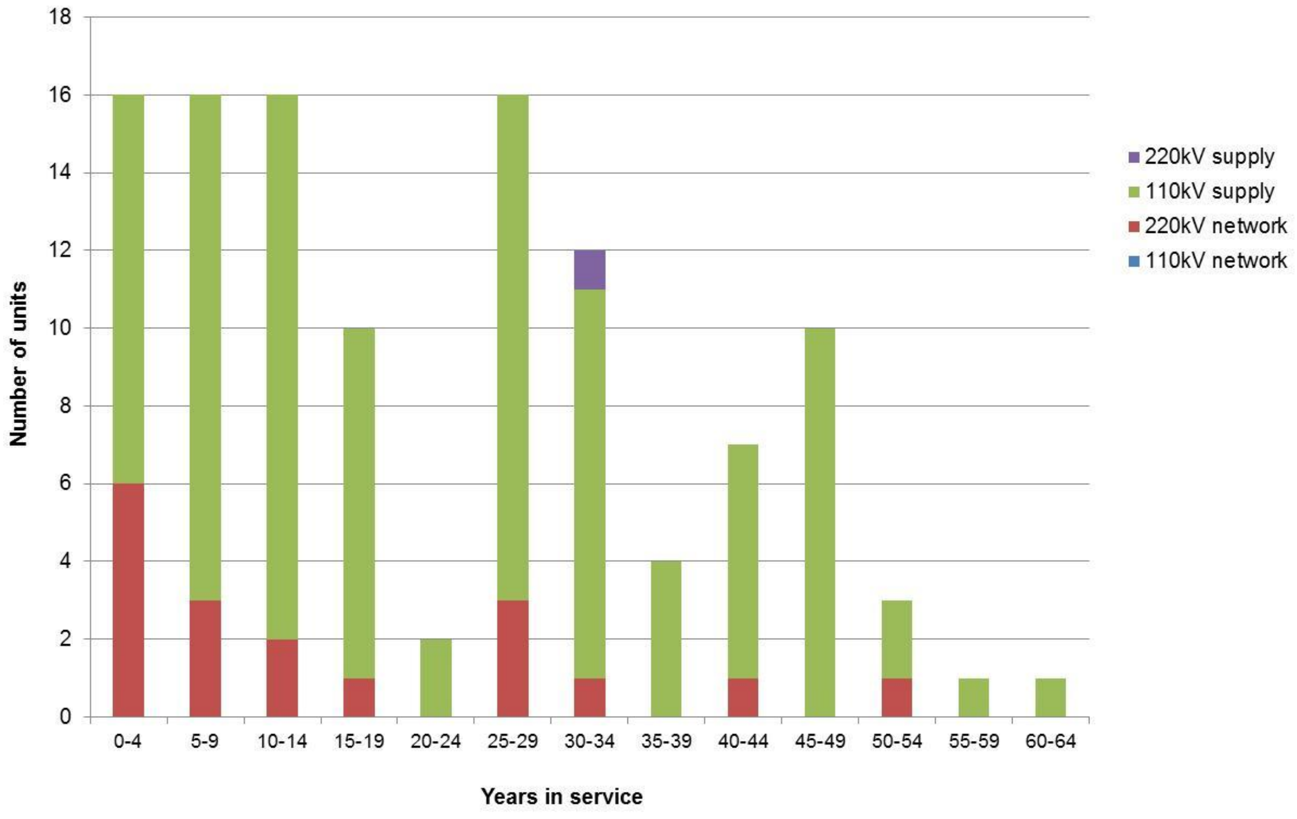
8.3 Power transformers

Transend typically divides the power transformer population into 2 main categories for the purpose of asset management:

- network transformers - transform voltage from 220kV to 110kV
- supply transformers - transform 220kV or 110kV to distribution voltage levels (33kV and lower)

However, for the purposes of assessing a reasonable and appropriate asset life, SKM has combined these 2 categories, and reviewed the entire population as a whole. The age profile for the total 110kV and 220kV power transformer population is shown in Figure 13.

Figure 13 Power transformer age profile



The average age of the 220kV network transformers is approximately 16 years, and the average for the 110kV supply transformers is 23 years. The overall population of power transformers has an average age of 22 years. The asset management strategies and practices for all power transformers are detailed in the Power Transformer AMP.[22]

[22] *Power Transformer Asset Management Plan*, D10/1589, issue 2.0, December 2012

Transend has a comprehensive condition assessment regime, monitoring the performance and reliability of each power transformer with the overall condition of each unit categorised as "acceptable", "marginal" or "poor". The AMP reports that as at December 2012, there were 7 supply transformers categorised as "poor" and a further 19 supply transformers as "marginal".[23] Most of these transformers are the oldest units still in service. There are plans in place to mitigate the risks that these 26 supply transformers represent to the transmission network.

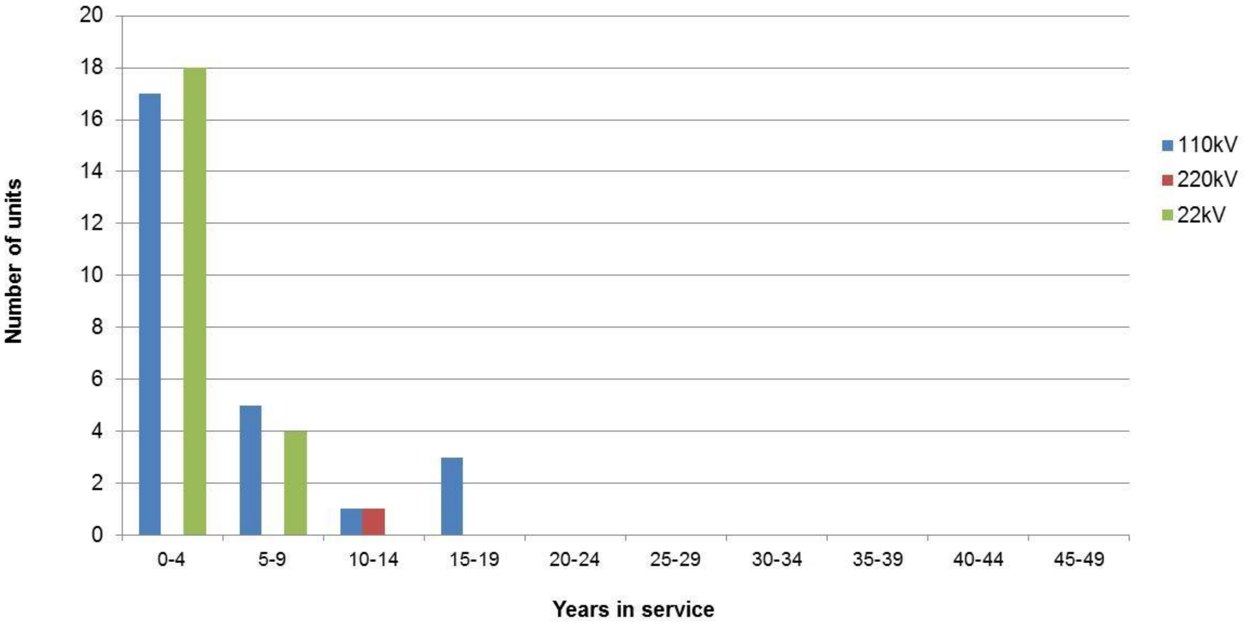
The general industry standard for asset lives is in a broad range of 40 to 60 years (refer Appendix C), depending upon the jurisdiction. This is a reflection of the different physical environments and the impact these have on power transformer life, together with the effect that the asset management strategies may have on the expected operational life on the power transformer population. The effective life recommended by the ATO is 40 years, whilst the asset valuation used 45 years as the asset life (refer section 3.3) for calculating the depreciated value.

The current performance of the Transend power transformers has reflected an operational life of approximately 45 years, which the AER accepted as the regulatory life in the previous 2009-14 regulatory decision. SKM considers that the AMP and the anecdotal evidence provided by Transend staff suggested that the typical expected operational life is 45 years. Therefore, SKM considers that the proposed regulatory life of 45 years is reasonable and appropriate.

8.4 Reactive compensation systems

Figure 14 shows the age profile as at June 2011 for the capacitor banks installed in the transmission network.

Figure 14 Capacitor bank age profile



The reactive plant in the transmission network is relatively young, and no advice was received from Transend staff that suggested there are any current issues affecting performance or operational life. The AER has previously approved a regulatory life of 45 years, which is comparable to the ATO recommended effective life of 40 years.

SKM is satisfied that the proposed regulatory life of 45 years is reasonable and appropriate.

23 section 3.2, p. 27

8.5 Switchbay infrastructure

The switchbay infrastructure relates to the bay assets less the primary plant, including busbar, post insulators, conductor and fittings.

As this equipment is closely related to the switchbay primary plant, SKM considers that it would be reasonable for the regulatory life assigned to these infrastructure assets to be similar to that allocated to the primary plant; that is 45 years (refer sections 8.1, 8.2, and 8.4). This is comparable to the ATO taxation ruling TR2012/2 recommended effective life of 40 years.

SKM considers that the proposed regulatory life of 45 years is reasonable and appropriate.

