Asset Management Plan

2015-16 to 2019-20

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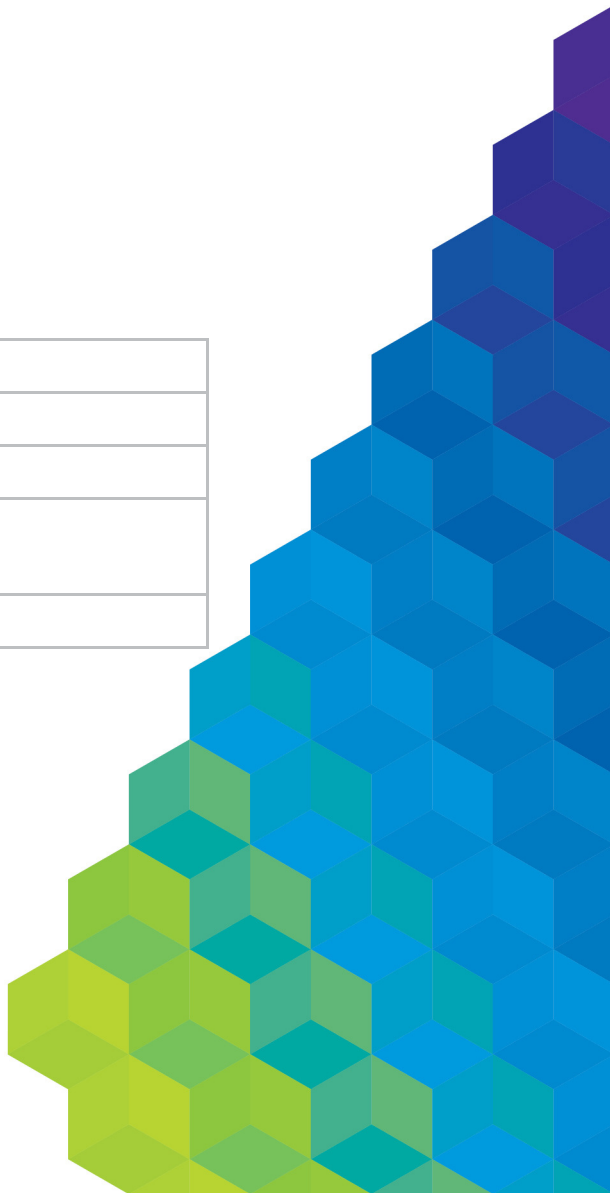

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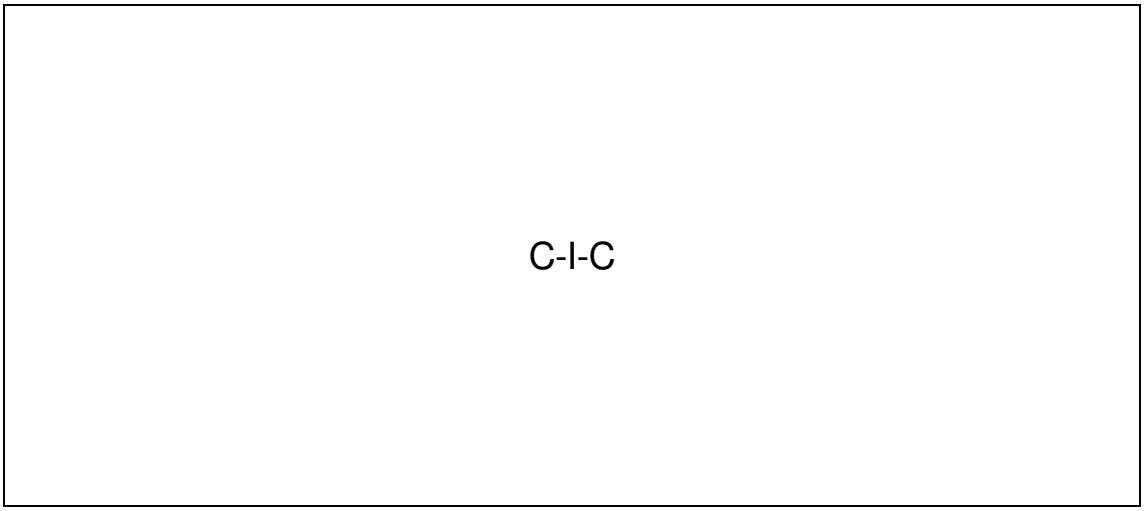
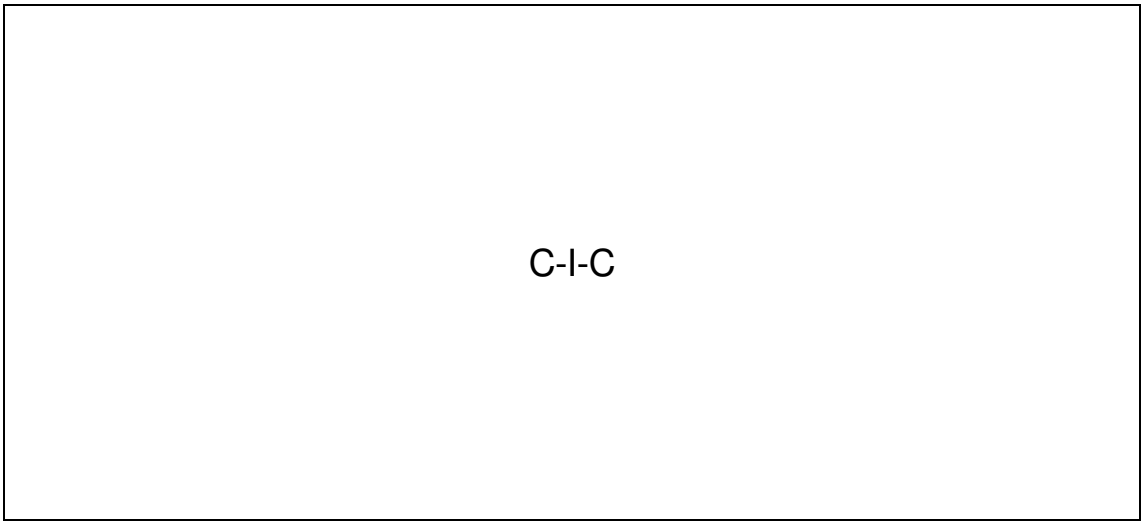
1 EXECUTIVE SUMMARY

The Asset Management Plan (AMP) is a summary of the programs, projects and planned expenditure needed to manage the three AusNet Services' regulated networks over the next 5 years. The expenditure is an output of the Asset Management System which minimises the life-cycle costs of the network assets while delivering both mandatory network obligations and maximising network service levels.

The recent increase in bushfire prevention and safety related expenditure in electricity distribution will stabilise at current levels over the plan period as AusNet Services continues to reduce these risks. Asset replacement across all networks is also at historically high levels as much of the network assets built during the 1960s become uneconomic to maintain. The changing environment with reducing demand growth from networks is decreasing the capital expenditure on augmentation of the networks. This reducing demand growth is also putting pressure on network prices and in response AusNet Services is continually improving the way work on the networks is scoped, justified, prioritised, designed and performed to incorporate these external factors.

The AMP summary of AusNet Services' expenditure on the three regulated networks is given in the capital expenditure and operating expenditure graphs below.





2 Introduction

AusNet Services manages three energy networks – electricity transmission, electricity distribution and gas distribution in Victoria. This Asset Management Plan (AMP) is for these three networks for financial years 2015/16 to 2019/2020.

This AMP has been prepared in parallel with the proposed business plan. Achieving this AMP will require active management of emerging issues, coordination of the delivery program and efficient deployment of field resources.

2.1 Purpose

This AMP defines the programs, projects and planned expenditure associated with managing AusNet Services' network assets. It informs stakeholders of the context, drivers, challenges and opportunities for network investment.

The AMP is part of a suite of Asset Management System documents that describe how AusNet Services manages its networks to meet customer, regulatory and investor requirements.

2.2 Structure

This document describes the major changes from the 2014/15 to 2018/19 AMP, provides an overview of themes across the three networks and summarises network expenditure.

Individual AMPs for the electricity distribution, gas distribution and electricity transmission networks are included as appendices.

2.3 Links to AusNet Services' strategy

Acknowledging that the nature of the energy sector will change fundamentally over the next decade, in response to community concerns about energy prices, shifting consumer behaviour and developments in the energy environment such as the growth in embedded generation, AusNet Services exists to:

"provide our customers with superior network and energy solutions"

The Corporate Business Plan for 2015 to 2018 underpins AusNet Services' purpose with eight Strategic Objectives to be achieved by 2018, as described in the diagram below:

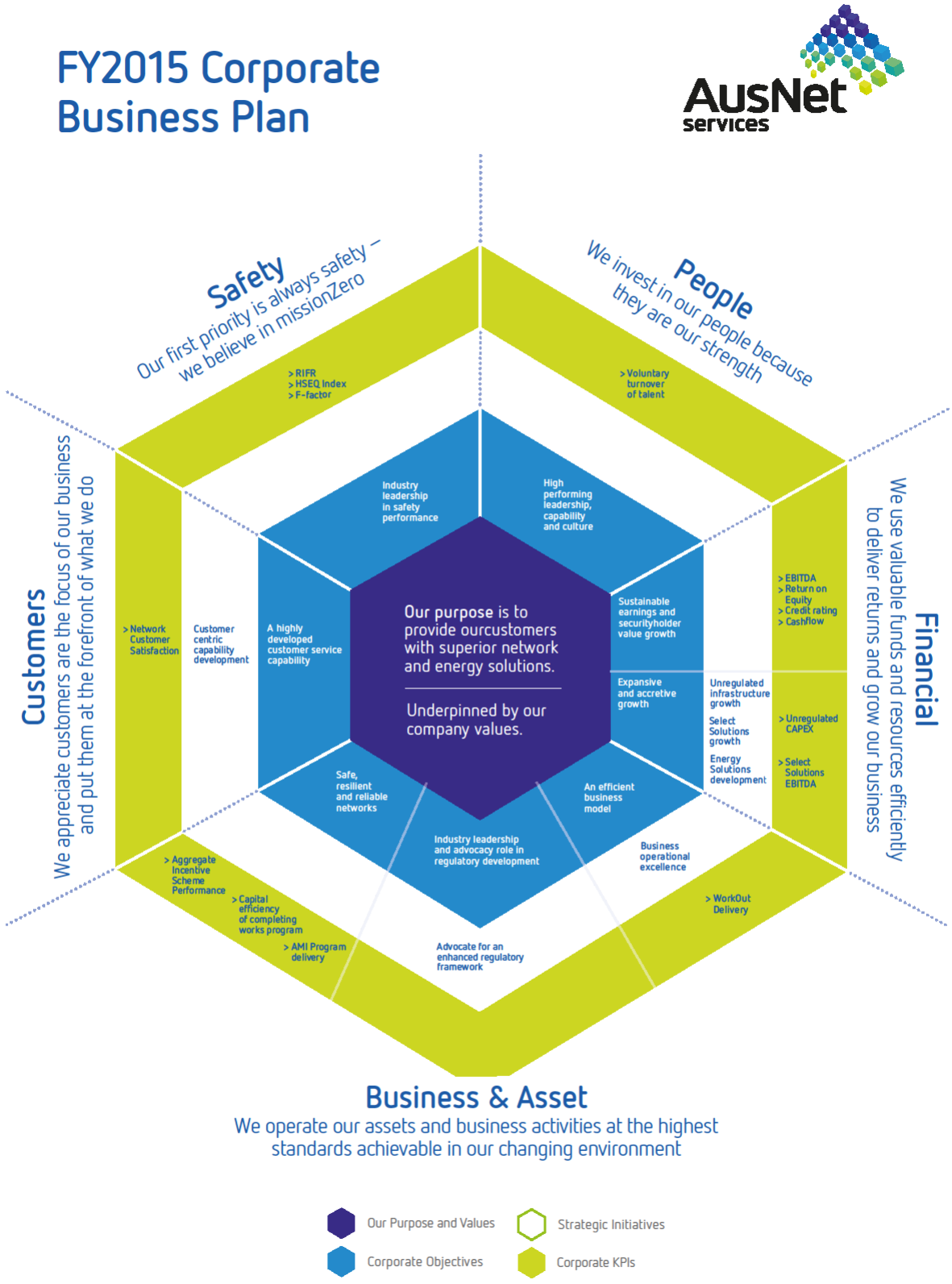


Figure 1 - AusNet Services purpose and business objectives

The corporate business plan provides the objectives and purpose to which its asset management strategies and plans are aligned. The hierarchy of documents from the Corporate Business Plan through to the five-year Asset Management Plan is shown in Figure 2, below.

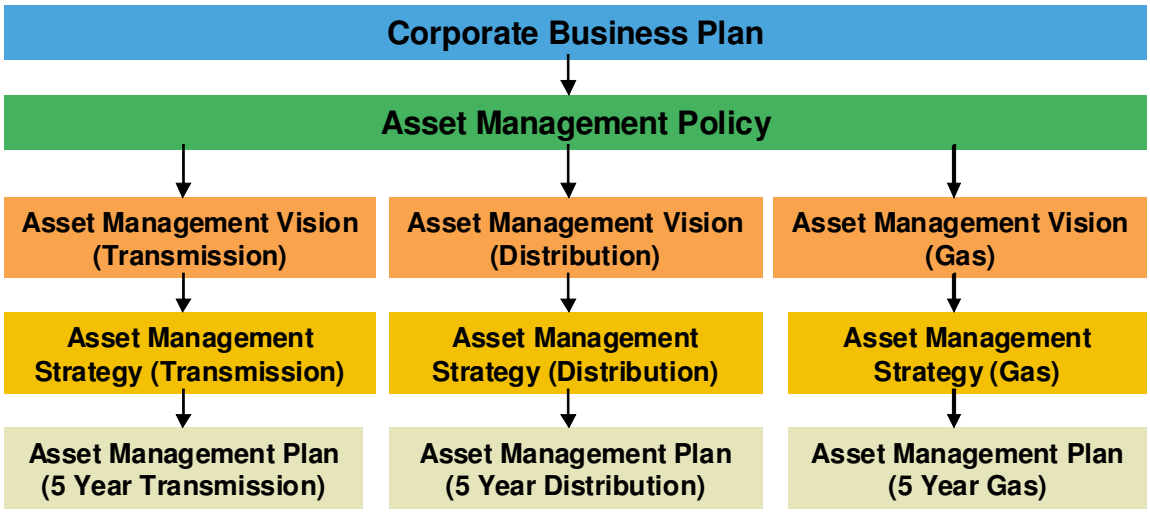


Figure 2 – Core asset management system document structure

2.4 Asset Management Process

AusNet Services' Asset Management System is described in AMS 01-01 Asset Management System Overview. The process, illustrated in Figure 3, includes the development of longer-term asset management strategies, this five-year asset management plan, the management of projects and programs of change and the application of standards to the life cycle of network assets.

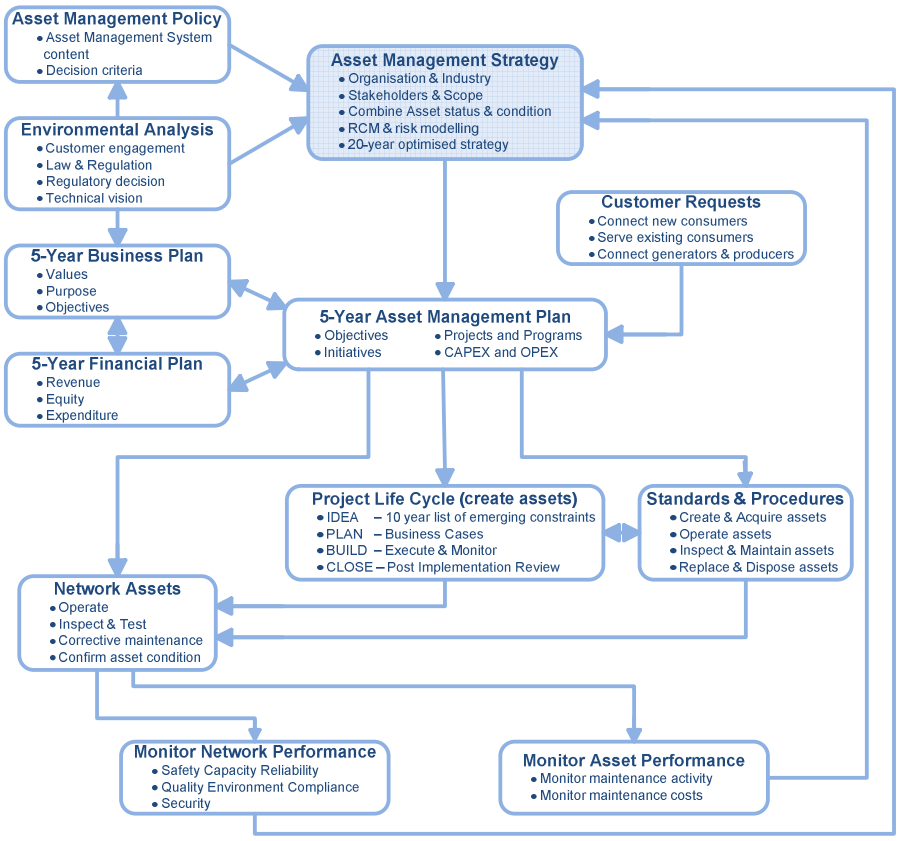


Figure 3 – Asset Management Process

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3 Changes from 2014/15 to 2018/19 AMP

The overall asset management approach used to develop the plan is broadly consistent with the 2014/15 to 2018/19 AMP. Changes in outcomes have arisen primarily due to changes in the external environment and the performance of a major project.

3.1 Business context

There have been a number of developments since the 2014/15 to 2018/19 AMP:

- Electricity demand growth continues to soften with forecast growth of 1.2% over the over the plan period. Per capita gas and electricity consumption is forecast to reduce but total energy consumption is forecast to grow by 0.3% for gas and 0.4% for electricity due to increasing customer numbers. Electricity distribution connection volumes have remained flat at 1.5% of total customer numbers in this AMP. New gas customer connections continue to grow, in part due to the Energy for the Regions initiative, but overall connections are behind GAAR forecast.
- The AER has published initial electricity distribution and transmission benchmarking reports and is collecting benchmarking data for Gas networks. The detailed benchmarking data has been made publicly available to a wide range of stakeholders and energy market participants. AER has indicated that the benchmarking data will be

applied in making pricing and revenue determinations, however the methodology for utilising the data is not yet clear.

- Significant instability in AMI systems performance as the number of smart meters connected to AMI systems has been increased has required a technical review of AMI systems. This has necessitated a remediation plan to stabilise the existing end-to-end metering systems and to complete the network coverage and has impacted on AusNet Services' capacity to fully deliver planned network programs.
- Customer and customer advocate group presentations, workshops and other initiatives to better engage customers (end users) have been completed and are providing information that is being incorporated into asset plans.

