United Energy
Asset Management Plan 2016 - 2025

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Network Asset Management

United Energy

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UE Asset Management Plan

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1. Introduction

United Energy (UE) owns and operates the electricity distribution network serving over 660,000 residential, commercial and industrial customers in Melbourne's south eastern suburbs and the Mornington Peninsula.

As the owner and operator of the network, UE is responsible for managing the electricity assets to ensure their value is optimised for all stakeholders sustainably, over the long term. UE stakeholders have many and varied interests, and UE is responsible for balancing these interests by making the appropriate trade-off decisions on a short and longer term basis.

The purpose of this Asset Management Plan is to outline the capital and operational expenditure requirements for the ten year period 2016 – 2025. The Asset Management Plan describes key asset management drivers that determine the required capital investment and operating expenditure.

The Asset Management Plan is a key deliverable of the UE Asset Management system that has been implemented to integrate the systems, policies, strategies, plans, standards and processes by which United Energy manage the assets forming its electricity network. The AMS is displayed in the section 2.2. Refer to UE PR 2900 Asset Management System Definition for more details.

The Asset Management Plan sets out the level of investment required to deliver the Asset Management Strategy and Objectives. Refer to UE PO 2050 AM Strategy and Objectives and the individual Asset and Non-Asset Class Strategies and Plans (refer to Appendix C).

2. Asset Management Framework

2.1. Asset Management objectives

United Energy is committed to the efficient and safe delivery of reliable services to customers. Efficient and effective management of United Energy's electricity network assets is critical to achieving this outcome.

United Energy has an asset management framework in place, which aims to:

- ensure the prudent, efficient and reliable delivery of electricity that meets customers' and stakeholders' needs;
- ensure the safety of the public and United Energy's personnel and contractors at all times;
- ensure that all compliance obligations are met; and
- manage risk efficiently.

2.2. Overview of the framework

United Energy's asset management framework provides an integrated and structured approach to guide the development, coordination and execution of asset creation and maintenance activities to optimise the lifecycle costs, risk and performance of United Energy's network assets. The framework provides a conduit for the execution of United Energy's corporate plan. It provides clear line-of-sight between the delivery of asset management projects and activities, and the overarching corporate objectives (detailed in UE PR 2051).

The asset management framework translates United Energy's corporate plan into specific asset management objectives and actions. It employs a systematic approach - including processes and documented asset strategies and plans – to ensure that the asset management objectives and actions deliver prudent and efficient outcomes over the asset life cycle. The framework ensures the alignment of asset management activities with all other related management processes, including United Energy's risk management, health and safety, environmental and quality management systems.

The framework is shown in the diagram on the following page. The diagram shows how this Life Cycle Management Plan fits into the overall asset management framework governed by United Energy's corporate strategy. A detailed description of the framework is provided in UE PR 2900 Asset Management System Definitions.