8.6 Grounds and buildings

The assets included under the broad category of “grounds and buildings” are:

- substation grounds
- oil containment
- switchgear foundations and structures
- substation buildings
- fencing and gates
- earthing systems
- security systems
- fire protection
- heating, ventilation and air-conditioning

8.6.1 Grounds and foundations

For the longer life assets, such as substation grounds, and switchgear foundations and structures, SKM considers a proposed regulatory life of 60 years to be consistent with other utility practices and with other major steel structures in the Transend network such as lattice towers. The effective life recommended by the ATO taxation ruling TR2012/2 is 40 years, which SKM considers is relatively short, given that asset valuations in the Australian electricity industry typically apply 60 years to these assets.

Therefore, SKM considers 60 years is reasonable and appropriate for grounds and foundations.

8.6.2 Oil containment

Oil containment tanks have historically been of concrete construction, although the newer installations are using fibreglass tanks that are prefabricated one-piece assemblies which are not susceptible to rust and exhibit excellent corrosion resistant properties. The advice from the manufacturer is that all of their underground fibreglass tank products have a design life of 50 years, and in some instances have been required to provide certification to clients for up to 99 years for a design life. The Australian distributor confirmed that the expected operational life is at least 50 years, and there are installations in the United Kingdom which have been in use for more than 50 years.

The general industry standard asset life for oil containment is approximately 60 years, based on a typical concrete construction. The ATO recommended effective life is 40 years, which SKM considers short in comparison with the 55-60 year asset life that utilities have typically applied to substation civil infrastructure.

SKM considers that the current trend for Transend to using fibreglass underground tanks should be matched with a regulatory life that is appropriate for both the traditional concrete and the newer constructions. The anecdotal evidence provided by the Australian distributor suggests that the fibreglass construction is expected to have an operational life that is at least equivalent to the concrete tanks. Therefore, SKM considers that the proposed regulatory life of 60 years is consistent with the asset life approved by the AER in their previous 2009-14 regulatory decision, and is reasonable and appropriate for both concrete and fibreglass oil containment tank installations.

8.6.3 Substation buildings

The proposed regulatory life for substation buildings, fencing and earthing is 45 years. The general industry standard asset lives for these assets is typically in the range of 45-55 years (refer Appendix C), and the asset valuation applied 60 years (refer section 3.3). SKM noted that Transend is in the process of adding civil infrastructure assets into the asset management system WASP, and therefore it is appropriate that separate regulatory lives are considered for these assets. The construction of substation and telecommunications fixed buildings are similar, and therefore the regulatory life applied should be 45 years (refer section 11.4.1).

The fencing used around substation switchyards is of a considerable construction, and built to a standard. Transend staff advised that have been site specific issues with the weld-mesh used at some substations, but generally substation fencing is lasting approximately 45 years in service, and therefore SKM considers that the proposed regulatory life of 45 years is reasonable and appropriate.

8.6.4 Building support systems

For building support services such as security systems, fire protection and climate control, SKM considers that these assets are typically replaced during the life of a substation, and therefore should have a shorter asset life than the building. These assets have a range of effective lives from the ATO taxation ruling TR2012/2; in contrast, Transend has grouped these assets into a short-life asset category, which SKM considers reasonable.

The proposed regulatory life of 15 years is comparable to New Zealand transmission asset lives (refer Appendix C) of 15 years and therefore SKM considers that the Transend proposed regulatory life is reasonable and reflect good business practice.

8.7 AC supply system

The AC supply system assets in a substation include:

- station service transformer
- standby generator
- AC and distribution switchboards
- photo-voltaic solar supply system

The proposed regulatory life for all these assets, excepting for the PV systems, is 45 years.

This is comparable to the ATO taxation ruling TR2012/2 recommended effective life of 40 years, and consistent with the anecdotal advice from Transend staff as to the current operational life for these assets. SKM considers that the proposed 45 year regulatory life is reasonable and appropriate.

Photo-voltaic solar systems are relatively new assets to the transmission network, and Transend has set the proposed regulatory life based on advice from manufacturers and suppliers. SKM agrees with the proposed regulatory life of 15 years.

8.8 DC supply system

The DC supply system consists of battery banks and charger, and DC switchboards. The batteries used in substation building applications are of a lower rating than those used for communications (refer section 11.6) but are tested in accordance with the provisions of Australian Standard AS2676 parts 1 and 2. This standard requires bi-annual discharge testing of the battery bank and impedance testing, with replacement recommended when the capacity of the battery drops below 80% of its rated capacity.

The battery banks in substation applications undergo fewer cyclic loads than the communications system batteries, and the expected operational life from the suppliers is 12 to 15 years. The ATO recommends an effective life of 15 years.

Based on this evidence, SKM agrees with the proposed regulatory life for battery banks and charger of 15 years as reasonable and appropriate.

8.9 Operational equipment

This asset category includes operational equipment and tools, and portable emergency generators. SKM would expect that this equipment is used frequently at some locations, and subject to relatively heavy wear and tear, requiring regular replacement.

Therefore, SKM is satisfied that, using the Transend 3-tranche approach, the proposed regulatory life for operational equipment is the short life option; namely 15 years. This is considerably longer than the ATO recommended effective life of 4 years for operational equipment and tools, and 10 years for portable emergency generators.

9. Substation protection and control

Substation secondary systems include the assets for protection, control, metering, monitoring, instrumentation and SCADA[24] applications within substations. These assets are critical to the safe operation of the transmission system within prescribed standards. The 2011-2016 TSMP notes that *"… the dominant trend in secondary systems is toward the development and application of digital technology devices and systems with in-built intelligence and integrated functionality."*[25]

Table 6 shows the proposed regulatory lives for substation protection and control assets.

Table 6 Protection and Control RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Short Life (PC15)	P&C scheme	15
	P&C scheme - bus zone	
	P&C scheme - load shedding	
	P&C scheme - metering	
	P&C scheme - monitoring	
	P&C scheme - Special Protection Scheme	
	P&C scheme - SCADA	
Very Short Life (PC04)	P&C - SCADA HMI	4

The TSMP also notes that "*… Transend's substation secondary assets are constantly being upgraded. The technology applied for secondary systems has seen a dramatic change over the past 20 years. There has been a shift from traditional electromechanical devices to modern, multifunctional, self-monitoring microprocessor devices.*"[26]

The expected operational life of electronic and microprocessor based devices is 15 years. The primary considerations in proposing a regulatory life are strategic issues, with regards to:

- constantly changing technology
- limited time for manufacturer support and availability of spare parts
- data access speed and functionality improvements

The TSMP highlights a number of key issues to be addressed in managing the protection and control schemes, and strategies for mitigating the risks these issues pose to the transmission network. The effective life proposed by the ATO for these types of assets is 12½ years, and the general industry standard asset life is 15 years (refer Appendix C).

Based on the anecdotal evidence from Transend staff, and the strategic issues that apply, SKM agrees with the Transend proposed regulatory life of 15 years for protection and control assets is reasonable and appropriate.

24 Supervisory Control and Data Acquisition

25 section 5.4.1, p. 59

26 ibid.

10. Network test equipment

Transend has proposed a single asset category for all test equipment used for condition assessment and monitoring of transmission network assets. Table 7 shows the proposed regulatory life for these assets.

Table 7 Network Test Equipment RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Very Short Life (PC04)	Network - Interrogation PCs and test equipment	4

This equipment relates to testing capability for both the electricity transmission and communications assets, and includes:

- laptop computers
- voltage detection equipment
- earthing testers
- infra-red thermal camera
- dissolved gas analysis
- high voltage injection test sets
- secondary injection test equipment

The nature of this equipment is that it will be subject to regular and rapid changes in technology, and will become dated quickly. As new test equipment is released to the market, manufacturers and suppliers will only support this test equipment for a limited time.

As a result, SKM agrees that Transend should propose the Very Short Life of 4 years as the regulatory life. By comparison, the ATO recommended effective life is 4 years.

11. Communications

Transend owns, operates, and maintains a telecommunications network within Tasmania. This is considered a critical operational component of the electricity network in Tasmania

The telecommunications bearer network is based on a route diverse microwave radio backbone with radio and optical fibre spurs extending communications to electricity infrastructure assets. The telecommunications network is designed for providing reliable, predictable, time critical services such as transmission line protection and SCADA whilst still maintaining its suitability for providing telephony and WAN/LAN data type services.

Asset lifecycles for communications equipment is closely linked to the type of asset, the assessed risk, performance and strategic factors such as availability of spare parts and support. Table 8 shows the proposed RACs for communications assets.