3.2 New information

Other new information has also become available since the 2014/15 to 2018/19 AMP:

- AEMO has completed a new study of the Value of Customer Reliability (VCR). The new VCR value is materially lower than the value that has historically been used in project economic justification and affects the electricity networks for both augmentation and major asset renewal planning decisions.
- An increase in the number of HV Aerial Bundled Cable failures in the Dandenong Ranges has led to reprioritisation of components of the Network Safety Program. A volume of safety related activities originally planned for completion in 2013/14 has now been rescheduled to later years, increasing the overall volumes of network safety related activities in the early years of this plan.
- Initial trials of Rapid Earth Fault Current Limiter (REFCL) devices have been completed as part of the Victorian Government's Powerline Bushfire Safety Program. The trials successfully demonstrated the potential for one type of fault current limiting device, the Ground Fault Neutraliser (GFN) to limit the ignition of vegetation and highlighted the potential for this, or other technology such as semiconductor switches, to reduce the risk of bushfire ignition.
- A "visioning" workshop was completed for the electricity distribution network. The conclusions from the workshop provide an important reference for a prudent strategy. This is particularly so as the visioning process identified significant changes in electricity distribution over the next 25 years.
- A significant incident occurred on the distribution network which impacted on customers fed from the Morwell Terminal Station. The incident highlighted the way in which technology has changed the spread of news, with videos of the incident available on-line within minutes of the fault occurring. Response to major network faults needs to consider multiple factors including rapid restoration, communication with stakeholders and incident investigation.
- An increasing number of class actions in relation to bushfires have been experienced in recent years, reflecting heightened awareness and the litigious nature of parts of the community. This only serves to highlight the importance of our bushfire mitigation measures.
- The early results of a program of customer engagement focusing on electricity distribution customers appears to indicate that customers are generally satisfied with network reliability and acknowledge the importance of an ongoing commitment to network safety. It is clear that customers and their advocacy groups have a strong desire for information relating to the way energy is delivered and consumed, and believe the

Network Service Provider plays a key part in provision of timely and relevant information. The key areas of customer interest are around solar (installations and impact), smart meters (program roll out update and benefits), and myHomeEnergy portal (accessibility and capability).

- The rate at which electricity distribution timber poles have been found unserviceable has increased significantly leading to an increased volume of pole replacements. Modelling and analysis of deterioration rates indicates that these increased volumes of replacement are likely to continue over the period of this plan.
- Alcoa ceased smelting aluminium at its Point Henry plant during the year. The transmission assets connecting the plant will remain in service to enable Anglesea Power Station to continue to generate. There is some uncertainty around continued operation of the power station so capital investment to maintain the transmission assets will be minimised.

3.3 Key Implications

The need to continue implementing the Enhanced Network Safety strategy is clear. The delivery of the Enhanced Network Safety program will remain a focus with significant programs of work and levels of expenditure continuing through the plan period.

Economic analysis is used to determine the economic timing of network augmentation and rebuild projects in the electricity networks. The value of energy not supplied in the event of a network failure, determined by the VCR, is one of the key benefits considered in the economic analysis. The lower value now ascribed to VCR will lead to the deferral of network augmentation and rebuild projects and consequently there will be a small reduction in average reliability as seen by customers.

The publication of raw benchmarking data increases the potential for external parties (in addition to the AER) to scrutinise the cost of undertaking a range of network maintenance, construction and replacement activities. This increased scrutiny highlights the need to have a detailed understanding of costs and cost drivers, and reinforces the importance of recording accurate data at the appropriate asset level. Project Workout will have a prominent role in this regard.

A continuing reduction in energy delivered by networks, large network safety and asset replacement programs and continuing media relating to the cost of energy will continue to put pressure on network prices. AusNet Services is continually improving the way work on the networks is scoped, justified, prioritised, designed and performed to incorporate these external factors.

4 Priorities and Challenges

This section summarises asset management focus areas and potential changes to successfully respond to emerging asset management themes.

4.1 Delivery of the AMI program

The significant instability in AMI systems performance and resulting remediation plan has resulted in additional cost, which impacts on other asset related programs, and the diversion of key resources onto the program.

It is a priority to implement the systems necessary to reliably deliver market data and to continue to deliver market data at a reasonable cost. It is expected that the rectification works necessary to ensure robust end to end processes will not be completed until the second year of the plan period. A suite of asset management plans which define the ongoing management of the assets are being prepared concurrently with the remediation works.

4.2 Delivery of Transmission rebuild projects

Major projects are underway at RTS, BTS and WMTS. Each of these projects presents challenges and all are critical to the provision of secure supply to the CBD. The redevelopment of RTS is in the delivery phase and is expected to be completed by 2018 and the redevelopment of WMTS is in the design phase with an expected completion date of 2022/23, however the project is under review with the recent load forecasts and reduced VCR. The BTS augmentation project has received planning approval, delivery has commenced and is on track to be completed by 2016.

The supply security risk at RTS and WMTS, that supply most of Melbourne's CBD, is now lower than the risks associated with the top eight connection terminal stations with energy at risk. The reduction in supply risk is the result of successful implementation of contingency plans at RTS (5th 220/66 kV transformer and load transfer capability) and WMTS (radial operation of hot spare transformer and load transfers).

Ongoing focus is required to keep these projects on schedule, meet local community expectations, and manage the changing environment (such as East-West link).

4.3 Safety programs and bushfire mitigation

Delivering the volume of work arising from the ESMS and Enhanced Network Safety plan for Electricity Distribution at forecast costs has been a challenge. The commitment to reduce bushfire ignition risk and deliver the volumes of work in the Enhanced Network Safety plan lead to large expenditures and volumes of activities, particularly over the first 3 years of the plan period. Delivering these large programs of work be challenging.

4.4 Project Workout

Successful completion of the Enterprise Asset Management project will enable improvements in the way assets are managed, particularly in the construction/renewal and maintenance processes. The new system will "go live" at the commencement of the plan period. During the first year of the plan the focus will be on training and learning the new system along with implementing new processes and organisational design. The challenge will be to quickly and efficiently apply the new system and processes to the delivery of asset management activities.

4.5 Changing customer usage

Consumer response to increasing energy prices, economic conditions, emerging technologies, and improved building efficiency continue to reduce energy consumption per customer on the gas and electricity networks. This trend has now been occurring since 2010 and is forecast to continue as the low cost of solar PV and reducing cost of energy storage have an impact.

Reducing consumption and a tariff structure based on energy consumption leads to increasing prices. Regulatory and public scrutiny of increasing prices is high, placing pressure on the asset expenditure program.

In response to this changing environment, priority will be given to developing lower cost and shorter life assets, better targeting network safety and asset replacement programs, and developing a deeper understanding of the impact of localised generation coupled with energy storage through trials and development of low-voltage network models.

4.6 Gas network

AusNet services continues to undertake low pressure replacement at a rate above that approved in the Access Arrangement in accordance with the pass-through mechanism introduced for the period. Accelerated replacement is only conducted where there is a clear commercial and/or technical justification. Medium Pressure replacement is being conducted in line with approved benchmarks, targeting the completed replacement of Cast Iron mains (operating at medium pressure) by 2018.

The AER approved the regulatory treatment for the proposed supply and reticulation of Avoca, Bannockburn and Winchelsea as part of the Energy for the Regions program. The program has commenced with approximately 1,300 additional connections expected on the network forecasted by the end of FY18.

4.7 Enhanced Security Awareness

In July 2014, Victorian Government established Emergency Management Victoria (EMV). The establishment of this new body combined with the Federal Government increasing the terror alert to High will involve a heightened awareness of security.

Responding to these changes in the security environment include physical measures such as ensuring the program of developing security measures at terminal stations is progressed, increasing monitoring and patrols of key sites, and routinely testing IT systems for vulnerabilities.

5 Opportunities

This section summarises the opportunities that support achievement of the asset management mission.

5.1 Using AMI data to improve network reliability, quality and utilisation

Significant progress has been made on applications that use the information from AMI meters to improve asset management. Current developments include the identification of faulty consumer neutrals and premises where energy theft is occurring. Further opportunities are available to identify the connected phase of consumers leading to improvements in load balance on distribution LV networks, and to detect defective assets before they result in a network outage. Opportunities also exist to improve network safety by detecting conductors that have fallen to the ground and to understand the status of the HV network through analysis at the LV level.

5.2 Improved efficiency of work delivery

The implementation of Project Workout in the first year of the plan period will provide opportunities to use the enhanced data, systems and processes to improve the delivery of work. In particular, there will be opportunities to reduce the cost of work delivered through optimising the timing and integrating the replacement of assets. For example, the Multi Resource Scheduling facility will enable scheduling of maintenance and asset replacement works at a single location avoiding the need for repeated visits and outages at a single site.

Project Workout will also provide a platform for desired improvements in maintenance through applying Reliability Centred Maintenance (RCM) techniques that are presently used for optimising asset replacements, to scheduled maintenance programs.

5.3 Asset data and modelling

In preparation for Project Workout, significant effort has been invested in improving the data in asset systems. This improved data combined with improvements in the assessment of asset condition and the availability of new models creates an opportunity to better target asset replacement programs. For example, the development by Government, of a Fire Loss Consequence model combined with assessment of asset condition at a detailed level, enables asset replacement programs to be targeted at specific locations where asset condition and fire consequence combine to make asset replacement or asset reconfiguration efficient.

5.4 Network Support initiatives

A number of network support initiatives have been implemented including the procurement and deployment of mobile generation facilities to support peak summer loads, contracting gas powered generation at Traralgon to avoid network augmentation, engaging large customers to provide demand response, and critical peak tariffs. Trials are currently underway into the use of battery storage to provide network support at both grid-scale and behind the meter.

Despite the lower growth rates now evident on the electricity distribution network, localised peak-demand is still increasing and driving network expenditure as outlined in the DAPR. Opportunities exist to broaden the use of network support to reduce risk on the network at both zone substation and feeder levels, and to assist with response to network contingency events. Where growth in network demand is slow, network support options assist in managing load at risk and may be able to defer network augmentation for several years by reducing demand peaks and keeping demand

within asset ratings. Network support options are flexible and reversible and enable the network to avoid commitment of capex in areas where demand growth is unpredictable.