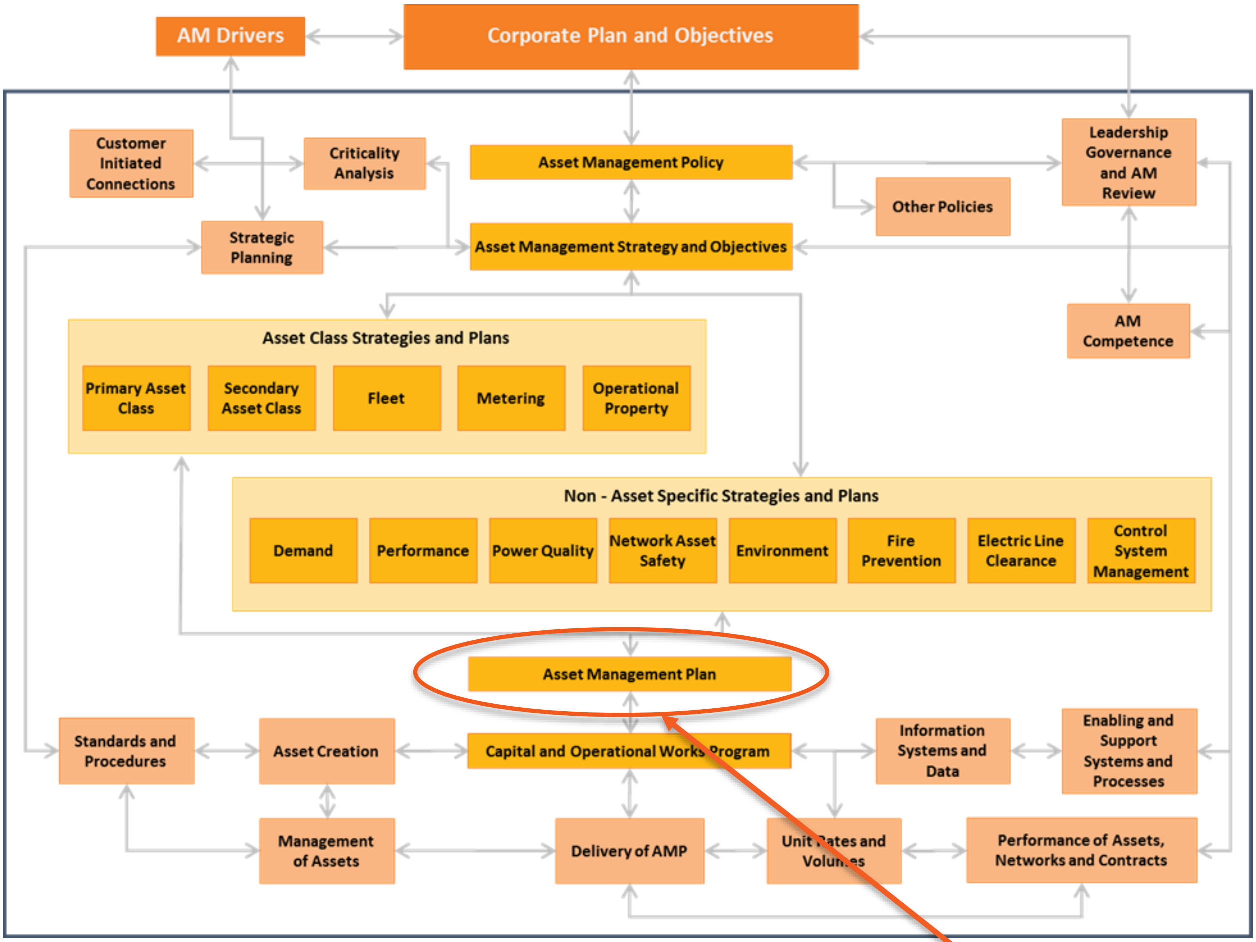


Figure 1: Asset management Framework

This is the Asset Management Plan

2.3. Asset management drivers

United Energy's asset management plans are driven by the Asset Management Strategy and Objectives, which in turn reflects the objectives set out in United Energy Asset Management Policy (UE PO 2001), which was promulgated by the Chief Executive Officer in December 2014. The Asset Management Policy identifies the following principles as the basis for all asset management expenditure:

- Safety
- Risk
- Performance
- Legal & regulatory
- Customer Service
- Continuous improvement & innovation
- Good asset management
- Adherence to relevant Australian & International standards
- Minimise of long-term cost structure
- Reputation
- Skills and Resources

2.4. Alignment with good asset management practice

United Energy's asset management framework has been developed based on good practice guidance from internationally recognised sources, including the Global Forum on Maintenance and Asset Management (GFMAM) and the Institute of Asset Management (IAM).

In January 2014, ISO 55001 was released by the International Organisation for Standardisation as the new international standard for asset management systems. United Energy's asset management framework now aligns with key elements of ISO 55001. Aligning United Energy's asset management system with key requirements of ISO 55001 provides all stakeholders with a high level of confidence that risks and costs associated with the management of assets are carefully considered and optimised.

3. Executive Summary

The Asset Management Plan incorporates UE's asset management strategies and objectives together with Asset Class and Non Asset Class Strategies and Plans which detail its intentions relating to network reliability, capacity, security and quality of supply to develop the 10 year Capex investment and 5 year Operating expenditure required.

UE's capital investment will focus on the lowest cost solutions by:

- Replacing assets at or nearing end of life with the objective of minimising total life cycle costs;
- Deferring capex through targeted refurbishment, condition monitoring and risk management initiatives;
- Improving reliability outcomes for those customers in our worst served areas; and
- Pursuing alternative to traditional investment in network capacity to meet growth in peak demand where it is economically prudent to do so

Each capital category is driven by a range of factors and these expenditure forecasts have been developed by UE after detailed and rigorous analysis of a range of both internal and external data sources. Internal inputs come from various asset information systems, including data collected by the field services teams from their asset inspections (both visual and measured). External data sources include economic growth, regulatory changes and technical developments.

In addition to capital expenditure, our asset management plans include operating expenditure activities that seek to minimise total life cycle costs. For example, we will improve inspection practices where it is economic to do so in order to facilitate better targeting of replacement Capex. For further information on optimising our total expenditure it is provided in the Life Cycle Strategies for each asset class.

As with all long-term forecasting activities however, there are risks that internal or external assumptions may be incorrect, and UE's forecast Capex or Opex will need adjusting. This could include changes in the regulatory or political environment, swings in customer demand for electricity, or an unexpected deterioration in the network performance. These risks are reviewed regularly as part of UE's risk management framework and, where necessary, adjustments are made to help manage those risks going forward.

4. Background Information

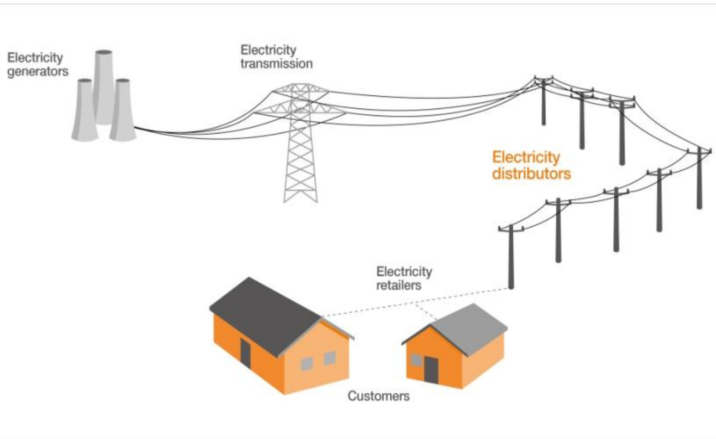
4.1. Overview of United Energy Network

We distribute electricity to more than 660,000 customers across east and south-east Melbourne and the Mornington Peninsula over an area of 1,472 square kilometres. The distribution network we construct, operate and maintain transforms electricity from sub-transmission voltages to distribution voltages for supply to our customers. Currently, our distribution network comprises 47 zone substations, approximately 214,000 poles, 13,200 distribution substations, 10,200 kilometres of overhead power lines and 2,600 kilometres of underground cables.