Table 8 Communication RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Medium Life (TL45)	Towers - steel lattice	45
	Fall arrest systems	
	Access tracks	
	Communication buildings	
	Poles - mono-pole or H-pole (steel or wood)	
	Optical Fibre Underground Cable (OPUC)	
	Copper cables	
	AC connection	
	Earthing system	
Short Life (TL10)	Communications buildings - transportable	10
	Fences and gates	
	Communications cabinet/rack	
	Security systems	
	Heating, ventilation, air conditioning	
	Power line carrier	
	Pressurisation equipment	
	Microwave bearer	
	Radio <1 GHz	
	Antenna and feeder (including IF to ODU)	
	Fibre terminal equipment	
	Time Division Multiplexed (TDM)	
	HDSL pair gain	
	Cables, internal, inter-panel	
	DCN site equipment (alarm and element manager)	

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Short Life (TL10)	Voice network end equipment	10
	Battery bank	
	Battery charger	
	DC/DC converter	
	UPS/inverter	
	Fire detection system	
	Fire extinguishers	
Very Short Life (TL5)	Packet based bearer	5
	Alarm and element manager software (Central)	
	Alarm and element manager hardware (Central)	
	Voice network core equipment hardware	
	Voice network core equipment software	
	Data networks (customer and overlay)	
	Test equipment	

11.1 Bearers

The telecommunications bearer network is a fully integrated platform consisting of microwave radio and optical fibre bearers supporting the delivery of SCADA, protection, data and voice telephony services across Tasmania. Some of the difficult to access locations utilise low bandwidth power line carrier systems. The bearer assets are categorised as:

- optical fibre cables
- optical fibre terminals
- digital radio - radio terminals, antenna and feeder equipment
- multiplexing equipment
- power line carrier
- network synchronisation system
- network supervisory equipment - alarm and current operational data, and asset control

11.1.1 Optical fibre cables

The OPUC as used by Transend for the communications network is typically connected to the OPGW or ADSS used on transmission lines, and transfers data from the landing span in the substation to the communications room. The size of the cable (fibre count) is typically the same as the incoming OPGW or ADSS cable. OPUC is also used for communications between buildings in the same region, or between a substation and a nearby repeater station.

As a result, the regulatory asset life for OPUC is proposed as the same as that proposed for ADSS or OPUC for transmission lines; this being 45 years (refer section 7). The anecdotal advice provided by Transend staff suggested that ADSS was achieving an operational life of approximately 45 years.

SKM considers that the proposed regulatory life of 45 years is reasonable and appropriate for optical fibre cables.

11.1.2 Bearer equipment

For electronic bearer equipment such as multiplexers, the strategic life for the asset is the limiting condition for determining the regulatory life. Transend provided several examples to SKM illustrating equipment that required regular firmware and software upgrades to ensure reliable performance and protection from software viruses. With constantly changing technology, equipment quickly becomes obsolete, and suppliers will only offer support for equipment for approximately 10-15 years before it becomes too out-dated. For example, multiplexers purchased in 2002 have had 3 software version upgrades and other firmware upgrades, and support from the equipment supplier has been critical in testing the upgrades to ensure the communications platform remains robust. Advice has been recently received that support for these multiplexers will no longer be provided from 2013.

Transend has an expected design life for the electronic network equipment of 10 years, taking consideration of manufacturer's advice, constantly changing and evolving technology, level of manufacturer technical support available, access to spare parts, performance levels and maintenance requirements.

For field based microwave and radio equipment, installation in remote areas exposes the equipment to harsh operating conditions, together with the supplier's capability to provide maintenance and repair support typically limits the regulatory and economic life of these assets to 10 years. Frequency changes also limit the life of antennas as these must be changed to accommodate any shifts in the operating spectrum. Transend advised that the radio units on the back of the microwave receivers in several remote installations are known to have operational issues as they age, and require additional maintenance. An in-service period of approximately 10 years is considered to be appropriate.

The age profiles for bearer equipment shown in the telecommunications bearer network AMP[27] illustrate that almost all of the assets are less than 10 years old. The AMP also highlights that the use of power line carrier is now very limited, with some scheduled for replacement in 2013. The ATO taxation ruling TR2012/2 has a detailed schedule[28] for telecommunication services, with microwave equipment and antennas, and multiplexers being allocated an effective life of 10 years

SKM considers that the regulatory life of 10 years proposed by Transend is reasonable, as it appropriately recognises the practical operating period that this equipment can be expected to achieve, with consideration of the Tasmanian environment and the capabilities of manufacturers and suppliers to provide the necessary support.

11.2 Voice Network

Transend owns and manages a telephone system which provides operational voice services for the Transend Network operations and control centres and substations, Hydro Tasmania Energy Control Centre and power stations, and connection to the Australian Energy Market Operator (AEMO) control centre. The network is designed and operated to deliver high availability performance.

The asset management of this telephone network is covered by the telecommunications telephone system AMP.[29] The network is comprised of a number of different technologies, from analogue key telephone systems to the Internet Protocol (IP) Openscape Voice system implemented in 2010. 30% of the total handset population are the older analogue handset, many of which were installed in the 1990s. IP handsets represent approximately 57% of the handset population, with most of these being replacements for discontinued models previously in service.

From the AMP and discussions with Transend staff, SKM understands that the voice network is an essential part of the transmission network, and that the rapid evolution of communications technology quickly makes current asset obsolete. The telephone system owned and managed by Transend has both legacy analogue

27 *Telecommunications Bearer Network Asset Management Plan*, D12/53567, version 1.0, October 2012

28 pp. 168-170

29 *Telecommunications Telephone System Asset Management Plan*, D13/14056, issue 1.0, March 2013

handsets and more current IP handsets, with the PBX nodes in the network undergoing regular upgrades to handle both the analogue and digital communications traffic.

From the age profiles, SKM considers that the handsets, or Voice Network End equipment are achieving an operational life of at least 10 years, whilst the Voice Network Core Equipment (PBX) for the older analogue system has been extended to 19 years. The ATO taxation ruling TR2012/2 recommends an effective life of 10 years for telephone handsets[30] and 10 years for PABX computerised assets. However, the new IP-based Openscape PBX has a recommended design life of 6 to 9 years. This reduced design life assumes the availability of periodic system upgrades to support the improved features and operation of the IP-based system in comparison to the limited functionality of the old multiplex-based system.

As Transend is necessarily migrating to the IP-based telephone system, SKM considers that the regulatory life should be based on the strategic life for the telephony equipment now being adopted for the network, rather than the age profile of the older, and now obsolete, equipment. SKM considers the proposed 10 year regulatory life for the IP-based handsets (voice network end equipment) and 5 years for the IP-PBX (voice network core equipment) to be reasonable and appropriate.

11.3 Data Communications Network

The Data Communications Network (DCN) uses an Ethernet system for the following networks:

- corporate data network
- wireless network
- Network Operations and Control System (NOCS) network
- carrier Ethernet network

The DCN is comprised of the following asset:

- Ethernet switches
- Ethernet routers
- Wireless Ethernet equipment
- Field equipment mounting racks and panels

Obsolescence rather than asset condition is the dominant consideration. The strategic life for the DCN Ethernet assets is the relevant asset life, due to the rapid rate of technology change. Manufacturers will only provide support for this equipment for a maximum of 5 years, after which it is more cost effective and risk adverse to replace these Ethernet assets rather than maintain them in service. It is essential that manufacturer support is available, as the DCN is important to efficient transmission network operation.

The age profile for carrier Ethernet equipment in the Ethernet systems AMP[31] shows that the average age of the Ethernet switches and routers is approximately 2 years. Advice from Transend staff is that the field equipment mounting racks and panels have generally provided 10 years of useful service, taking account of space required for the greater bandwidths and physical requirements for the equipment.

Therefore, SKM considers the proposed regulatory life of 5 years for Ethernet switches, routers and wireless equipment, and 10 years for the field equipment mounting racks and panels are reasonable and appropriate.

[30] p. 217

[31] *Telecommunications Ethernet Systems Asset Management Plans*, D12/53719, version 1.0, October 2012

11.4 Civil infrastructure

The Transend telecommunications network consists[32] of:

- 19 microwave backbone sites
- 18 repeater sites
- 4 passive reflectors
- 62 optical fibre sites
- 34 substation locations
- 34 power generation locations
- 8 office locations

11.4.1 Buildings and fences

At each field site, the civil infrastructure will include a building and a support structure in a fenced area, and an access track for those sites in a remote location. The building will generally be of a pre-cast concrete with tilt-up construction or considerably lighter transportable construction, with basic security system, fire detection and extinguishers. The fence is a less substantial construction than that used for zone and terminal substations; fencing around communications sites are typically of a chain-mesh type with the posts either directly standing in the ground or concreted into place.

Transend staff advised that the competitive nature of the telecommunications market has driven the construction of buildings, fencing and the associated infrastructure to minimal cost installations, as there is currently no standard in place.

SKM noted that there are some differences in the regulatory lives proposed for telecommunications buildings and fencing in comparison to similarly described substation assets, but images of telecommunication sites and anecdotal advice received highlighted that there are different construction standards for substation and communications sites, and therefore there is no need for identical regulatory lives to apply.

The ATO taxation ruling TR2012/2 only provides a recommendation for the effective life for a transportable communications building of 25 years. As Transend are using two distinctly different constructions, SKM agrees that there should be separate regulatory lives applied to the two different building types. Transend advised that the telecommunications building of concrete construction is expected to provide a design life of 45 years, and SKM considers this is reasonable.