5.5 Rapidly emerging technologies

The following technologies will impact the networks over the five year period:

- Smart Network options have been applied to the electricity distribution network through Distribution Feeder Automation (DFA). Replacement of Oil Circuit Reclosers with SCADA equipped Automatic Circuit Reclosers (ACRs) is progressively providing sensitive high-speed protection for SWER networks to mitigate fire ignitions and there are further opportunities emerging to extend SCADA control to other parts of the medium voltage network.
- Installation of Ground Fault Neutralisers (GFNs) in zone substations supplying high fire risk areas is in the research phase. Initial trials appear to indicate that GFNs are effective in reducing fire ignitions in a test environment. Further trials will be necessary to determine whether this technology is a practical means of mitigating fire ignitions from single-phase-to-ground network faults.
- Semiconductor switches that open rapidly upon sensing a fault current could be used to limit fault current on distribution networks and result in improvements to safety and a reduction in the potential for bushfire ignition. Fast-acting switches could provide benefits similar to those provided by GFNs but have the advantage of being able to be deployed on a feeder or part of a feeder rather than all the feeders from a zone substation.
- Electricity storage is potentially a disruptive technology; impacting electricity networks through uncontrolled charge and discharge cycles. As storage technology costs reduce; their wider application in electronic devices, smoothing of renewable outputs and electric vehicles will heighten their effect on distribution networks. Trial applications of specific storage technologies have been initiated to investigate peak demand and supply reliability impacts.

6 Key Asset Management Objectives

A summary of the combined key asset management objectives is shown in Table 1. A full set of these objectives and further detail of each objective including the drivers and strategic alignment is shown in the individual plans attached in the appendices.

AM Objective		Targets and Measures
Meet or manage customer demand	D	• Contracted demand management target: >70 MW (FY15/16 and FY 16/17) • Maintain ZSUB transformer capacity per customer: <4.8 kVA (FY15/16) and <4.6kVA (FY17/18)
Maintain the capacity of the network	G	• Maintain capacity in accordance with the Gas Distribution System Code minimum pressure targets: >140kPa HP networks; >15kPa MP; >1.4kPa LP
Improve safety	D	• Reduce Fire Risk incidents to <8, 000 by end FY15/16; <7,700 by end FY16/17 • Meet Enhanced Safety Scheme commitments as agreed with ESV by end FY2016 • Electrical shock incidents reported to ESV: <65 (FY 15/16) • F factor incidents < 257

Maintain and improve safety	G	• Emergency Response Times above ESV benchmarks: 95% Metro Bus. Hrs; 90% Metro After Hrs; 90% Non-Metro All Hrs
		• Deliver low & MP replacement programs: ≥ 80km pa LP; ≥15km pa MP
		• Mechanical damage
		  ○ ≤ 6.6 per 1,000 km - Mains
		  ○ ≤ 1.8 per 1,000 customer connections - Services
		• ≤ 0.35 Mains & Services leaks per km

Improve reliability	D	• Improve electricity distribution network reliability USAIDI: 148.5 mins (CY15); 146.5 mins (CY16): USAIFI: 2.01 (CY15); 1.99 (CY16)
Maintain customer service levels	G	• Maintain USAIDI below 1min
Provide value for money	T	• STPIS – Service component: - Not < -$1M (FY2016) • STPIS – Market Impact Parameter Scheme: ≤ 1, 035 Dispatch Intervals (FY2016) excluding HYTS 3rd transformer outages • STPIS – NCIPAP: < approved project expenditure (FY2016) and complete projects by April 2017 • AEMO Availability Incentive Scheme: > -$0.3M (FY2016)
Modernise the network	D	• Develop accurate near real-time information on utilisation across the network • Establish and Enterprise Asset Management system

Table 1 – Summary of Asset Management Objectives and Targets

7 Capital Expenditure

The five-year capital expenditure forecast[1] is summarised in Table 2.

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Table 2 – FY16-FY20 Business Plan CAPEX Forecasts

[1] (02/03/2015)

The five-year total capital expenditure forecast is depicted by category in Figure 1.

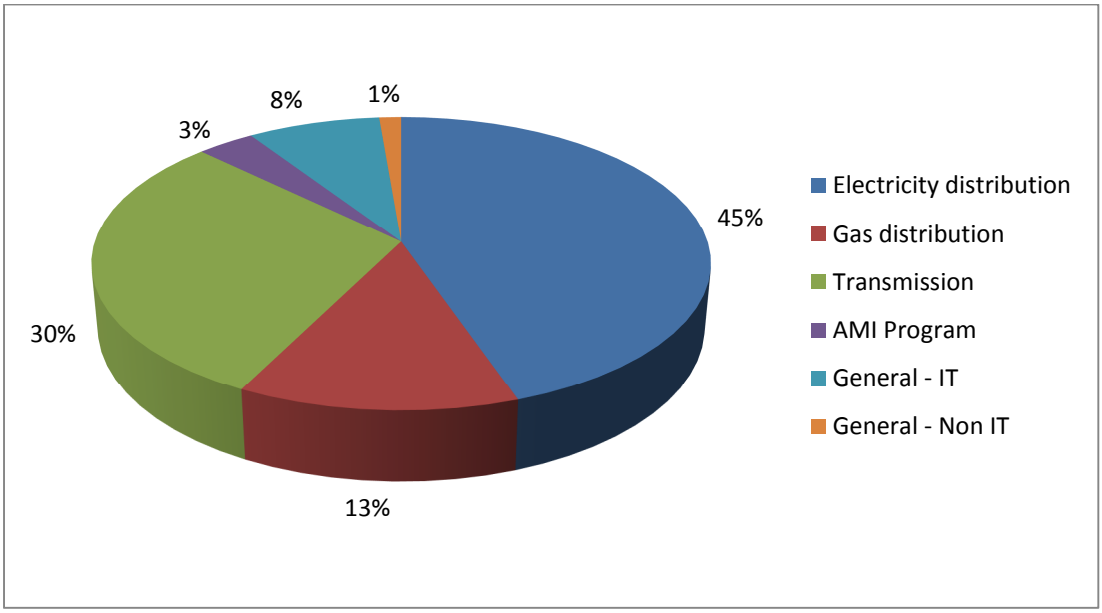

Figure 4 – FY16-FY20 total gross capital expenditure forecast by category

8 Operating Expenditure

The five year operating expenditure forecast[2] is summarised in Table 3.

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Table 3 – FY15-FY19 Operating Expenditure Forecast

Note: Excludes Select Solutions operating expenditure related to external customers.

AusNet Services' five-year total operating expenditure forecast is depicted in Figure 2.

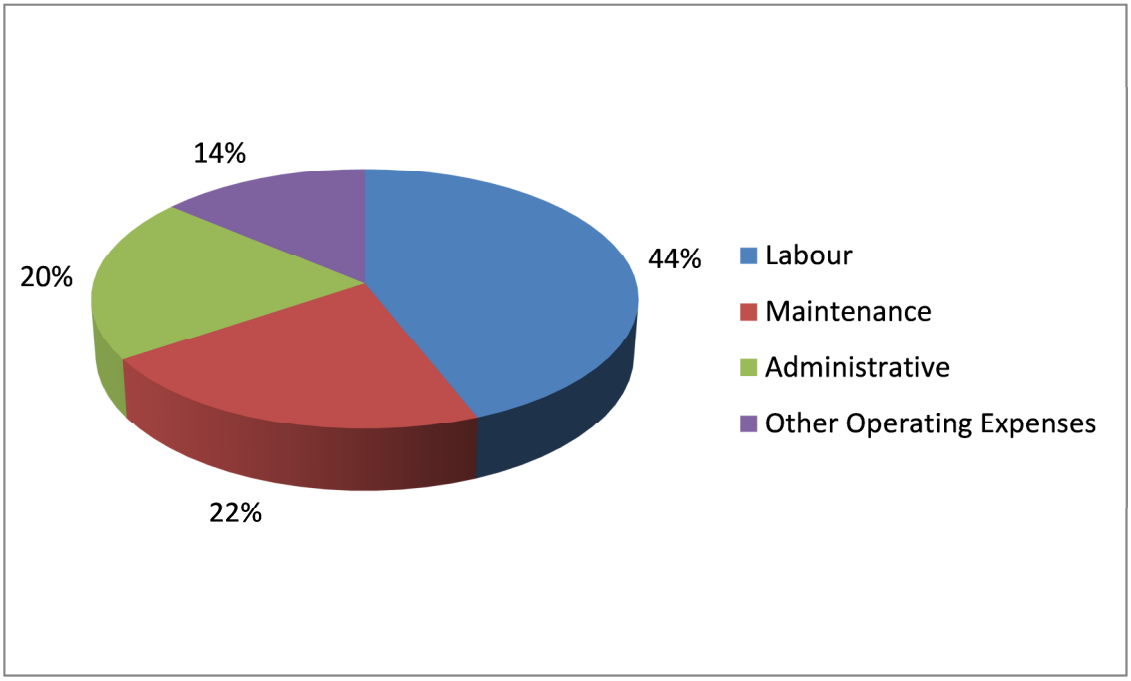

Figure 5 – FY16-FY20 total operating expenditure forecast (% gross)

[2] (03/03/2015)

1 Purpose

The Electricity Transmission Asset Management Plan (AMP) is central to AusNet Services' processes for delivery of network services in accordance with AusNet Services' Asset Management Policy and the Victorian Electricity Transmission Network Asset Management Strategy (AMS 10-01).

The AMP defines the investment profile for the periods 2015/16 to 2019/20 (inclusive) needed to maintain and safely operate the Electricity Transmission network in accordance with network objectives.

2 Electricity Transmission Network Overview

AusNet Services' electricity transmission network serves more than 2.4 million Victorian households and businesses with more than 6,500 kilometres of transmission lines that transport electricity from power stations to electricity distributors and large customers. The network is centrally located among Australia's five eastern states that form the National Energy Market, providing key connections between South Australia, New South Wales and Tasmania's electricity transmission networks[3]. In total, this network transferred over 45,691 GW[4] hours of energy in 2013/14 and serviced a peak demand of 10,313 MW[5].

Figure 1 shows the Victorian electricity transmission network.