Ninety per cent of our customers are residential:

- The northern part of our service area is a developed urban region in metropolitan Melbourne, comprising predominantly residential and commercial centres such as Box Hill, Caulfield, Doncaster and Glen Waverley, and light industrial centres such as Braeside, Clayton, Heatherton, Mulgrave and Scoresby.
- The central part of our service area is a mix of developed and undeveloped land and includes the industrial and commercial centre of Dandenong, which is Victoria's manufacturing heartland in the south-east of Melbourne. Dandenong and the adjacent suburb of Keysborough is our largest growth area for new residential and industrial development.
- The southern part of our service area comprises Frankston and the Mornington Peninsula. Frankston is one of the largest retail areas outside the Melbourne CBD. The Mornington Peninsula has a large retirement population and significant holiday use with a coastal boundary of over 190 kilometres.

Although our service area is geographically small (about one percent of Victoria's land area), it accounts for around one quarter of Victoria's population and one fifth of Victoria's electricity maximum demand.



As a business, we have come a long way since the State Electricity Commission of Victoria was privatised in 1994 and the Victorian Government established Victoria's current electricity industry structure and a new regulatory framework. United Energy Limited was formed originally as a distributer and retailer, but sold its last interest in the electricity retail business in 2002. In 2003, we were restructured and delisted from the Australian Stock Exchange. United Energy Distribution Holdings Pty Ltd was established as a new holding company, with DUET holding 66 per cent equity and Alinta Ltd holding the remaining shares. The majority of our operations were outsourced to Alinta Asset Management, which in turn was purchased by Singapore Power in 2007. DUET continues to hold majority (66 per cent) ownership with the remaining 34 per cent owned by SGSP (Australia) Assets Pty Ltd (SGSPAA).

DUET is a large Australian infrastructure specialist fund and SGSPAA is a joint venture between the Singapore-based Singapore Power Limited (SP) and the Chinese-backed State Grid Corporation of China (SG). We do not generate electricity or sell it to customers. Rather, electricity is produced by generators in the National Electricity Market and is transported (in most part) through the transmission network into our distribution network.

Since the restructuring and disaggregation of the electricity industry in the early 1990s, retailers have acted as the custodians of the customer relationship, with distribution being part of the supply chain but not highly visible to customers. However, this model is changing, as customers become more engaged and proactive in relation to energy supply and consumption, including with our business and the services we deliver. Technology is also playing an important role by increasing the range of services we can offer to our customers.

4.1.1. Assets Covered

Table 1: UE network parameters

Network Parameters	Statistics
Geographic area	1,472km2
Consumer density	448 per km2
Small customer connections (CY2014)	603,075
Medium customer connections(CY2014)	53,320
Large customer connections(CY2014)	3,301
Total energy distributed (CY2014)	7,696 GWh
Overhead distribution lines(CY2014)	10,232 km
Underground distribution cables(CY2014)	2,717 km
Maximum demand (FY2014)	2,066 MW
Regulated asset base (“RAB”)	~ A$2B

Table 2: Distribution and sub-transmission network major assets

Data (CY 2014)	Totals
LV Lines (km)	5832
LV Cables (km)	1715
HV Lines (km)	4253
HV Cables (km)	1023
Switches (count)	10961
Substations (count)	11834
Poles (count)	203622
Feeders (count)	436

Table 3: UE asset replacement profile

Asset Category	Average Design Life (Weighted by Cost)	Average Age (Weighted by Cost)
Poles	73.42	34.81
Pole top structures	43.12	23.28
Conductor	59.12	40.97
Public lighting	20.00	19.53
Distribution transformers	52.87	20.27
Underground cable	46.67	20.98
Communications	30.44	15.13
Zone substation	47.63	34.57
Protection	38.03	24.60
Distribution switchgear	45.00	10.40
Services	73.42	34.81

4.2. Capex and Opex Forecasting and the Works Program

The Asset Management Plan sources information from Asset and Non-Asset Class Strategies and Plans to enable Capex and Opex forecasting to take place.

The Asset Management Plan provides context and justification for the annual Capex and Opex Works program (COWP) that is derived from the Capex and Opex forecasts.

The COWP details specific planned investments in the network, and once approved is used as an input into project planning and delivery.

When developing the Works Program, projects are sequenced in such a way that they are targeted for completion at a time when they will deliver the best outcomes for the business and its customers and comprise:

- Programmed asset replacement projects scheduled to be performed in accordance with replacement policies and as close to, but before, in-service failure.
- Demand projects which are completed to ensure that sufficient network capacity is in place to meet forecast loads immediately prior to the critical summer loading period.