The lighter transportable building type is similar to the type used as demountable buildings on project sites. SKM is aware of transportable buildings used on mining sites having an operational life of approximately 20 years, which is comparable to the ATO taxation ruling recommendation. The AER approved 15 years for demountable substation buildings for ElectraNet in their recent final decision (refer Appendix D.2). Anecdotal evidence from Transend staff suggested that the transportable buildings used in remote locations have been prone to becoming waterlogged and rusting, and for the interior to require air-conditioning to avoid becoming humid. SKM noted that Transend have applied only 3 tranches of lives to the communications assets. The proposed regulatory life of 10 years for transportable buildings is the best option, and reflects the difficulties Transend have experienced with transportable buildings in remote locations.

For the building ancillary services, such as security and fire protection, the regulatory life of 10 years proposed by Transend is comparable to the ATO taxation ruling TR2012/2 effective life of 5 years for similar equipment. SKM considers the 10 year regulatory life reasonable and appropriate.

[32] *Telecommunications Bearer Network Asset Management Plan*, D12/53567, October 2012, section 2, p. 14

The fence construction used by Transend is basic, using chain-mesh security fencing on posts that do not have plinths. The evidence provided by Transend to SKM suggested that the typical operational life for this type of fence has been 10 years, and the images of communications sites across Tasmania showed that this type of fence construction is common across the network. Whilst the ATO taxation ruling TR2012/2 recommends an effective life of 20 years, SKM considers the proposed regulatory life of 10 years to be appropriate.

11.4.2 Access tracks

The nature of access tracks to the sites is dependent upon statutory and/or jurisdictional requirements that may exist for the area in which the communications station is located. Transend staff advised that some recent transmission line projects have required the installation of a class 4 road, which is an unsealed road suitable for all-weather access.[33] By contrast, some of the remote locations for telecommunications sites have access tracks that are less substantial, but still require all-weather access.

SKM noted that the requirement for more substantial access tracks has only be in place during the past decade, but it is apparent that future access ways will be required to be constructed to the same standard. Whilst the ATO taxation ruling TR2012/2 recommends an effective life of 25 years, SKM considers that the longer proposed regulatory life of 45 years is more appropriate for this more substantial construction.

11.4.3 Support structures

In contrast to towers used for transmission lines that are built in accordance with design standards and consider strain and suspension loading, communications towers may be of several different constructions and have foundations that are designed to cope with wind loadings. Communications towers may be either stobie poles or of tubular steel construction, and are built for considerably less cost than transmission line towers. Anecdotal evidence received from Transend staff suggested that this is in part driven by a very competitive market.

From recent images taken by Transend, SKM noted several communications sites have towers that are showing visible signs of corrosion, and that a variety of different tower types are currently being used.

The ATO taxation ruling TR2012/2 recommends an effective life of 25 years for communications towers. SKM considers the proposed regulatory life of 45 years to be reasonable, although it is likely that many of the communications towers will need considerable maintenance to achieve this life in-service. In addition, SKM considers the proposed regulatory life of 45 years for wood poles is likely to be at the upper limit of the operational life for these poles, particularly for any wood poles used in some of the harsher environments that exist in Tasmania.

11.4.4 Fall arrest system

The fall arrest system used by workers gaining access to the towers is similar to that used on the transmission line towers (refer section 7.7.1). With consideration of this, SKM considers a regulatory life of 45 years is considered reasonable and appropriate.

11.5 AC supply system

The AC connection from the communications building to the transmission network uses similar transformers, cables and switchboards as are used in substations, and therefore are expected to have a similar operational life.

The proposed regulatory life of 45 years is considered reasonable, and in contrast to the ATO taxation ruling TR2012/2 recommended effective life of 15 years.

33 *Tasmanian Forest Practices Code*, 2000, section B.2, p. 8

11.6 DC supply system

The DC supply system comprises:

- Battery bank
- Battery charger, including small DC switchboard
- DC/DC converter and Uninterruptible Power Supply (UPS)

The effective life for this equipment as recommended by the ATO is 6 years.

The requirements for the battery banks differ to those of similar description in substation buildings. The batteries are of sufficient capacity to provide power to a communications site for 24 hours in readily accessible locations, and 48 hours in remote areas, and are regularly cycled. The batteries used have historically been of a Ni-Cad type, although Transend is now using gel cell type in newer installations. All of these battery banks are tested in accordance with the requirements of Australian Standard AS2676 parts 1 and 2. The testing provisions in each part are similar, and in clause 7.2.1 recommends that "*… a performance test of the battery capacity should be made as part of the commissioning procedure then periodically (typically every two years) … a performance test of battery capacity should be given to any battery that shows signs of degradation or has reached 85% of the service life for the application.*"[34] Clause 7.5 defines battery replacement criteria, stating that "*… a battery or cell that has a capacity below 80% of the manufacturer's rating should be replaced … a capacity of 80% shows that the battery's rate of deterioration is increasing and the battery is rapidly approaching the end of its useful life, even if there is ample capacity to meet the load requirements.*"[35]

The operational life Transend has achieved from its battery banks has typically been around 10 years before they deteriorate to 80% of their rated capacity. Therefore, SKM considers the proposed regulatory life of 10 years to be reasonable and appropriate.

Anecdotal evidence from Transend staff suggested that the DC/DC converters and UPSs used in communications sites are achieving an operational life of approximately 10 years, and therefore SKM agrees with the proposed regulatory life of 10 years.

11.7 Operational equipment

Given the rapid change in communications technology (refer sections 11.2 and 11.3), the test equipment used by commissioning and maintenance staff must be replaced on a regular basis to ensure it is not redundant or inappropriate for the technology of the assets being tested.

The ATO recommends an effective life for communications test equipment of 4 years. This is comparable to the proposed regulatory life of 5 years, and therefore SKM considers the proposed life to be reasonable and appropriate.

[34] *AS2676 Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings - Part 2: Sealed cells*, section 7, p. 18

[35] ibid., p. 19

12. Transmission operations

The transmission operations assets relate to the software and hardware systems in the Network Operations Control System (NOCS), and the asset management and operational systems. Table 9 shows the proposed regulatory lives for these assets.

Table 9 Transmission Operations RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Short Life (TO10)	NOCS software	10
	Operational Information Systems	
	Asset Management Information System (AMIS)	
Very Short Life (TO04)	NOCS hardware	4

The short-life assets are software systems that include:

- NOCS software
- Plant Restriction Outage Management System (PROMS)
- Drawing Management System (DMS)
- Rating Information System (RIS)
- Operational Diagram System (ODS)
- Thermal Rating Calculator (TRCalc)
- AMIS software

In each case, the regulatory life will be based on the strategic issues related to the support and ability to upgrade the software until a new version is required. The ATO effective life for software systems is 12½ years for operational information systems and 4 years for asset management systems.

In light of this, SKM is satisfied that the proposed regulatory life for the software systems of 10 years is reasonable and appropriate.

The proposed regulatory life of 4 years for the NOCS hardware is consistent with the ATO recommended effective life, and SKM agrees that this proposed life is reasonable and acceptable.

13. Non-network assets

Table 10 shows the proposed regulatory lives for non-network assets.

Table 10 Non-Network RACs

Regulatory Asset Class (RAC)	Regulatory Asset Category (RACT)	Asset Life (years)
Medium Life (OT40)	Non-network buildings	40
Short Life (OT09)	Office furniture	9
	Motor vehicles	
	Trailers	
Very Short Life (OT04)	Mobile telephones	4
	Office equipment	
	Corporate computer network	
	IT applications	
	IT systems	
	Personal computers	

13.1 Buildings

Non-network buildings include corporate buildings and depots, and are of a different construction and type to substation and communications buildings. These are commercial style buildings, and SKM considers the most relevant reference would be the ATO taxation ruling TR2012/2. The ATO recommends an effective life for commercial buildings of 40 years. SKM notes that in their final regulatory decision for Powerlink (refer Appendix D.1), the AER allocated 40 years as the regulatory life for commercial buildings.

SKM considers the proposed regulatory life of 40 years to be reasonable and appropriate.

13.2 Motor vehicles

The proposed regulatory lives from Transend for motor vehicles and trailers are longer than those previously assessed in 2008, and are more comparable to the effectives lives recommended by the ATO, and recently allocated by the AER to Powerlink in their final regulatory decision (refer Appendix D.1).

The ATO recommends 8 years for motor vehicles and 10 years for trailers, whilst the AER considered 7 years appropriate for Powerlink. SKM does not consider there are any particular environmental conditions in Tasmania that would justify a marked deviation from these values.

Therefore, SKM considers the proposed regulatory life of 9 years for motor vehicles and trailers is reasonable.

13.3 IT and office equipment

13.3.1 Office furniture

Office furniture in the ATO taxation ruling TR2012/2 is broken down into different categories - workstations, desks, tables, chairs and the like - and is allocated separate effective lives. Transend has preferred to group all of these assets into a single regulatory asset category. This is similar to the Powerlink approach, and the AER allocated an asset life of 7 years to office furniture in their final regulatory decision.

Based on this precedent, SKM considers the regulatory life of 9 years proposed by Transend for office furniture to be reasonable.

13.3.2 Office equipment

Office equipment includes items such as electronic whiteboards, facsimile machines, photo-copiers, and multi-function machines. All of these assets are typically subject to heavy use, and are prone to strategic issues such as technical obsolescence, limited time for manufacturer support and maintenance/lease arrangements.