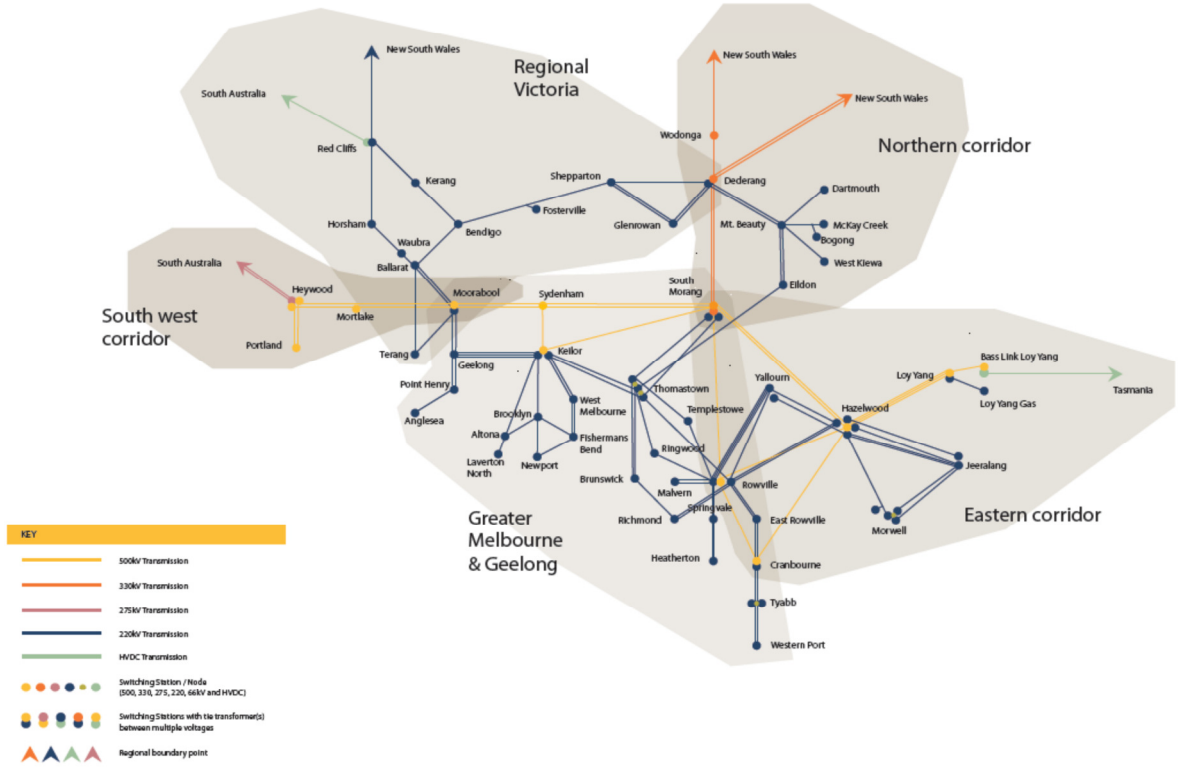

Figure 1 – Electricity Transmission Network Diagram

3 SP AusNet 2011 Business Review

4 National Electricity Forecasting Report (NEFR) 2013

5 ibid

3 Transmission Network Asset Management Objectives

Two primary objectives have been developed for AusNet Services' electricity transmission network to enable the successful delivery of the asset management vision and mission and to govern how the network is operated and maintained.

The asset management objectives are summarised in Table 1.

AM Objective	Drivers	Targets	Strategic Alignment
• **Provide value for money**	• Regulatory Reform • Technology Development	• STPIS – Service component: Not < - $1M (FY 2016) • STPIS – Market Impact Parameter Scheme: ≤ 1,035 Dispatch Intervals (FY2016) excluding HYTS 3rd transformer outages • STPIS – NCIPAP: < approved project expenditure (FY2016) and complete projects by April 2017 • AEMO Availability Incentive Scheme: > -$0.3M (FY2016)	• An efficient business model supported by intelligent, automated and integrated processes & systems • A highly developed customer service capability • Sustainable earnings and securityholder value growth

Table 1 – Electricity Transmission Network Objectives

The Service Target Performance Incentive Scheme (STPIS) and Availability Incentive Scheme provides an opportunity for AusNet Services to gain additional revenue by outperforming service targets. From 2014/15 the STPIS comprises three components; a Service Component, a Market Impact Component (MIC), and a Network Capability Component (NCIPAP).

The Service Component only covers unplanned outages, with a focus on those which cause a loss of supply. The targets for the Service Component are based on historical performance and as past performance has been very good, there is little opportunity to earn additional revenue for this component.

The MIC provides an additional reward of up to 2% of annual revenue (there is no penalty in this adoption phase) for reducing the number of generation dispatch intervals with a market impact of more than $10/MWhr that are caused by AusNet Services' initiated outages.

MIC exclusions definitions and calculation methodologies are:

- Planned customer initiated outages are included.
- Performance is based on a target calculated over 3 years compared to a measure based on the last two years of performance.

In 2014-17 AusNet Services' MIC performance will be limited by the impact of planned customer funded augmentations and the inclusion of customer initiated outages in the performance count.

NCIPAP was introduced in STPIS V4 and AusNet Services is the first TNSP to participate in this parameter. NCIPAP has been introduced to encourage efficient levels of network capability from existing assets, when and where most needed, to improve customer or wholesale market outcomes.

Participation in this component required AusNet Services to submit a plan which contained:

- A list of every transmission circuit and injection point on the network, and the reason for the network capability limit for each.
- A list of priority projects to be undertaken during the forthcoming regulatory control period to remove or improve the identified network limit through operational and/or minor capital expenditure projects when it is economical.

AEMO plans the transmission network in Victoria. Therefore the NCIPAP has been prepared jointly with AEMO. AusNet Services approved NCIPAP contains 14 minor capex and opex priority projects.

AEMO's analysis suggests the NPV of the benefits of these projects is approximately $80m. The budget included in this AMP incorporates total expenditure of $15.9m (capex and opex) to undertake NCIPAP projects and these works must be delivered by the end of March 2017 to secure maximum revenue.

4 Capital Expenditure

This AMP draws from the plant specific strategies that support the above network objectives and ensure the network is operated safely and sustainably. Capital investment is captured in two categories:

- **Customer Initiated** – Customer capital expenditure driven by connections, upgrades and additions to AusNet Services' transmission network.
- **Company Initiated** – Capital expenditure initiated by AusNet Services' Electricity Transmission Asset Management team required to maintain network safety, sustainability and availability.

The current capital expenditure requirements for FY2015/16 to FY2019/20 is summarised below in Figure 2, and Table 2.

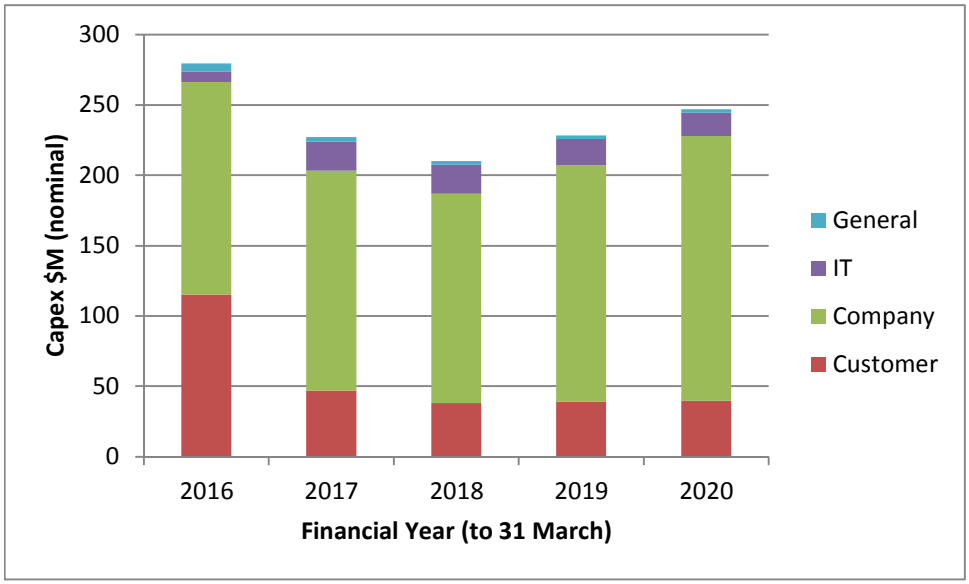

Figure 2 – Electricity Transmission Capex Summary ($Nominal)

(A$M) Nominal	2016 Budget	2017 Plan	2018 Plan	2019 Plan	2020 Plan	Total FY16-20
Customer	115.2	47.0	38.1	38.9	39.7	278.8
Company	151.2	156.2	148.8	168.3	188.1	812.6
IT	7.2	20.6	20.6	18.6	16.8	83.8
General	5.9	3.3	2.5	2.4	2.5	16.6
Transmission Capex	**279.5**	**227.1**	**210.0**	**228.2**	**247.0**	**1,191.8**

Table 2 – Electricity Transmission Capex 2015/16 to 2019/20

4.1 Programs

The augmentation plans of the Australian Energy Market Operator (AEMO)[6] and the distribution businesses[7] have been integrated with AusNet Services' asset renewal plan to form a consolidated plan to forecast transmission asset renewal capital expenditure as summarised in the following sections and Appendix A of this AMP.

AusNet Services' asset renewal projects are primarily focussed on strengthening the resilience and reliability of the network. This includes improving the security of the network by means such as replacing traditional fences with electric power fencing and installing improved security lighting. To a lesser extent, a number of protection, control and communication renewal projects can be categorised as modernising the network to meet the requirements of the National Electricity Code.

A few key projects dominate expenditures within the period of this plan and annual refinement of the work plan will be required to adjust the timing of projects and programs to ensure that risks are managed while meeting financial targets and accommodating inevitable changes in the timing of key project expenditure.