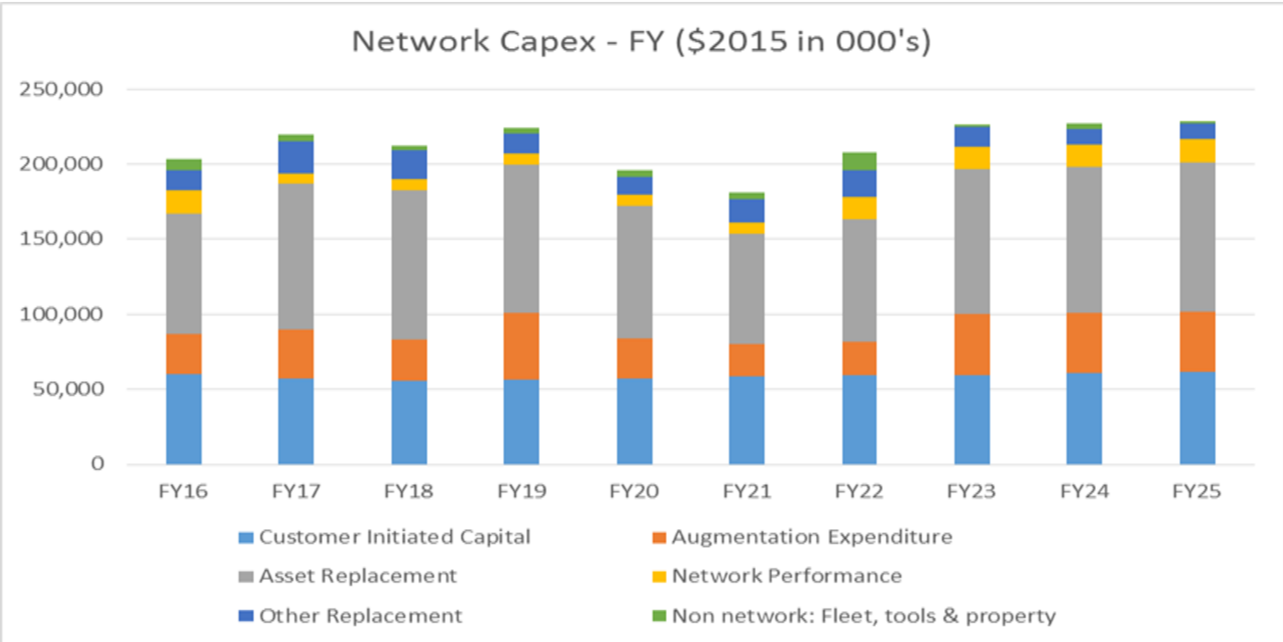
5. Expenditure Plan: Capital Expenditure

For the period FY 2016 - 2025, UE is forecasting to spend $2.1B (Real $2015) in Capex across the distribution network. Capex is broken up into the following categories:

- Connections (Customer Initiated Capital) covers all new connections to residential premises, most new connections to commercial and industrial premises, and any other modification work requested by customers.
- Augmentation (demand) capital refers to new capital investment that expands the network's capacity to deliver electricity.
- Replacement capital refers to the replacement of assets (aged or faulty) in the UE network where it is economic to do so. This includes network performance capital that improves any aspect of the performance of the network including reliability, risk and safety.
- General capital refers to all non-network assets owned by UE but related to the operation of the network. This includes the telecommunications network that sits atop the network, as well as depots and major equipment, such as fleet, however it excludes IT, AMI and accommodation.

Each Capex category is driven by a different set of economic, network, customer or regulatory drivers. In addition, the flexibility UE has to manage and adjust the spend profile varies from category to category. These drivers, and UE's opportunities and levers to manage spend, are discussed below.

Figure 2: Total Capex (Real $2015)



$2015	FY16 $M	FY17 $M	FY18 $M	FY19 $M	FY20 $M	FY21 $M	FY22 $M	FY23 $M	FY24 $M	FY25 $M	Total $M
Network Capex (excluding IT, AMI & accommodation)	203.4	219.9	212.3	224.1	196.2	181.5	208.2	226.5	227.2	228.6	2,127.9

Note: the figures above exclude escalators

Capex spend in FY16 $203.4M (Real $2015) is expected to remain similiar to FY15 $204.2M, before increasing to $219.7M (Real $2015) in FY17. The largest increase will be in replacement Capex as more equipment reaches end of life. This will also contribute to delivering the expected regulator SAIDI target of 68 minutes in the next regulatory period (CY2016 – 2020), being a reduction of 10 minutes on our 2014 SAIDI performance of 78 minutes.

5.1. Connections (Customer Initiated Capital)

CIC is forecast to represent ~30% of UE's Capex in FY16. CIC volumes are driven entirely by customer related requests for connections (or other network augmentation). Requests are beyond UE's control and volumes are closely linked to construction activity – residential, commercial and industrial – and a customer's need to have a new premise connected to the electricity grid. Under its AEMC obligations, UE is required to complete all CIC projects within certain timeframes, and so has little scope to manage and adjust volumes.

Forecasts for CIC volumes are relatively reliable in the short-term as they are linked to construction activity – a forecast which UE tracks by monitoring construction indices, such as building approvals, from various market bodies. This helps build a high level of accuracy into the Works Program. Over the longer-term however, forecasts are more uncertain. While UE again leverages market indices and forecasts to estimate the required investment, the spend profile is subject to the swings and fluctuations of the economic environment and construction activity. Building in this uncertainty is a critical part of the long-term asset management planning process.

CIC can be broken into two broad sub-categories:

- Commercial and Industrial CIC consists of approximately 80% (value weighted) of all work and is driven by the level of commercial, industrial and infrastructure development across the network. Examples include Peninsula Link – Frankston Bypass, Box Hill Hospital redevelopment, and the ANZ Data Centre expansion in Notting Hill. Smaller projects include connection of small businesses, newly developed factories etc. Construction of roads and various other infrastructure projects is expected to continue albeit at a growth rate slightly lower than the State's GDP growth (~2-3%). Given this, UE expects Commercial & Industrial CIC volumes to remain stable over the next 10 years.
- Residential CIC consists of approximately 20% (value weighted) of all work and is driven by the level of residential activity in the network. Residential activity typically involves connecting underground or overhead services to residential housing. Residential CIC volumes can experience a high level of volatility, similar to the housing market. Volumes crashed significantly in 2009 during the GFC, and then recovered quickly in 2010 when the stimulus package was announced. UE expects Residential CIC volumes to grow at 2% per annum from 2016-2025 – closely aligned with the overall state population growth of 1.5-2.0%.