The ATO effective life for these types of assets is 5 years. The regulatory life proposed by Transend is 4 years.

As Transend has proposed only 3 tranches of regulatory lives for non-network assets, SKM considers the Very Short Life tranche is the most appropriate for office equipment, as the strategic life of these assets will be less than 9 years. Therefore, SKM considers the proposed 4 year regulatory life as reasonable for office equipment.

13.3.3 IT equipment

IT equipment includes network servers, desktop and laptop computers and IT peripherals, and printers and plotters. As for office equipment, these assets are often on lease arrangements, and subject to regular software upgrades to remain current. The primary consideration for establishing a regulatory life is the strategic life; that is, the period of time over which Transend will have sufficient supplier support to keep these assets useful.

The ATO effective life for IT equipment is recommended as 4 years. Transend have proposed a similar regulatory life.

SKM agrees that the Transend proposed regulatory life is reasonable and appropriate.

13.4 Land

Land assets are not depreciable assets and the concept of a regulatory asset life does not apply to these assets.

14. Recommended regulatory asset lives

After consideration of the Transend asset management systems and asset lives used in other Australian and relevant international jurisdictions, SKM endorses the asset category regulatory lives proposed by Transend as shown in Appendix A.

Appendix A. Proposed Regulatory Asset Categories

The following tables illustrate the various tranches that Transend has used in assigning asset lives to network assets. Table 11 shows the proposed regulatory asset classes, and Table 12 lists the various physical asset categories, financial asset categories and definitions.

Table 11 Proposed regulatory asset classes

Regulatory Asset Class (RAC)	RAC	Asset Life (years)
Transmission line assets - long life (60)	TL60	60
Transmission line assets - medium life (45)	TL45	45
Transmission line assets - short life (10)	TL10	10
Substation assets - long life (60)	SS60	60
Substation assets - medium life (45)	SS45	45
Substation assets - short life (15)	SS15	15
Protection and control - short life (15)	PC15	15
Protection and control - very short life (4)	PC04	4
Network test equipment - very short life (4)	PC04	4
Communication assets - medium life (45)	COM45	45
Communication assets - short life (10)	COM10	10
Communication assets - very short life (4)	COM05	5
Transmission operations - short life (10)	TO10	10
Transmission operations - very short life (4)	TO04	4
Other - medium life (40)	OT40	40
Other - short life (9)	OT09	9
Other - very short life (4)	OT04	4
Land	LB	n/a

Table 12 Proposed regulatory asset lives

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
TRANSMISSION LINE				
TL60	TLI	TL	Transmission Lines (TL)	*including* labour & material, (was Tower Line) that is specific to the implementation of each transmission line and its components. Generally includes labour and material for foundations, tower erection, and transmission line stringing, but *excludes* acquisition of transmission line routes and easement compensation
TL60	TAT	TRA	TL - Tracks	*including* labour & material; TL specific; for tracks
TL60	TWW	SS	TL - Support Structure - steel	*including* labour (erection) & material; TL specific; for towers, poles, steelwork only
TL60	TLF	FND	TL - Foundations	*including* labour & material; TL specific; for concrete, reinforcing, leg, (not including anode)
TL60	GZEW	OHEW (GZ)	TL - Galvanised Steel earth wire	*including* labour & material; TL specific; for Galvanised Steel (GZ) overhead earthwire
INSULATOR ASSEMBLY				
TL60	TLIN	INSA, WEIG	TL - Insulator assembly	*including* labour & material; TL specific; for insulator assembly, porcelain and glass insulators only, including string insulator, clips, shackles and weights
CONDUCTOR ASSEMBLY				
TL60	CON	SEC, ISF	TL - Conductor	*including* labour (stringing) & material; TL specific; for conductor, conductor clamps (AGSU, dead-end, strain or suspension clamp) and in-span fittings (mid-span joint, mid-span repair fitting)
TL60	TLE (& OPGW)	UGEW, OHEW, OPGW	TL - Earth Wire including OPGW	*including* labour & material; TL specific; for underground earthwire, Aluminium overhead earthwire, and OPGW
TRANSMISSION LINE				
TL45	SSW	SS	TL - Support Structure - wood	*including* labour & material; TL specific; for wood H-poles, wood poles (including cross-arm)
TL45	FAS	FAS	TL - Fall Arrest System	*including* labour & material; TL specific; for cable, shackles, bolts, but excluding runner
TL45	BRI	BRI	TL - Bridges	*including* labour & material; TL specific; for bridges on access tracks
INSULATOR ASSEMBLY				
TL45	TLIN	INSA, WEIG	TL - Insulator assembly	*including* labour & material; TL specific; for insulator assembly, synthetic-composite (silicon) insulators only, including string insulator, shackles and weights

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
CONDUCTOR ASSEMBLY				
TL45	DAMP	DAMP	TL - Damper	*including* labour & material; TL specific; for damper
TRANSMISSION CABLE				
TL45	TUC	TC	TL - Transmission Cable (TC)	*including* labour & material; that is specific to the implementation of each Transmission Cables (power cable above 33 kV) and its components, such as pressure cylinders, cable section (CASE), cable joints, terminations (CTER), link boxes and conduits. (this includes substation's transmission cable)
TL45	ADSS	ADSS, PWC	TL - ADSS (Optical Fibre - All-dielectric self-supporting)	*including* labour & material; TL specific; for all-dielectric self-supporting optical-fibre cable, and pilot-wire cables.
TL45	OPUC		TL - OPUC (Optical Fibre Underground Cable)	*including* labour & material; TL specific; for optical fibre underground cables, including splice boxes
TRANSMISSION LINE				
TL10	TWPC	SS	TL - Support Structure - protective coatings	*including* labour & material; TL specific; for anti-corrosion protective coatings, including paint & tapes
TL10	ANOD	ANOD	TL - Anode	*including* labour & material; TL specific; for anode
TL10	TLA	GATE, LOC, KEY	TL - Access and ID	*including* labour & material; TL specific; for fences, gates, locks, keys, signage
TL10	ISF	ISF	TL - Markers	*including* labour & material; TL specific; for aircraft marker ball, bird warning marker
REAL-TIME MONITORING EQUIPMENT				
TL10	TWS	WEAT	TL - Weather Stations	*including* labour & material; TL specific; for weather station (includes weather stations located within substations), including associated remote area power supplies
TL10	TLM	TENM	TL - Tension monitors	*including* labour & material; TL specific; for tension monitor, including associated remote area power supplies
GROUNDS AND BUILDINGS				
SS60	PLI	PLI	SS Foundations	*including* labour & material; to be listed as transformer, capacitor bank and bay specific; for each transformer and capacitor bank plinth, together with civil foundations for each bay's devices, such as pedestals and support structures and substation towers, but *excluding* building, fences and gates foundations
SS60	TWR	TWR	SS Structures	*including* labour & material; major bus structures and line termination towers, but excluding pedestals and support structures for individual primary devices

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
SS60	SGS	ARTT, BOLL, CDUC, SEWR, TUNN, WASU, EAGB	SS Grounds	*including* labour & material; site specific; for access tracks, transformer tracks and driveways, bollards, concrete cable ducts, sewerage, storm-water, tunnels, water supply, grounds - earthworks, gravel surfacing, landscaping and underground earth-mat, but *excluding* buildings, fences and gates, land acquisition costs and payment for substation land
SS60	BUN	BLA, NOIS, OILS,	SS Oil containment system	*including* labour & material; site specific; for blast wall, noise containment, oil separation tank and oil bunding. Includes both concrete and fibre-glass oil separation tanks
SS60	CRN	CRAN	SS Cranes	*including* labour & material; cranes
SUBSTATION BAY				
SS45	SWE	BAY	Bay (**)	*including* labour and material; that is specific to each bay eg. device prefixes A1, A2, A4, A5, A6, A7, A8. Includes implementation costs of primary equipment and earthing system within bay, excluding Station Services Transformer, Power Transformer or Capacitor Bank. It includes construction consumables, such as conduits and cable tray.
GROUNDS AND BUILDINGS				
SS45	NBD	INFR	SS Buildings (was Network Buildings)	*including* labour & material; site specific; for each substation building including high bays, but excluding air-conditioning/heating systems and indoor cable tray
SS45	FEN	SFGT, FENC, GATE	Fences and gates	*including* labour & material; site specific; security fence and gate, includes plinth, but excludes powered fencing
OTHER ASSETS				
SS45	BUS	BCON, BBAR, COMF, RBB, SCON	Busbar and conductor (**)	*including* labour & material; site and bay specific for bay conductor, includes rigid or strung conductor, and compression or bolted fittings. Site, voltage and bus specific for busbar, includes rigid or strung busbar, and compression or bolted fittings
SS45	NET	NET*, NER*	Earthing transformer	*including* labour & material; neutral earthing transformer, reactor and resistor
SS45	SWI	PAN	Switchboard panels - HV (6.6, 11, 22 & 33 kV) (**PN)	*including* labour & material; for HV & GIS switchboard panel (effectively each 'bay'); *excluding* separately listed major plant and associated protection and control - feeder scheme
SS45	IES	INSP	Post Insulators	*including* labour & material; support structure for free-standing post insulators
SS45	PCB	**PC	Power Cables (**PC)	*including* labour & material; power cables greater than 1 kV to 33 kV