4.2 Melbourne CBD

Two major station redevelopment projects at Richmond Terminal Station (RTS) and West Melbourne Terminal Station (WMTS), and an augmentation project at Brunswick Terminal Station (BTS) are being undertaken during this period. These projects will replace critical end of life assets and enhance the supply to Melbourne's Central Business District (CBD).

The RTS redevelopment project has been approved for an amount of $219M with completion currently scheduled for 2017.

The BTS 220/66kV augmentation is part of CitiPower's plan to provide an increased level of security of supply, to the CBD consistent with good industry practice, estimated at around $215M. This project has been significantly delayed however it is currently under construction and is scheduled for completion in 2016.

The redevelopment of WMTS has been approved for an amount of $192.8M with completion currently scheduled for 2022.

4.3 New Network Connections

Demand growth in the western metropolitan growth corridor and the distance of the growth area from the existing connection station at Keilor are the main drivers to establish a new 220/66 kV connection

6 Victorian Annual Planning Report 2013 AEMO.

7 Transmission Connection Planning Report 2013 Victorian Electricity Distribution Businesses.

station at Deer Park. The Deer Park 220/66 kV connection is scheduled for completion by the end of 2017.

A further generator connection at Ararat is not yet committed but could proceed with a scheduled completion date of the end of 2016.

The Brunswick 220/66 kV augmentation will provide another supply point for Melbourne's CBD area and will offload the heavily loaded Richmond and West Melbourne Terminal Stations.

4.4 Power Transformers

AEMO has initiated a project to mitigate a constraint on the interconnector between Heywood and South Australia. The preferred option will result in the installation of an additional 500/275kV transformer at Heywood by 2016. AusNet Services won the tender to construct an additional transformer at Heywood. This option reduces the risk associated with transformer failure as no spares are currently held for the existing Heywood 500/275kV transformers.

Connections transformers will be added to the network through Distribution Business initiated augmentation at BTS with three 220/66 kV 225 MVA transformers by end 2015 and Deer Park with two 220/66 kV 225 MVA transformers by end 2017.

Modelling of safety, environmental, reliability, availability and business risks associated with major transformer failures is used to rank transformer refurbishments and replacements from the fleet of more than 200 units[8]. A number of transformer replacements have been initiated to strengthen the resilience and reliability of the existing network (refer to Table 3). These are in addition to the replacement of transformers at RTS and WMTS as part of the station redevelopment works previously discussed in Section 4.2.

Location	Transformer	Voltage	Target
Glenrowan TS*	B1	220/66kV	2014
Dederang TS	H1	330/220kV	2015
Morwell TS	B2	220/66kV	2015
South Morang TS	H2	330/220kV	2017
Heatherton TS	B1, B2 and B3	220/66kV	2018

Table 3 – Power Transformer Replacements

** Note: single phase transformers are installed at Glenrowan (3 units)*

The transformer contingency plan is reviewed annually to ensure that the consequences of a major failure of a connection transformer are minimised by the availability of appropriate spare equipment.

4.5 Terminal Station Redevelopments

Redevelopment projects for Glenrowan and Heatherton terminal stations are currently in the construction phase with Glenrowan to be completed at the start of the plan period. The Heatherton terminal station project has been advanced in response to new transformer condition information which indicates that the transformers have deteriorated rapidly in the recent past.

[8] A number of single phase transformers will be replaced with 3-phase units over the next decade resulting in a reduced total number of power transformers.

These redevelopment projects are focussed on strengthening the resilience and reliability by stabilising circuit breaker and transformer failure risks within sustainable ranges and include re-configuration to meet future network needs as defined by AEMO and the Distribution Businesses.

4.6 Reactive Plant

Refurbishment of the Fishermans Bend and Templestowe terminal station synchronous condensers and replacement of their associated secondary systems is being planned to meet AEMO's specification for dynamic reactive support of the shared transmission network. However, AEMO is undertaking additional studies as there is currently some uncertainty around the ongoing need for the support provided by the synchronous condensers.

AEMO has previously requested that the existing condensers are kept in operation[9] and AEMO and AusNet Services jointly determined that refurbishment of the existing units would be the most economical method to maintain essential dynamic reactive support functionality for the foreseeable future.

Also, the replacement of the control and secondary systems on the static VAR compensators (SVCs) at Kerang and Rowville terminal stations will modernise these assets.

4.7 Circuit Breakers

Air-blast circuit breakers – AusNet Services has substantially completed a program to replace air-blast circuit breakers, which has included the replacement of 99 units over the past ten years. The project currently in the construction phase to replace the air-blast circuit breakers at GNTS will complete the air-blast circuit breaker program.

Bulk Oil Circuit Breakers – A replacement program for 220kV bulk oil circuit breakers and selected replacement of critical 66kV bulk oil units is underway to reduce safety, reliability and environmental risks. The staged replacement of 220kV bulk oil circuit breakers at Hazelwood power station switchyard is underway (XB56) and 20 units have been replaced as part of the Thomastown terminal station rebuild project (X785). In addition, 11 circuit breakers are scheduled for replacement at Rowville (X926) and Dederang terminal stations (XA03). This leaves 10 units at Ringwood terminal station and the further stages of Hazelwood power station switchyard subject to future replacement projects.

4.8 Lines

The tower climbing fall arrest system program involving installation of a cable system to prevent falls is underway with expenditure of approximately $18M over the next five years. This program will not be complete over the forecast period and is planned to continue beyond the forecast period. A further program to install fall arrests on station racks will commence in 2015/16 and extend over the forecast period.

Conductor replacements totalling $35M are planned over the forecast period to replace corroded conductor. The second phase of conductor replacement on the Heywood – Alcoa 500kV line is scheduled for 2014/15 and 2015/16. Sections of ground wire will also be replaced with some sections of the Hazelwood – South Morang 500 kV line targeted for replacement.

The insulator replacement program undertaken over the past few years has been successful in reducing failures and risk associated with failure. This program will now reduce in size and will primarily involve replacement of very old insulators in low corrosion environments.

[9] AEMO Direction: Synchronous Condenser Refurbishment Project – Letter to Alastair Parker 4/5/2012.

A program to strengthen towers that on the South Morang – Dederang line will commence in 2015/16. Total expenditure on towers over the forecast period is over $30M.

Risk modelling of the transmission network has identified conductor as an emerging issue due to a combination of corrosive environments and asset age. Further analysis using aerial imaging correlated with conductor sampling is planned to develop a detailed understanding of the size of this issue and the required response over a 20-year period. It is likely that the result of this analysis will result in an increasing volume of conductor replacements.

4.9 Secondary Systems

Protection system replacements have focused on addressing reliability risks associated with slow or incorrect operation and deterioration of older electro-mechanical and first generation electronic relays. The new protection systems have provided the benefit of remote access to fault location information that has improved fault investigation and response.

The secondary systems replacement program of over $50M over the period of this plan program will continue to target non-compliant and non-supported assets. This program incorporates DC systems replacement, primarily batteries and chargers that no longer provide the required back-up supply at terminal stations.

A protection and control modernisation strategy has been adopted that will lead to more flexible and lower cost protection, monitoring and control schemes. This strategy involves sourcing all future relays with the capability to communicate simultaneously using IEC61850 TCP/IP communications as well as serial DNP3 communications protocol. This strategy will enable a low risk entry into IEC61850 and allow the same configuration standards to be used in both brownfield and green field sites.

4.10 Communications

The existing power line carrier systems are being progressively replaced with modern microwave and optical fibre bearers to comply with the redundancy and timing performance requirements of the National Electricity Rules (NER) and mitigate the risks associated with the absence of manufacturer's support. Modern power line carrier systems are used where NER compliance can be achieved.

The copper supervisory cables are reaching end-of-life and services are being transferred to fibre in conjunction with protection and communication equipment replacements.

5 Operational and Maintenance Expenditure

AusNet Services determines its asset related operations and maintenance activities by reference to industry best practice programs, and by introducing incremental refinements to established programs as a result of accumulated knowledge of the asset base. From time to time these schedules are revised to cater for external changes (i.e. new legislation), risk exposure or reviewed from a zero-base (e.g. application of RCM analysis to maintenance schedules).

The Opex plan showing forecast expenditure[10] for each of the transmission network operational functions is detailed in Table 4 and Figure .

Transmission Opex Category		FY 16	FY 17	FY 18	FY 19	FY 20
OAE	Easement Management	0.02	0.02	0.02	0.02	0.02
OAW	Asset Works	6.52	6.77	7.02	7.29	7.57
OMD	O&M Maintenance Domestic	1.40	1.45	1.50	1.56	1.62
OMO	O&M Maintenance Operations	0.84	0.87	0.90	0.93	0.97
OMN	NCIPAP	1.51	1.57	1.63	1.69	1.76
OMS	O&M Maintenance Scheduled	10.80	11.21	11.64	12.08	12.54
OMU + OMTA	O&M Maintenance Unscheduled	4.44	4.61	4.79	4.97	5.16
OMV	O&M Veg Mgt Transmission	3.10	3.22	3.34	3.47	3.60
EM	Maint for External Customers	0.77	0.80	0.83	0.86	0.89
Total Operating and Maintenance Budget		29.39	30.51	31.67	32.87	34.12