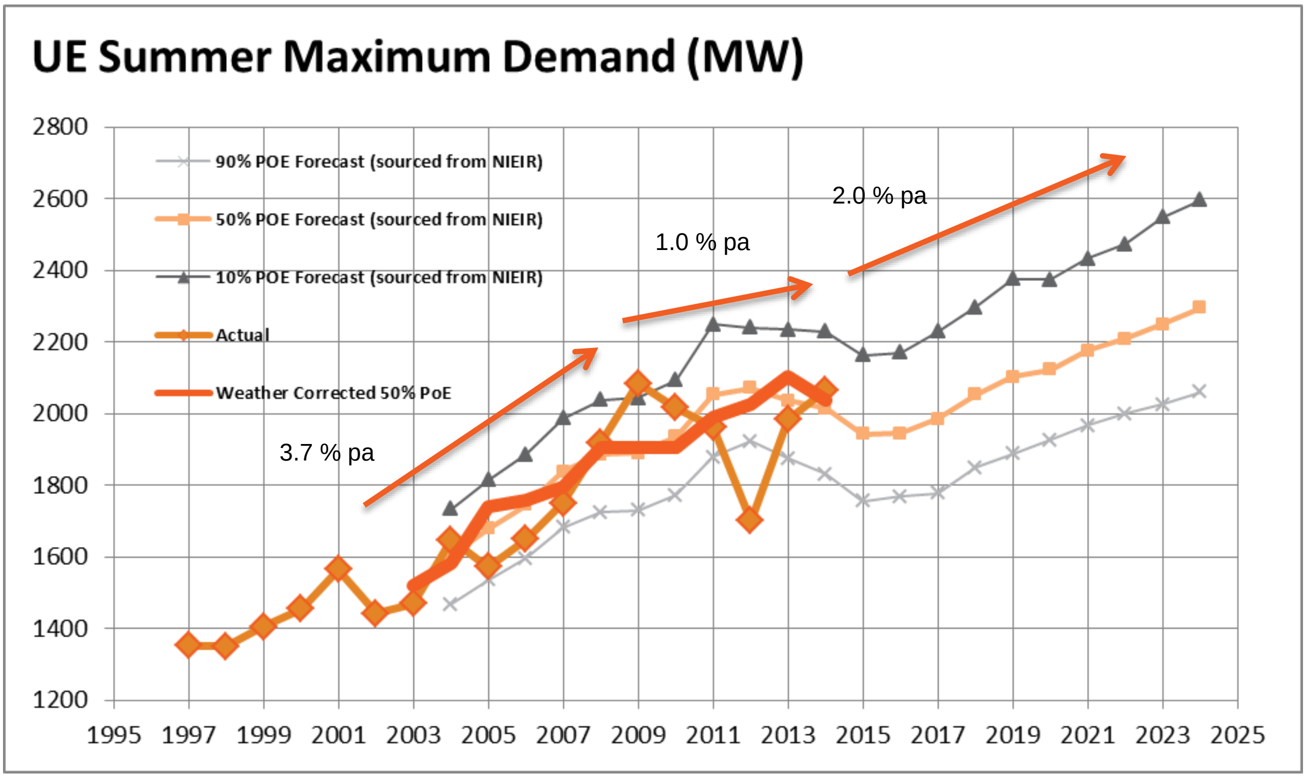
5.2. Augmentation (Demand)

Demand Capex is investment into the network to increase its overall capacity to deliver electricity through the distribution network. This could include capacity increases to any parts of the network highlighted in Figure 2. Overall demand Capex is forecast to be relatively stable at 13% of total Capex in FY16, and fluctuating between to 12% and 18% of total Capex over the next ten years

The capital required is driven by the level of "peak" electricity used across the network at any point in time. Peak demand is driven by economic growth, changes in usage behaviour and weather factors, hence is highly variable. UE forecasts underlying demand based on economic growth and usage behaviour – but not weather. This is achieved by undertaking a weather correction of its actual maximum demand to a 10% PoE and then calculates forecast maximum demands based on defined 10% PoE ambient temperature conditions to observe underlying growth trends.

Peak demand growth over the last 15 years has been primarily driven by economic growth and the uptake of air-conditioning. Growth is expected to continue over the next decade at an estimated 2.0% per annum. In recent times growth has been slower because of a slowing economy, higher electricity prices, energy efficiency initiatives and the increasing penetration of solar panels. There are a range of risks that impact the accuracy of the long-term forecasts, i.e. uncertainty in the growth of self-generation assets like solar panels, demand management schemes, and electric vehicle uptake rates. These risks are discussed further in Section 7.

Figure 3: Peak Demand At May 2014



Demand Capex requirements tend to be lumpy given the nature of demand with significant variations experienced over the period 2008 to 2012. As such new investments have a level of flexibility associated with them and UE has the capability to flex its investment spend over several years to manage within any capital constraints. On one hand, delaying demand Capex reduces the capital requirements of the business in the short-term, however it will mean existing network assets are more heavily utilised and likely to have a shorter life span, potentially leading to higher costs in the long-term.

While average growth is forecasted at 2.0% pa, investment requirements will differ across the network, and planning needs to be done at a more granular level by asset class and geographic area. At present, demand planning is done at the zone substation and feeder level with measured data, but as improvements in network information systems such as the AMI data is captured in the process, demand planning will be able to be done at a distribution transformer and customer premises level from measured data. UE will be able to pinpoint underutilised distribution transformers and this will enable us to operate our network more effectively by increasing the use of all assets and better planning investments to address specific bottlenecks.