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
SS45	INST	INST	String Insulators (**)	*including* labour & material; string insulator, including glass and synthetic-composite (silicon)
SS45	SDV	**SD	Surge Diverters (**SD)	*including* labour & material; for surge diverters; support structure, comprising three (3) x single phase units
AC SUPPLY SYSTEM				
SS45	SST	TFSS - ST**	Transformers - Station Service (ST**)	*including* labour and material; for station services transformer
SS45	SDG	GEN	Generator	*including* labour and material; for standby diesel generator
SS45	AAC	ACDB, LTAP, DCAC, LVC	AC Supply system	*including* labour & material; site specific; AC switchboard, light and power distribution system, DC/AC inverters and LV supply cables
SS45	ADC	DCSB	DC Supply System	*including* labour and material; site specific; DC fuse-switchboard, DC distribution board, but *excluding battery and* battery charger (separate listing)
AIR SYSTEM				
SS45	ASS	COMP, PRRV, REC,	Air Supply System	*including* labour & material; site specific; air compressors, pressure valves (reducing, release), receivers, control system
EARTHING SYSTEM				
SS45	ERS	EABG, LIMA, OHEW	Earthing systems	*including* labour & material;site specific; above-ground earthing, lightning masts, overhead earth-wire (substation) - but excluding underground earth-mat (separately listed within SS grounds)
REACTIVE COMPENSATION SYSTEM				
SS45	DEDR	DEDR, REAC, L**	Detuning and Damping Reactors (L*)	*including* labour and material; for each reactor; support structure, comprising three (3) x single phase units
SS45	RCT	C**	Shunt Capacitors (C*)	*including* labour and material; for each capacitor; support structure, comprising a three (3) phase bank of capacitor cans
SWITCHGEAR				
SS45	CBK	**52	Circuit Breakers (**52; CB)	*including* labour & material; for circuit breaker; support structure, including bushing CTs in DTCB
SS45	DIS	**29/**31	Disconnectors and earth switches (**29/**31; DS/ES)	*including* labour & material; support structure, isolators, earth switches, disconnectors, and post insulators, also including free-standing earth switches
SS45	FUSE	**89 or **29, FUSE	Fuse-switch (**89; FS)	*including* labour & material; for fuse-switch panel; including fuse

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
POWER TRANSFORMER				
SS45	PWT	T**, CONM, CONT, COOL, MECH, T84T, TNNT	Transformers - Network and Supply (T*)	*including* labour and material; for each transformer, includes transport and on-site assembly cost; includes condition monitoring, control system, cooling equipment, mechanical protection, tap changer, and transformer bushings
INSTRUMENT TRANSFORMER				
SS45	CLT	**CC	Carrier Coupling Capacitor (**CC)	*including* labour & material; for carrier coupler; comprising two (2) or three (3) x single-phase units
SS45	CRT	**96	Transformers - Current (**96; CT)	*including* labour & material; for free-standing current transformer; comprising three (3) x single-phase units
SS45	VLT	**97	Transformers - Voltage (**97;VT)	*including* labour & material; for voltage transformer (VT); comprising three (3) x single-phase units, electromagnetic VT and CVT units
SS45	TCV	**96/97	Transformers - Combined voltage and current transformer (**96/97; CVCT)	*including* labour & material; for combined voltage and current transformer; comprising three (3) x single-phase units
SS45	TLW	WAVT-**	Wave-trap (**WT)	*including* labour & material; for wave-trap; comprising two (2) or three (3) x single-phase units
GROUNDS AND BUILDINGS				
SS15	SCS	INDE, SEEA, SEVD,	Security Systems	*including* labour & material only; site specific; for security electronic (SEEA) systems, including intruder detection (INDE), access control, powered fencing and video surveillance (SEVD)
SS15	HVAC	HVAC, CTRA	Heating, Ventilation, Air-conditioning	*including* labour & material only; site specific; for heating, ventilation and air-conditioning & cable-trays
AC SUPPLY SYSTEM				
SS15	PVSS	PVSS	Photo-voltaic Solar Supply System	*including* labour and material; site specific; for photo-voltaic solar cells, inverter and cabling
DC SUPPLY SYSTEM				
SS15	BAT	BATT	Battery (B*)	*including* labour and material; site specific; battery racks and cubicle
SS15	BCH	BACH	Battery charger (BC*)	*including* labour and material; site specific; battery chargers
FIRE PROTECTION SYSTEM				
SS15	FDS	FIDE	Fire detection system	*including* labour & material; site specific; for fire detection systems, eg. VESDA

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
SS15	FEX	FIEX	Fire extinguishers	*including* labour & material only; site specific; for fire extinguishers and fire-fighting equipment
SS15	FIME	FIME	Fire suppression system	*including* labour & material; site specific; for fire suppression system, includes fire mains; gas (hypoxic) systems or deluge systems
OPERATIONAL EQUIPMENT				
SS15	PEG	PGEN	Portable Emergency Generators	*including* labour and material
SS15	OTE	ERLD, MART, OPSI, OPST, POBO, ROPE, SIGN	Operational Equipment and Tools	*including* labour and material; site specific; for earth lead, maintenance and repair tool, operational sign, operational stick, portable bollard, rope, sign, eg. SF6 gas-filling & detection equipment, SF6 gas storage
PROTECTION & CONTROL				
PC15	PCS	PC	P&C Scheme (**)	*including* labour and material; that is specific to each bay eg. device prefixes A1, A2, A4, A5, A6, A7, A8; Includes implementation costs of secondary equipment within scheme, including control cables. Includes transmission line, feeder, transformer HV and LV, capacitor bank and bus coupler, together with any teleprotection, SCADA (ethernet switch or bay control RTU) anti-islanding or load shedding schemes contained within the specific bay scheme
PC15	SBB	SCBZ	P&C Scheme - Bus zone	*including* labour & material; site and bus specific; bus zone scheme - integrated CB fail protection and control cables
PC15	SPU	SCLS	P&C Scheme - Load Shedding	*including* labour & material; site specific; under frequency scheme (UFLS) and control cables, excludes load shedding schemes contained within specific bay schemes
PC15	SCME	SCME	P&C Scheme - Metering	*including* labour & material; site specific; metering panels (wholesale) and control cables, normally excludes meters
PC15	SCMO	SCMO	P&C Scheme - Monitoring	*including* labour & material; site specific; monitoring equipment and control cables, Integrated Data Monitors (IDM) & stand-alone fault locators
PC15	SPS	SCSP	P&C Scheme - Special Protection Scheme	*including* labour & material; site specific; *SSPS, NCSPS, FCSPS, BNCSPS* and associated control cables
PC15	SCA	SCAD	P&C Scheme - SCADA	*including* labour & material; site specific; SCADA - RTU hardware and control cables, excludes RTU devices (ethernet switches) installed in specific bay scheme's panels

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
PROTECTION & CONTROL				
PC04	SCAH	SCHM	P&C - SCADA HMI	*including* labour & material; site specific; desktop or industrial PCs for local station control'
NETWORK TEST EQUIPMENT				
PC04	***NTTE***	SCTE, PVDT	Network - Interrogation PCs & test equipment	*including* labour & material; portable equipment; laptops and test equipment, including transmission line, substation, P&C and SCADA test equipment, such as portable voltage-detection equipment (Modie-wark), earthing testers, infra-red thermal cameras, dew point testers, gas-in-oil analysis equipment, HV injection test sets, and secondary injection test equipment;
GROUNDS AND BUILDINGS				
COM45	CTOW		Towers - steel lattice	*including* labour & material; site specific; for each box lattice tower
COM45	CFAS		Fall Arrest Systems	
COM45	CTRA		Communications Access Tracks	*including* labour & material; site specific; for each repeater's access track
COM45	CBLD		Communications Buildings	*including* labour & material; site specific; for each repeater building, but excluding air-conditioning/heating systems and indoor cable tray
COM45	CPOL		Poles - mono-pole or H-pole (steel or wood)	
COM45	CPRR		Passive Reflector/Repeater	
BEARERS				
COM45	CFCA		Optical Fibre Underground Cable (OPUC)	including labour & material; site specific, includes splice boxes/joint pits, external bearers between sites
COM45	CCCA		Copper Cable	including labour & material; site specific, pilot cables, includes poles if above ground, and cable joint pits if underground, external bearers between sites
AC SUPPLY SYSTEM				
COM45	CACC		AC Connection	includes feeder, transformer, cables, switchboard
EARTHING SYSTEMS				
COM45	CERS		Earthing System	
GROUNDS AND BUILDINGS				
COM10	CTBL		Communications Building – Transportable	including labour & material; site specific; pre-fabricated, non-masonry, transportable buildings.
COM10	CFEN		Fences and Gates	*including* labour & material; site specific; chain-mesh security fence and hinged gates, excludes plinth, cross-arms and powered fencing