Table 4 – Electricity Transmission O&M 2015-16 to 2019-20

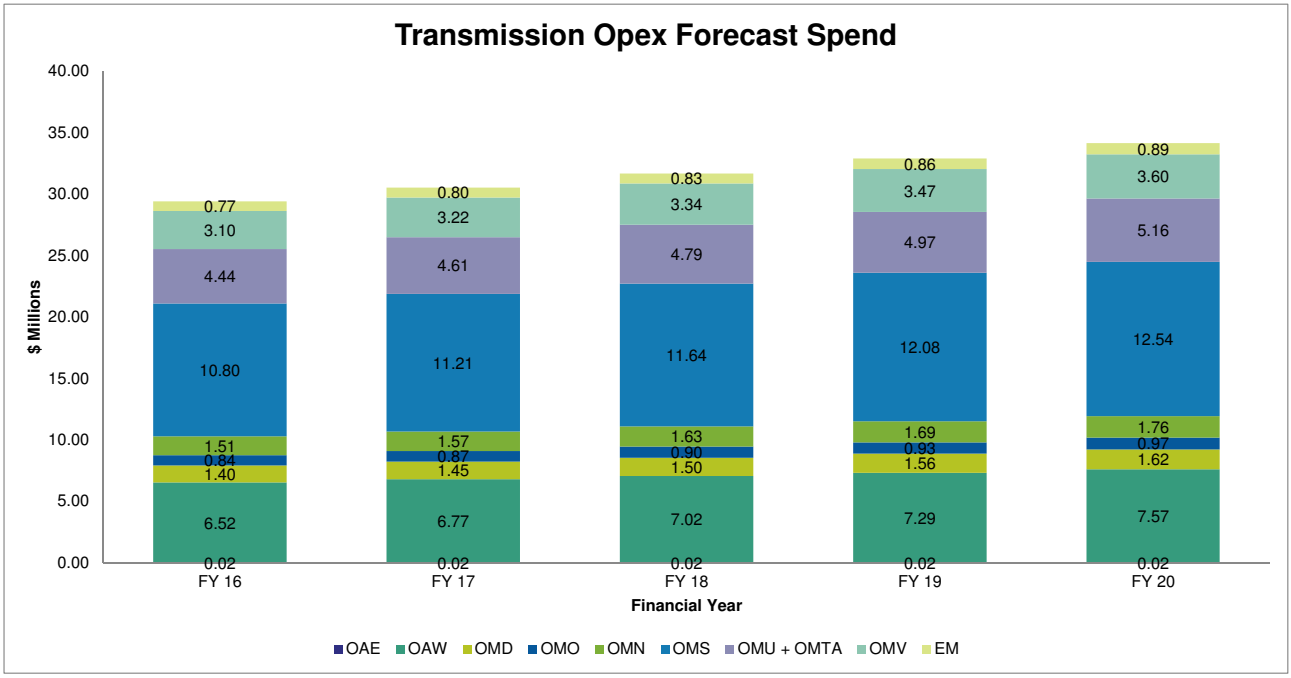

Figure 3 – Electricity Transmission O&M 2015-16 to 2019-20

[10] The table shows an approved budget for 2015/16 and an estimate for years 2016/17 to 2019/20.

5.1 Recurrent Opex

Recurrent Opex includes both scheduled and unscheduled maintenance of network assets. The maintenance philosophy is to "optimise the security, reliability and operational capability of the transmission system, under both normal and abnormal conditions, and preserve the good condition and functional capability so as to maximise service life by the use of safe, efficient and cost-effective work practices". In general terms, the goal is to perform maintenance in conjunction with asset replacement to achieve the mandated levels of service and performance at the lowest total life cycle cost.

A detailed maintenance plan covering the next 12 months is produced each year and a three-month look-ahead plan is produced each month.

5.2 Non-recurrent Opex

Non-recurrent works (known as Asset Works) are singular, large, or specialised activities focussed on specific issues. They include emergency works following major failures, corrosion mitigation, repair of equipment fleets, condition assessments, civil infrastructure maintenance, power cable repairs and high voltage bushing replacements. Major self-funded insurance events are also funded from the Asset Works Allowance.

Asset works expenditure of over $30M is planned for the period of this plan. The major programs of work are:

- Refurbishment of circuit breakers – SF_6 and minimum oil;
- Refurbishment of Gas Insulated Switchgear (GIS);
- Power transformer oil leak repairs and oil treatment;
- Repair of failed circuit breakers and instrument transformers;
- Overhaul of reactive plant;
- Refurbishment and repair of civil infrastructure and station facilities;
- Treatment of ground level tower corrosion (Sox);
- Replacement of line hardware and tower steelwork;
- Assessing clearance of lines using Light Detection and Ranging (LIDAR) technology; and
- Improving maintenance support for circuit breakers.

5.3 Easement and Vegetation Management

The easement and vegetation management provision includes inspections, regular vegetation clearing to meet relevant codes and upkeep of access tracks.

6 Network Risk Profile

This AMP includes programs, projects and planned expenditure aimed at stabilising the risks associated with the electricity transmission network. The trends in failure risk for major asset classes is summarised in Figure 4 and is based on the proposed programs and associated planned expenditure. The risk shown is the incremental total risk including the supply and safety risks. The network risk shown in Figure 4 was calculated for the TRR 2014-17 submission and has not been updated this year.

As an asset deteriorates with time and use, the risk of the asset failing increases, and the supply and safety risks increase. i.e. there is an increased risk that an asset will fail to supply energy and an increased risk that an asset will fail resulting in an injury to a person. These individual asset failure risks have been summed and the result in Figure 4 is shown relative to the base level risk for 2013. The overall sum of asset risks is shown to be decreasing over time indicating that those assets that present the greatest supply and safety risks are being replaced with new assets with a lower probability of failure. The overall risk level is reducing because the reduction in risk arising from replacing assets with the greatest supply and safety risks outweighs the gradual increase in risk from asset deterioration.

The reduction in transmission network risk is primarily the result of the large number of transformer replacements related to the CBD station rebuild projects. Asset classes other than transformers display a relatively flat risk profile with the exception of transmission lines, where risk is increasing due to deterioration of assets and a relatively small asset replacement program.