5.3. Replacement

Replacement capital is the investment needed to maintain the existing network so that it performs in a manner acceptable to our stakeholders in terms of both reliability, as well as safety. Replacement Capex (forecast at 54% of total Capex in FY16) is driven primarily by the need to economically replace ageing infrastructure, as well as to replace assets that fail to comply with safety requirements. The required investment is driven by a range of factors, including: the level of network faults and emergencies, the age and condition of the network, asset replacement policies, environmental & safety policies; bushfire and vegetation policies; and, others. Replacement Capex can be categorised into three main areas of expenditure: Asset Replacement, Network Performance and Other Replacement.

5.3.1. Asset Replacement

Asset replacement is driven by asset condition and economics. Replacement on failure of the asset is non-discretionary. Following an inspection where deterioration is evident, timing of the replacement has some limited timing discretion depending on the level of deterioration. Replacement on condition and risk assessment is somewhat discretionary on timing, with deferral of replacement increasing the likelihood of failure. Asset Replacement Capex is forecast at $80m for FY16 (39% of UE's total Capex investment). This is expected to rise to $97m in FY17 and to $100m in FY18 with the natural ageing of assets, as larger volumes of asset reach their end of life. The value of replacement then stabilises over the remaining ten year period.

Asset replacement long term forecasts are driven by the age of the network and the expected life of the assets in order to develop the asset replacement profile. As assets mature, UE draws on asset condition data in order to refine its forecasts, and also to feed into and update its model on the life expectancy of the various assets.

While forecasts are based on an assets life expectancy, actual replacement work is carried out based on an asset's observed condition and UE's asset replacement policies. This is based on asset condition data derived from asset inspections carried out by the field service teams. For some assets, e.g. wooden poles and zone substations, asset conditions are measured and analysed against quantitative criteria (e.g. wood thickness for poles). For most other assets though, inspections are visual against a maintenance index, which calibrates the risk-adjusted cost of failure, based on likelihood and cost, including STPIS, by asset category and position in the network. Assessments are then made as to whether or not to replace the asset based on its observed condition when reviewed against maintenance, health and safety, and other policies. This determines the actual Capex investment.

In the future, UE is expecting asset conditions to deteriorate as even more assets reach their life expectancy over the next 10 years – this will drive replacement Capex higher than historical levels. This step up in replacement costs is largely reflective of the growth in the network throughout the 1960s. During this period, pole top structures were first included in the network design and these, with a life expectancy of 45 years, are starting to need replacement. In addition, a large number of zone substations were built in the 1960s to support the network growth and the transformers, high voltage buses, and circuit breakers that are part of the zone substation all have a typical life expectancy of 45 to 55 years. It is primarily these two assets that are driving the immediate step up in replacement Capex.

Over the long-run, UE can forecast asset replacement requirements with reasonable certainty – a certain proportion of the network will always need to be replaced each year. However, UE can exercise some discretion and defer the replacement of assets in the short-term as it can either try to extend their life or take on more risk that the assets fail prematurely. Projects can only be deferred for a limited period however, as soon after that the cost of the risk of failure starts to exceed projected carrying costs, thus making it uneconomical to defer longer. Given the ageing of the network, and the growing replacement Capex, better data sources can help ensure more rigorous analysis on the asset replacement program to help optimise asset replacement timing.

5.3.2. Other Replacement

Drivers of 'Other' Replacement include safety, security, environmental and power quality performance. This category also comprises network operational technologies and network performance capex to maintain reliability. While timing on these projects can be optimised, there are some instances where UE may have very little option to defer expenditure as compliance is a government requirement and failure to invest may attract significant compliance penalties – for example, when bushfire management policies were recently introduced.

'Other' replacement capex is forecast at $28m in FY16 (14% of total capex). In the remaining ten year period this investment will vary between 9% and 16% of total capex over the period, fluctuating with the timing of safety related programs.

5.3.3. Safety

The safety improvements are primarily driven by improvements in bushfire areas. An example is the installation of Rapid Earth Fault Current Limiters (REFCLs) to limit the probability of a fire starting should a network fault occur. Together the safety components from both replacement and other Capex contribute to the required capex investments needed to comply with the Electricity Safety Management Scheme.

5.3.4. Network Performance (Reliability Maintained)

Network Performance capex is primarily investment to address network performance. It is often expenditure on new assets to increase the resilience of the network events. An example is remote controlled gas switches (RCGS's) which allow the faulted section of the network to be isolated remotely and customers on the non-faulted sections to have their supply restored quickly. Network performance capital of this nature is discretionary.

Network Performance Capex is forecast at $15m in FY16 (about 8% of UE's total Capex investment). This is expected to decrease significantly in FY17, reducing to $7M (3% of total Capex) over the next five years.

5.3.5. Environmental

Environmental legislation drives further investment into the network to mitigate potential environmental risks such as sound pollution, oil containment and public safety. UE currently has a broad range of environmental management and mitigation measures in place that are embedded in business as usual processes to manage and prevent environmental risks. These measures drive a program of work that has been incorporated into the forecasted asset replacement program.

Environmental projects within this program are:-

- Noise reduction works at zone substations, particularly for transformers;
- Bunding works to contain oil at zone substations; and
- Asbestos removal from zone substation buildings.

UE's strategies are also in line with the requirements of its Environmental Management Systems (EMS) which is aligned to the international standard for Environmental Management Systems (ISO 14001).