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
COM10	CCR		Communications Cabinet/Rack	*including* trays & cabinets
COM10	***CSCS***		Security Systems	*including* labour & material; site specific; for security electronic (SEEA) systems, including intruder detection (INDE), access control, powered fencing and video surveillance (SEVD)
COM10	***CHVA***		Heating, Ventilation, Air Conditioning	*including* labour & material; site specific; for heating, ventilation and air-conditioning
BEARERS				
COM10	CPLC		Power Line Carrier	*including* filters, *excluding* carrier couplers & wave traps
COM10	CPEQ		Pressurisation Equipment	
COM10	CMBE		Microwave Bearer	
COM10	CRAD		Radio < 1 GHz	
COM10	CANF		Antenna and Feeder (Inc. IF to ODU)	*including* dish, grid-pac or mast
COM10	CFTE		Fibre Terminal Equipment (excluding LTO)	
COM10	CTDM		Time Division Multiplexed – TDM	
COM10	CHDS		HDSL Pair Gain	
COM10	CFIT		Cables, internal, inter-panel	including labour & material; site specific, fibre patch-cords and copper cables (& krone frames)
DATA COMMUNICATIONS NETWORK				
COM10	CDCN		DCN Site Equipment (Alarm and Element Manager)	
NETWORKS				
COM10	CVNE		Voice Network End Equipment	
DC SUPPLY SYSTEM				
COM10	CBAT		Battery Bank	
COM10	CREC		Battery Charger	includes DC switchboard, Rectifiers (was CREC)
COM10	CDCC		DC/DC Converter	
COM10	CUPS		UPS/Inverter	
FIRE PROTECTION SYSTEM				
COM10	CFDS		Fire detection system	*including* labour & material; site specific; for fire detection systems, eg. VESDA
COM10	CFEX		Fire extinguishers	*including* labour & material only; site specific; for fire extinguishers and fire-fighting equipment
BEARERS				
COM5	CPBA		Packet Based	

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
DATA COMMUNICATIONS NETWORK				
COM5	CASW		Alarm and Element Manager Software (central)	
COM5	CAHW		Alarm and Element Manager Hardware (central)	includes ethernet switches
NETWORKS				
COM5	CVNC		Voice Network Core Equipment Hardware	includes ethernet switches
COM5	CVNS		Voice Network Core Equipment Software	
COM5	CDNE		Data Networks (Customer and Overlay)	
OPERATIONAL EQUIPMENT				
COM5	CTE		Test Equipment	
TRANSMISSION OPERATIONS				
TO10	NOC		NOCS software	*excluding* hardware
TO10	OIT		Operational Information Systems	*including* PROMS, DMS (Drawing Management System), RIS (Rating Information System), ODS (Operational Diagram Systems), TRCalc (real-time ratings), Thermal Rating Calculator
TO10	AMIS		AMIS (Asset Management Information System)	*excluding* hardware
TO04	NOCH		NOCS hardware	*including* PCs, servers and networking equipment
OTHER ASSETS				
OT40	BLD		Non-network buildings	*including* system control centre building, office buildings, archives building, houses on Transend land, *and excluding* substation buildings
OT	LEAS		Leasehold improvements	*including* building improvements (for period of lease)
OTHER ASSETS				
OT09	OFF		Office furniture	
OT09	MVH		Motor vehicles	
OT09	TRL		Trailers	
OTHER ASSETS				
OT04	MOT		Mobile telephones	
OT04	OEQ		Office equipment	
OT04	CCN		Corporate computer network	
OT04	ITA		IT applications	
OT04	ITS		IT systems	
OT04	PCO		Personal computers	

RAC	Financial Asset Category (FAC)	Asset Breakdown Structure (ABS)	Regulatory Asset Category (RACT)	RACT Definition
OTHER ASSETS				
LB	SLD	LAND	Network land	land for substations or to secure transmission line easements
LB	NSL		Non-network land	land for administration and/or storage purposes

Appendix B. Transend Asset Management Plan library

Record Number	Title	Issue Number	Approval Date
D10/97690	AC Distribution System AMP	1.0	01/09/2007
D09/41132	Capacitor Bank AMP	1.0	01/04/2009
D09/70682	DC Distribution System AMP	2.0	17/02/2013
D08/99116	Earthing and Lightning Protection AMP	1.0	01/12/2008
D08/91219	EHV Circuit Breaker AMP	1.0	01/11/2008
D08/99054	EHV Current Transformer AMP	1.0	01/07/2008
D08/91256	EHV Disconnector and Earth Switch AMP	3.0	19/10/2012
D08/99652	EHV Post Insulator AMP	1.0	01/12/2008
D09/41250	Gas Insulated Switchgear AMP	1.0	01/04/2009
D09/70693	High Voltage Switchgear AMP	2.0	19/12/2012
D09/70510	Network Transformer AMP	2.0	01/07/2009
D09/9131	Power Cable AMP	2.0	01/02/2009
D10/1589	Power Transformer AMP	2.0	18/12/2012
D08/99050	Structures and Busbars AMP	1.0	01/12/2008
D09/52017	Substation Civil Infrastructure AMP	1.0	01/05/2009
D09/42697	Surge Diverter AMP	1.0	01/04/2009
D09/5542	Voltage Transformer AMP	1.0	01/11/2008
D09/13327	EHV Busbar Protection AMP	2.0	15/08/2012
D12/37708	EHV Capacitor Bank Protection AMP	1.0	16/08/2012
D12/10734	HV Substation Protection AMP	1.0	07/03/2012
D12/20938	SCADA Systems AMP	1.0	18/05/2012
D12/10081	Transformer Protection AMP	1.0	07/03/2012
D09/34013	Transmission Line Protection AMP	2.0	17/08/2012
D08/99628	Circuit Rating and Weather Monitoring Systems AMP	1.0	01/12/2008
D03/5593	Easement Management Plan	3.0	30/09/2010
D08/99101	Transmission Line Conductor Assemblies AMP	5.0	14/06/2013
D08/99660	Transmission Line Insulator Assemblies AMP	3.0	12/10/2012
D08/99418	Transmission Line Support Structures AMP	4.0	12/10/2012
D08/99473	Transmission Line Support Structure Foundations AMP	2.0	01/12/2008
D12/53567	Telecommunications Bearer Network AMP	1.0	06/11/2012
D12/53719	Telecommunications Ethernet Systems AMP	1.0	12/10/2012
D12/14056	Telecommunications Telephone System AMP	1.0	21/02/2013
D06/38655	Revenue Metering AMP	1.0	01/09/2006
D10/78184	AMIS AMP	3.0	17/01/2013
D13/13621	Service and Performance AMP	1.0	25/02/2013

Appendix C. Comparison with Industry Standard References

C.1 Australian standard regulatory asset lives

For many years in Australia, the valuation of electricity networks was based generally on the principles and methodology provided in the NSW Treasury document, "*Valuation of Electricity Network Assets – A Policy Guideline for NSW DNSP's*" (May 2003). There being no other recognised State or National document on the application of ODRC asset valuation methodologies to electricity networks, the NSW Treasury Guidelines have become the de-facto standard for regulatory valuations of electricity network assets in Australia.

The Treasury Guidelines assigned a class life based on Australian and overseas experience at the time.

The level of disaggregation adopted in the Treasury Guidelines was not as high as is typically applied today.

The following table compares the standard asset class lives assigned in the NSW Treasury Guidelines with those proposed by Transend for a selection of asset categories that are represented in both asset structures.

Table 13 Comparison of asset class lives

Asset Category	NSW Treasury Guidelines (years)	Proposed Transend RACT Life (years)
Transmission lines and cables		
• Transmission steel tower transmission line	60	60
• Timber support structures	45 (wet zone)	45
	55 (dry zone)	
• Transmission cables	45	45
Transmission & zone substation switch-bay equipment		
• Indoor GIS switchgear	40	45
• Indoor circuit breakers	40	45
• Outdoor circuit breakers	40	45
• Current transformers	40	45
• Voltage transformers	40	45
• Outdoor isolators	40	45
• Remainder of switch-bay equipment	40	45
• Power transformers	50	45
• Reactors	40	45
• Capacitor banks	40	45
Substation buildings and establishment		
• Civil works and foundations	60	60
• Buildings	60	45
• Climate control	NA	15
• Fire system	NA	15
• Security system	NA	15
• SCADA	10	15

Asset Category	NSW Treasury Guidelines (years)	Proposed Transend RACT Life (years)
• Auxiliary transformer	NA	45
• Battery bank and charger	NA	15
Revenue metering & load relays		
• Digital	15	15
Communications		
• Pilot cable - overhead	35	45
• Pilot cable - underground	60	45
• Fibre optic cable	NA	45
• UHF / VHF transmission/repeater	NA	10
• General communications (terminal equipment etc)	10	10

C.2 International jurisdictional asset lives

In this section we compare and contrast the range of standard asset class lives that are used for regulatory valuations in other jurisdictions.

We have selected the UK and New Zealand for very specific reasons. The primary reason is that the transmission and distribution systems that have been built in these countries over the past 50-100 years (including PWC's), were based very much on historical British Standards for the design and construction of electrical infrastructure. The selection of system voltages in Australia and New Zealand were based on system voltages in use in the UK in the early to middle part of the 20th century.

Early designs of transmission and distribution overhead systems in Australia were based on original UK designs (including the design assumptions for ambient and maximum operating temperatures).