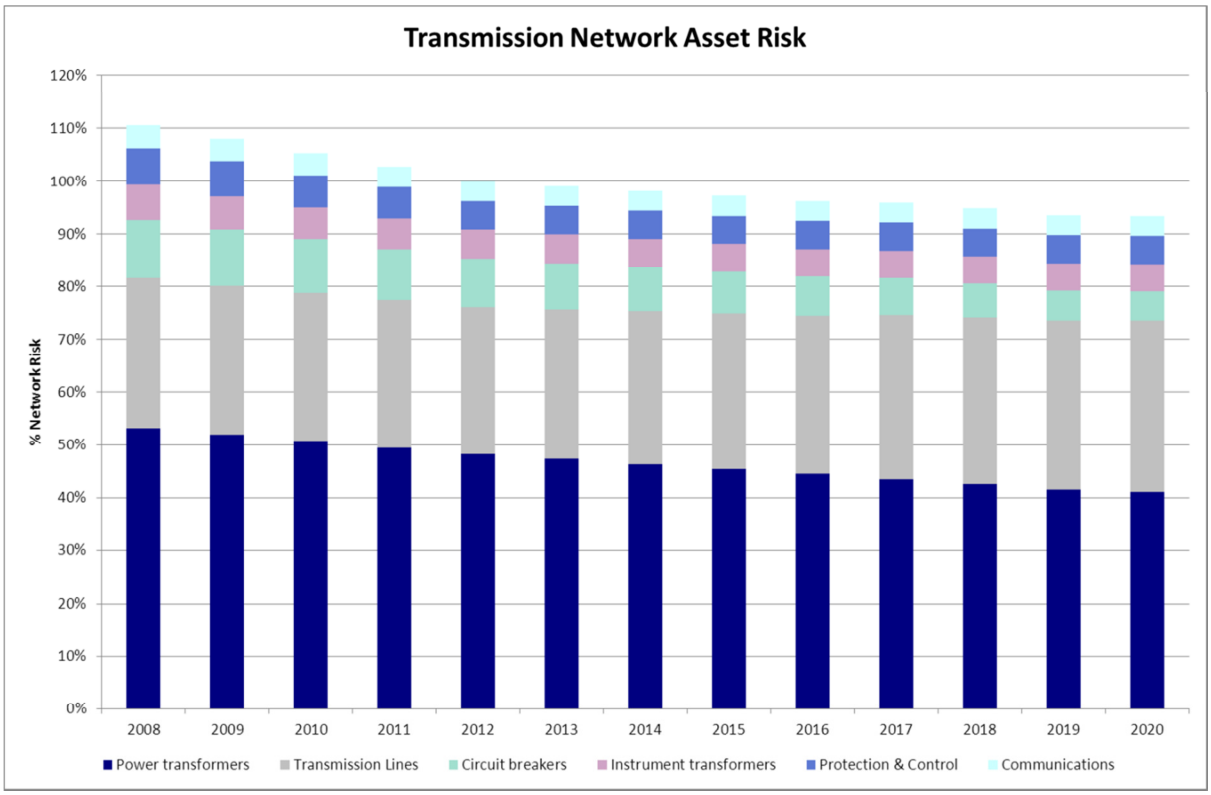

Figure 4 – Electricity Transmission Network Risk Profile

Appendix 3A – Transmission Projects

Transmission Company Initiated Projects

Ref	Title	2015/16	2016/17	2017/18	2018/19	2019/20
	STATION REBUILD					
XA09	RTS Redevelopment Project	29,734	20,584	12,290	892	-
XA14	WMTS Redevelopment Project	1,760	456	1,870	11,487	25,467
XB12	Glenrowan Terminal Station Redevelopment Project	1,700	1,100	-	-	-
XB56	HWPS CB Replacement Stage 3	3,000	-	-	-	-
XB59	HTS Rebuild	18,000	10,692	3,714	-	-
XB61	SVTS Redevelopment Project		363	1,487	9,130	20,242
XB64	MWTS B2 Transformer Replacement	3,680	-	-	-	-
XC15	TSTS B2 Transformer & 66kV Switchgear Replacement	-	-	-	726	9,649
XC16	TTS Bus Tie CB Replacement	1,640	-	-	-	-
XC17	FBTS B1 Transformer & 66kV CB's Replacement	1,000	10,032	3,924	-	-
XC18	YPS 220kV CB Replacement	3,739	3,723	-	-	-
XC19	SMTS H2 Transformer Replacement	3,100	9,787		-	-
XC21	Ringwood Terminal Station - Replace B4 ASEA Transformer and 8 66kV circuit breakers	316	3,352	5,811	3,786	
XC27	RCTS R1 Transformer, 66 kV CB and 66 kV Reactor Replacement	-	-	193	2,566	4,443
XC28	Redevelopment of HWPS 220kV Switchyard, Stage 4	1,660	10,516	7,764	3,674	-
	HYTS 500kV and 275kV CB replacement				292	3,890
	LINES					
X939	Insulator Replacement Project Priority 2 Insulators	4,040				
XC76	Transmission Line Insulator replacement program 2014 - 2020	3,000	840	2,100	2,100	1,400
XC77	Transmission Line Conductor & Groundwire replacement program 2014-2020	5,000	5,232	13,080	13,080	8,720
XC78	Tower replacement on high risk sites	3,100	4,368	10,920	10,920	7,280
XC79	Fall Arrest Installation on EHV Towers	3,890	2,160	5,400	5,400	3,600
XC81	Fall arrest installation project on rack structures		480	480	320	
XC82	Line Easement Access Bridge Replacement	-	-	945	907	
	STATIONS PLANT & CIVIL					
XB08	Station Environmental Works	1,057	-	-	-	-
XC32	Synchronous Condensors Refurbishment - Stage 2		2,400	1,100	400	-
XC34	Fire protection - Fire hydrants replacement and upgrade - stage 3	610	-	-	-	-
XC35	Building asbestos removal - replacement floors, claddings and roofs - stage 1	110	250	-	-	-
XC36	Fire protection - Fire hydrants replacement and upgrade - stage 4	-	1,000	1,800	1,200	
XC37	Building asbestos removal - replacement floors, claddings, and roofs - stage 2	-	200	880	-	
XC38	Station service transformer upgrade at BATS & SHTS	1,190	-	-	-	-
XC42	Station Security upgrades (fences, access system)	1,400	2,100	1,000	-	-
XC44	Instrument Transformer Replacement Program - Stage 7	1,200	702	7	-	-
XC45	Instrument Transformer Replacement Program - Stage 8	-	450	2,200	2,200	
XC47	Replacement of LG4C 66kV Circuit Breakers at SHTS	910	-	-	-	-
XC61	Station security upgrades (fences, access system) - stage 2	-	850	1,700	2,300	
XC62	Switchyard surfaces and roads replacements - stage 2		800	1,200	-	
XC69	Transformer - Improved safe maintenance access for units since late 1990's		1,800	1,250	-	-
XC70	Transformer - Improved safe maintenance access for units installed prior to late 1990's	-	-	600	600	
XC71	Transformer - OTI/WTI replacement - Stage 2		640	640	540	
XC72	Transformer - Bushing replacement program - Stage 3	950	1,200	1,300	400	-
XC86	Replacement of security fencing at KGTS	680	-	-	-	-
XCAU	LG4C Bulk Oil CB Replacement - Stage 2	-	1,635	1,090	436	
XCCA	ERTS CT and CB Replacements	1,000	-	-	-	-
XCB5	Upgrade/ replace deluge systems for transformers at HYTS, KTS and SMTS	488	400	-	-	
XCCZ	Yarraville supply upgrade project	-	-	-	500	
	CB Replacement program - ongoing			5,670	7,830	8,012
	Instrument transformer replacement program - ongoing					2,713
	Power transformer - life extension program - ongoing					3,445
	Civil works program - ongoing					2,376
	Synchronous Condensors Refurbishment - Stage 3				8,127	2,376

Transmission Asset Management Plan 2015/16 to 2019/20

Ref	Title	2015/16	2016/17	2017/18	2018/19	2019/20
	PROTECTION & CONTROL					
XC08	**500kV Protection Upgrade at KTS**	1,300	-	-	-	-
XC09	**Upgrade 500kV CB Management Relays at LYPS**	1,100	-	-	-	-
XC12	**Upgrade 500kV CB Management Relays at HWTS**	1,930	(0)	-	-	-
XA29	**DC Supply Upgrade at various stations**	3,200				
XA36	**Protection upgrade HWTS-SMTS Lines**	1,100				
XA45	**LYPSB-LYPS Protection upgrade**	1,200				
XA47	**Replace 1990 vintage line differential protections.**	2,480	-	-	-	-
XA49	**Upgrade 500kV CB Fail at SMTS**	1,460				
XA50	**Replace CB Fail with CB Management on 330kV network**	1,500				
XC66	**Replace A Transformer Protection at KTS**	-	600	750	-	
XC83	**Replace Protection on SVCs (KGTS, HOTS, ROTS No1, ROTS No2)**	500	750	725	-	
XC84	**DC Supply Upgrade Stage 3 (Stations not covered by X803 & XA29)**	1,000	1,000	1,000	1,000	
XC85	**Upgrade SCADA at Non-SCIMS & Old SCIMS sites**	1,300	2,500	2,500	2,500	
XC87	**Install 220kV CB Management Relays at MLTS**	20	400	980	-	
XC89	**Replace SVC Controls at ROTS No2 SVC**	480	1,000	-	-	
XC90	**Replace SVC Controls at HOTS**	20	480	1,000	-	
XC91	**WOTS: Replace 66kV Feeder Prot (WO1, WO2, HPS)**	770	-	-	-	
XC93	**MWTS: Replace 66kV Feeder Prot (APM1, APM2)**	590	-	-	-	
XC94	**HOTS: Replace 66kV Feeder Prot (HSM1Y, HSM2Y, STL1, STL2)**	50	300	350	-	
XCAA	**Replace PLCs on Network Control Schemes (DBUSS, VFRB, BARBS)**	-	-	800	800	
XCAN	**Replace Cap Bank & Reactor M40 PLC AVC Controls**		300	300	300	
XCAP	**Replace Cap Bank & Reactor T2E PLC AVC Controls**		300	300	300	
XCAQ	**Replace CB PLC controls (500 PLCs)**	-	1,125	1,125	1,125	
XCAR	**Replace Energy Metering (600 Meters)**	-	-	-	1,200	
XCAS	**Replace Load Shedding (24 Stations)**	-	-	-	1,200	
XCAT	**Replace Weather Stations at Terminal Stations (22 Terminal Stations)**	-	-	-	2,200	
XCCH	**Battery upgrade and replacement program 2014**	1,900	467	-	-	-
XCCJ	**Battery upgrade and replacement program Phase 2**	-	-	697	697	
	Protection & control ongoing program				5,800	16,632
	COMMUNICATIONS					
XC95	**Replace ADSS FBTS-Mary St. (Cable 926)**	680	-	-	-	-
XC96	**Replace ADSS HTS-MTS (909)**	680	-	-	-	-
XCAY	**KGTS-WETS OPGW**	-	-	5,220	5,220	
XCB4	**HYTS-SESS Communications Link**	1,215	1,215	-	-	-
XCB6	**BETS-KGTS Radio Link**		3,112	-	-	
XCBQ	**Next Generation Network Phase 1**	540	-	-	-	-
XCBR	**Next Generation Network Phase 2**		1,363	-	-	-
XCBS	**Next Generation Network Phase 3**		2,044	-	-	
XCBT	**Next Generation Network Phase 5**	-	-	-	890	
XCBU	**OTN Replacement**	-	1,716	1,352	-	
XCBV	**CEOT Console System Replacement**	-	260	-	-	
XCBW	**TMR Replacement/Upgrade**	-	-	164	164	
XCBZ	**Hardened (Engineering) Servers Replacement Program**	-	-	315	-	
XCC0	**Rugged Switch/Router Replacement**	-	-	-	284	
XCC4	**Integrate Communications Assets into GIS**	490	-	-	-	-
XCCC	**External Diesel Gen. Connectivity at Radio sites**	-	195	-	-	
XCCD	**Upgrade Radio tower fall arrest systems**	970	435	-	-	-
XCCE	**Radio site earthing**	195	-	-	-	
XCCF	**Replacement of Air Cons at Communications Sites Phase 1**	-	-	-	-	
XCCG	**Replacement of Air Cons at Communications Sites Phase 2**	-	-	318	318	
XCCX	**IED Cyber Security**		446	-	-	-
XD03	**Next Generation Network Phase 4**	-	-	1,780	890	
	Communications projects - ongoing program			3,402	4,644	14,256
	NCIPAP					
XD05	**Network Capability Incentive Parameter Action Plan (NCIPAP)**	3,380	779	-	-	-
Total		**128,004**	**118,899**	**113,491**	**119,345**	**134,501**
	Minor projects, Overheads & Unscoped Projects	23,196	37,301	35,309	48,955	53,599
Transmission Company Initiated		**151,200**	**156,200**	**148,800**	**168,300**	**188,100**

Appendix 4 – Asset Management Policy

The Asset Management Plan is central to the delivery of network services to customers safely and reliably in accordance with AusNet Services' Asset Management Policy, which is shown in the following figure.

AusNet services

Provide our customers with superior network and energy solutions

This policy directs the content and implementation of asset management strategies, objectives and plans for AusNet Services' energy delivery networks. It guides employees, contractors, suppliers and delegates in each asset management decision.

Sound risk management and the continuous improvement practices of our integrated safety, health, environment, quality and asset management systems will manage the complete life cycle of network assets.

- Hazards and risks to the safety of any person and their property will be minimised *"so far as is practicable".*
- *Provide consumers with information, tools and service options* to facilitate their energy choices.
- *Effective consultation with stakeholders* to comprehend and integrate their requirements in asset management decisions.
- The specification and application of assets will *comply with legislation, regulation, Australian Standards and industry codes.*
- The *national energy laws, rules and their fundamental price, performance and security principles* will guide service development in the interests of customers.
- *Innovation and technology will be embraced* to economically reduce service risks, increase service value and manage service performance commensurate with customer's emerging needs.
- *Skilled people will be developed and deployed* to sustainably manage risks, increase the value of services and improve the range of services.
- Energy network development will *balance the environmental, economic, and social needs of today without sacrificing the interests of future generations.*
- Practices, systems and facilities will *continuously improve commensurate with certification to a recognised asset management standard.*

Nino Ficca
Managing Director
17 April 2013

missionzero