5.3.6. Power Quality

The projects and initiatives under Power Quality (PQ) by UE address PQ regulatory compliance requirements. These requirements include obligations to measure network power quality and to correct power quality where it is not within codified limits. Data captured by the power quality monitoring system can also be used to provide crucial information for network fault investigations, allowing UE to make better decisions about corrective actions and investment options on the network.

A significant proportion of the population of PQ meters were installed around 10-15 years ago when it first became a regulatory requirement to monitor and report on network quality of supply. With a nominal lifespan of 15 years, many meters are now approaching end of life and are being replaced.

5.3.7. Operational Technologies

UE intends to continue to develop and invest in technology to allow us to better anticipate imminent asset failures and respond to major outage events more effectively, included in the other replacement forecast is a variety of projects under the Operational Technology heading. These are projects that introduce new technologies to deliver further benefits to customers and maintain network performance. The benefits of investment in these new technologies will include: increased asset life, early detection of abnormal behaviour to ultimately reduce customer costs and provide a more secure and robust network.

Operational technology investment provides for activities such as fault location and identification, asset condition monitoring and continuous testing of the integrity of service supply neutral connections. These activities support programs for maintaining reliability – in fact, our replacement capital expenditure plans depend on the support from new technology to deliver the target reliability outcomes.

The range of operational technology projects proposed include:

- New ways to monitor our HV equipment to better predict and prevent their failure.
- Survey the condition of our poles and wires using Lidar. This will both give us a true understanding of the state of our assets and help us identify where safe clearance is not meeting the current standards.
- Providing security to our network communication systems. This will mitigate the risk of cyber-attacks on our network systems.
- Better ways to collect and analyse data. This will allow us to make better use of our network data so that better, more informed decisions can be made.
- New ways to make use of our AMI communications. This is about providing communication systems for the network at the lowest cost.
- New ways to making use of our smart meters. We would like to make use of the intelligence in our smart meters to provide a better, safer service to our customers
- New ways to test our smart meters. This project is about providing efficiency in testing the changes that will occur over time with our smart meter software.

5.4. Non Network: Fleet, tools & property

Non network capital investment refers to any Capex not related directly to the electricity network. This includes fleet and tools to support the field service teams, as well as UE's property portfolio. Non network Capex is forecast at $7M in FY16, and represents about 4% of UE's total Capex investment.

General capital investment increased sharply during the period 2009-13 before declining in 2014. The primary driver of this was the need to replace various trucks and vehicles in UE's fleet and to purchase additional vehicles for service providers to use under the regional contracting model. In addition, substantial investment was put into the relocation of the primary and secondary NCCs.

Additional fleet will be purchased to increase the overall level of fleet ownership to 85% of UE's total requirements, with the majority of these purchases occurring in 2016. Going forward spend in this category is expected to decrease to 2 – 3% over the next five years. Key elements of the general Capex investment going forward include:

- Property projects: primarily land acquisitions for future zone substations
- Fleet, being motor vehicles, specialist truck and other mobile plant
- Miscellaneous tools and equipment

5.5. Prudent Holistic Approach to Maintaining Network Reliability

In terms of performance outcomes for customers, maintaining reliability is a significant driver in the forthcoming regulatory period. As shown in Figure 4 and Table 4 below, our current network reliability is following a deteriorating trend. This is important background given our regulatory obligation to 'maintain reliability'.

Figure 4: Network Reliability Performance 2006-2014

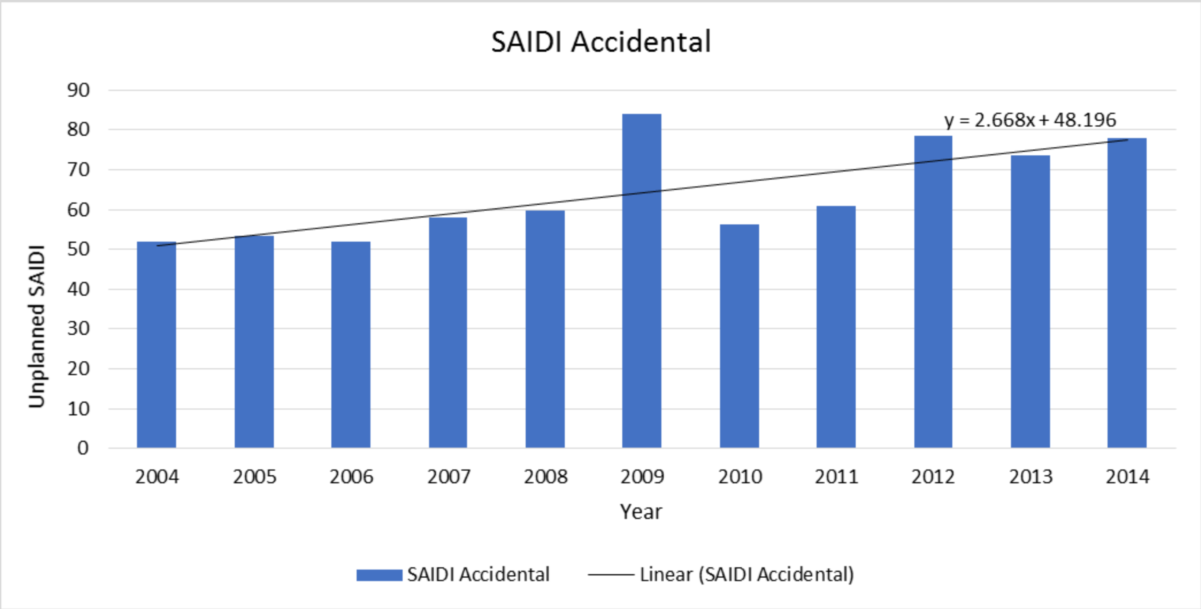
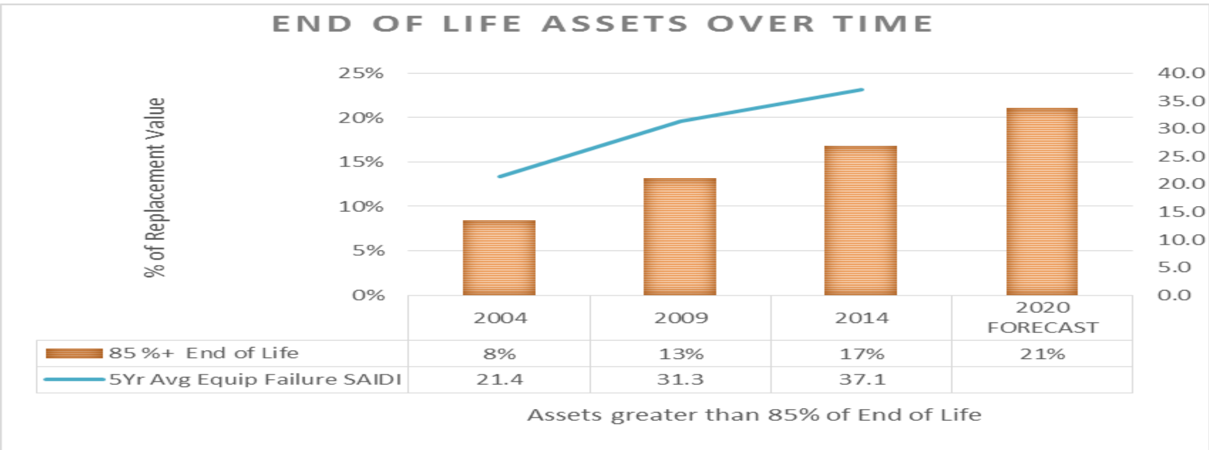