Prior to the introduction of Australian and International Standards for the specification of electrical equipment, most major items of equipment (e.g power transformers, switchgear, cable, etc) were purchased to British Standards.

SKM is therefore of the view that much can be learned about the expected performance, and life-cycle expectancy of transmission and distribution systems in Australia by also studying the views and experiences of utilities in those countries that also inherited the UK designs, as well as utilities in the UK itself.

C.2.1 United Kingdom

Transmission and distribution asset lives in the UK are not mandated by the jurisdictional regulator (Ofgem), but rather each Utility adopts its own assessment of the average expected economic life of asset classes, based on its own operational experiences, environmental conditions, asset management policies, and maintenance practices, etc.

As such, there is no single standard asset class life in the UK, but rather a range of asset lives, as adopted by the various DNO's. The Table below compares the range of asset lives with those proposed by Transend for a selection of asset categories that are represented in both asset structures.

Table 14 Average UK DNO Asset Lives

Asset type	UK Average Life (years)	Proposed Transend RACT Life (years)
Transmission lines OH	40-75	60
Transmission structures - tower	50-65	60
EHV (66/33kV) poles and structures - wood	55-65	45
Transmission lines UG	55-70	45
Substation switchgear - indoor	45-55	45
Substation switchgear - outdoor	45-55	45
Power transformers	50-60	45

As can be seen in the table above, a number of the UK standard asset classes are predicted to achieve an average economic life at least 10 years greater than currently expected in Australia.

SKM is unaware of any differences in technical, environmental, or operational reasons that would explain the longer asset life expectancy in the UK, and it may be that in due course and with greater experience in the managing of ageing assets, that Australian utilities may also realise longer average asset life expectancy.

An anomaly that has existed in the UK since privatisation in the late 1980's has been that:

- All post-vesting (post privatisation) assets have a regulatory asset life of 20 years and are depreciated on a straight line basis.
- There is also a supplementary depreciation allowance associated with a 15 year smoothing adjustment which was introduced once electricity distribution network owners (DNO's) pre-vesting assets became fully depreciated.

Being aware of the discrepancy between asset lives for depreciation purposes, and the real average economic life of network assets, Ofgem engaged a consulting consortium led by Cambridge Economic Policy Associates (CEPA) to advise them on the matter.

In their open letter to the electricity industry dated 14 January, 2011 Ofgem stated:

> *"In October 2010, we published our RIIO framework decision document. This established the principle that regulatory asset lives should reflect the expected economic life of the related network assets. This principle will apply for the next electricity distribution price control from April 2015."*

In their letter, Ofgem also noted that the weighted average age of the existing UK networks is over 39 years, which is approximately 10 years greater than the weighted average age of Australian electricity networks.

C.2.2 New Zealand

In August 2004, the New Zealand Commerce Commission issued the "Handbook for Optimised Deprival Valuation of System Fixed Assets of Electricity Lines Businesses".

The handbook details the optimised deprival valuation (ODV) methodology that large electricity lines businesses, large line owners, and large electricity distributors (ELB's) are required to use when valuing their "system fixed assets" on an ODV basis for the purposes of the regulatory regime under the Commerce Act, 1986.

The handbook specifies a list of standard total lives (TL's) for different asset classes. The table below compares a sample of these Standards Lives with the standard asset class lives proposed by Transend.

The handbook also specifies circumstances under which some assets (in particular transmission lines) may be assigned shorter lives due to proximity to coastal or polluted environments, and circumstances under which certain assets (power transformers, indoor switchgear, distribution transformers, and transmission lines) may have extended total lives.

Table 15 NZ Commerce Commission ODV handbook

<table>
<tr><th>Asset class</th><th colspan="2">NZ Standard Life (years)</th><th>Proposed Transend RACT Life (years)</th></tr>
<tr><td>Transmission lines and cables</td><td colspan="2"></td><td></td></tr>
<tr><td>• Transmission lines</td><td colspan="2">55</td><td>60</td></tr>
<tr><td rowspan="3">• Transmission cables</td><td colspan="2">Cable type</td><td rowspan="3">45</td></tr>
<tr><td>XLPE</td><td>PILC</td></tr>
<tr><td>45</td><td>70</td></tr>
<tr><td>• Pilot/communications - O/H circuits</td><td colspan="2">45</td><td>45</td></tr>
<tr><td>• Pilot/communications - U/G circuits</td><td colspan="2">45</td><td>45</td></tr>
<tr><td>Substations</td><td colspan="2"></td><td></td></tr>
<tr><td>• Primary plant</td><td colspan="2">45</td><td>45</td></tr>
<tr><td>• Power transformers</td><td colspan="2">55</td><td>45</td></tr>
<tr><td>• Bus section/coupler protection and controls</td><td colspan="2">15</td><td>15</td></tr>
<tr><td>• SCADA and communications equipment</td><td colspan="2">15</td><td>10</td></tr>
<tr><td>• Substation buildings</td><td colspan="2">55</td><td>45</td></tr>
<tr><td>• Site development, civil works, foundations</td><td colspan="2">55</td><td>60</td></tr>
<tr><td>• Oil containment</td><td colspan="2">45</td><td>60</td></tr>
<tr><td>• DC supplies, batteries and inverters</td><td colspan="2">20</td><td>15</td></tr>
<tr><td>Other system fixed assets</td><td colspan="2"></td><td></td></tr>
<tr><td>• SCADA and communications (central facilities)</td><td colspan="2">15</td><td>10</td></tr>
</table>

Appendix D. Recent AER decisions

D.1 AER 2012 Decision approved standard lives for Powerlink

The AER, in its final decision regarding Powerlink's revenue proposal in April 2012, assigned standard asset lives to a range of transmission assets.

The table below compares the standard asset class lives assigned in the AER Powerlink regulatory decision with those proposed by Transend for a selection of asset categories that are represented in both asset structures.

Table 16 Powerlink Decision

Asset Category	AER Powerlink Standard Life (years)	Proposed Transend RACT Life (years)
Transmission lines - overhead	50	60
Transmission lines - underground	45	45
Substations primary plant	40	45
Substations secondary systems	15	15
Communications – other assets	15	10
Communications – civil works	40	45
Network Switching Centres	12	4 (hardware)
		10 (software)
Commercial buildings	40	40
Computer equipment	5	4
Office furniture and miscellaneous	7	9
Office machines	7	4
Vehicles	7	9
Moveable plant	7	9

The Powerlink asset hierarchy does not have the same level of disaggregation as Transend so not all asset categories map directly. Therefore comparisons present some difficulties. As an example, Powerlink has an approved standard life for overhead transmission lines of 50 years. Transend has proposed a standard asset life of 60 for towers, conductors and glass and porcelain insulator assemblies, but has proposed a reduced life of 45 years for synthetic insulator strings, dampers and galvanised earth wire. The average life of the transmission line composite therefore would fall somewhere between 50 and 60 years.

In all asset categories reported above, the Transend proposed lives are generally within 5 years of the previously approved AER asset lives.

D.2 AER final decision for ElectraNet

The following table illustrates the asset lives approved by the AER for ElectraNet in the final decision[36] for the regulatory period 2013-18.

Table 17 AER approved asset lives for ElectraNet 2013-18

Asset class	Standard Asset Life (years)	Proposed Transend RACT Life (years)
Commercial buildings	30	40
Communications - civil	55	45
Communications - other	15	10
Computers, software and office machines	4	4
Easement	n/a	-
Land	n/a	-
Network switching centres	5	4 (hardware)
		10 (software)
Office furniture, movable plant and miscellaneous	10	9
Refurbishment projects for 2003-08 regulatory control period	10	-
Substation primary plant	44.8	45
Substation demountable buildings	15	10
Substation establishment	55	60
Substation fences	35	45
Substation secondary systems - electromechanical	27	-
Substation secondary systems - electronic	15	15
Transmission lines - overhead	55	60
Transmission lines - underground	40	45
Working capital	n/a	-
Accelerated depreciation	5	-
Refurbishment projects 2008-13	12½	-
Equity raising cost - 2003 opening RAB and 2003-08 capex	43	-
Equity raising cost - 2013-18	43	-
Transmission lines refit - insulators replacement 2013-18	27	45 (synthetic)
		60 (glass & porcelain)

[36] AER, *Final decision: ElectraNet Transmission determination 2013-14 to 2017-18*, April 2013, table 6.3, p.p 149

D.3 SP AusNet regulatory submission for period 2014-17

The following table shows SP AusNet's proposed standard asset lives[37] for the forthcoming regulatory control period, which are unchanged from the current regulatory period.

Table 18 SP AusNet proposed asset lives for 2014-17 regulatory period

Asset class	Standard Asset Life (years)	Proposed Transend RACT Life (years)
System assets		
Secondary	15	15
Switchgear	45	45
Transformers	45	45
Reactive plant	40	45
Lines	60	60
Establishment	45	60
Communications equipment	15	10
Business support		
Buildings	45	40
Vehicles	7	9
Other business support	10	-
IT	5	4
Land	n/a	-
Easements	n/a	-

37 SPI PowerNet Pty Ltd, *Electricity Transmission Revenue Proposal 2014/15 - 2016/17*, 28 February 2013, table 8.1, p. 169