Table 4: Table Reliability performance 2006-2014

	2006	2007	2008	2009	2010	2011	2012	2013	2014
SAIDI unplanned[1]	52	58	60	84	58	61	79	74	78
SAIFI	0.94	101	1.00	1.23	0.95	0.96	1.09	1.02	1.01
MAIFI	1.17	1.09	1.17	1.18	0.98	1.08	1.17	1.31	1.13

Figure 5: End of life assets over time

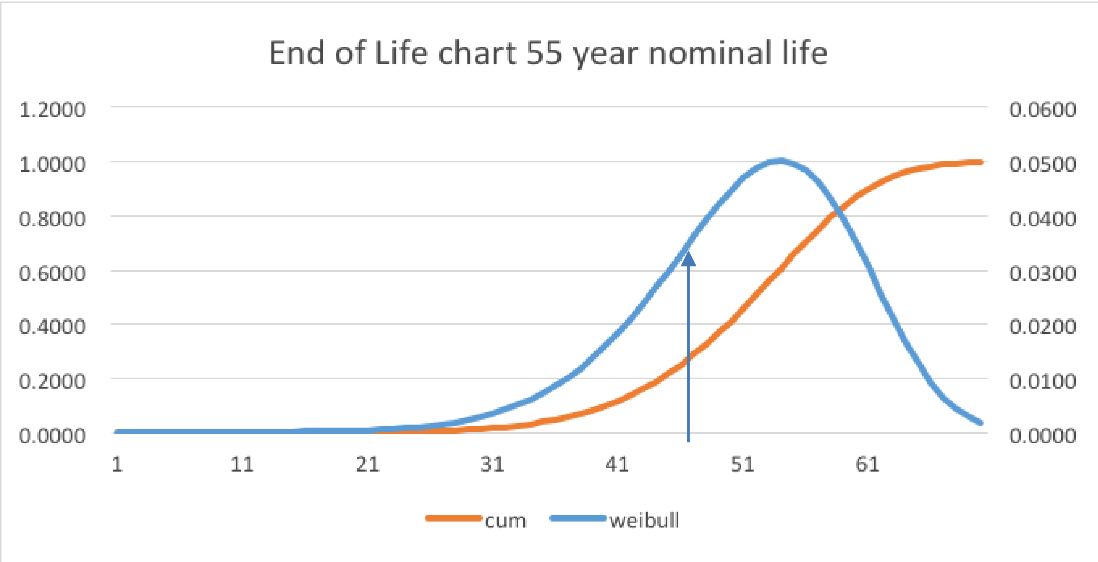


[1] All metric based on the current MED exemption regime

Figure 5 shows a strong correlation between the percentage of assets beyond 85 per cent of their asset life and the contribution to SAIDI from equipment failure. The figure predicts that by 2020, 21 per cent of our assets will fall within this age category, with the consequence that SAIDI will increase significantly as a result of equipment failure.

The relationship between asset age and the probability of asset failure is well known. It is reflected in the Weibull probability density function, which depicts the distribution of failure rates for a particular asset class. Figure 6 shows the Weibull probability density function for an asset an expected life of 55 years. It indicates that approximately 75 per cent of assets will still remain in service at 47 years (with 15 per cent of life remaining). At this age, however, the rate of failure (shown by the slope of the blue line) increases markedly, exposing customers to increased risk of deteriorating reliability performance through equipment failure.

Figure 6: Weibull distribution for asset with 55 year expected life

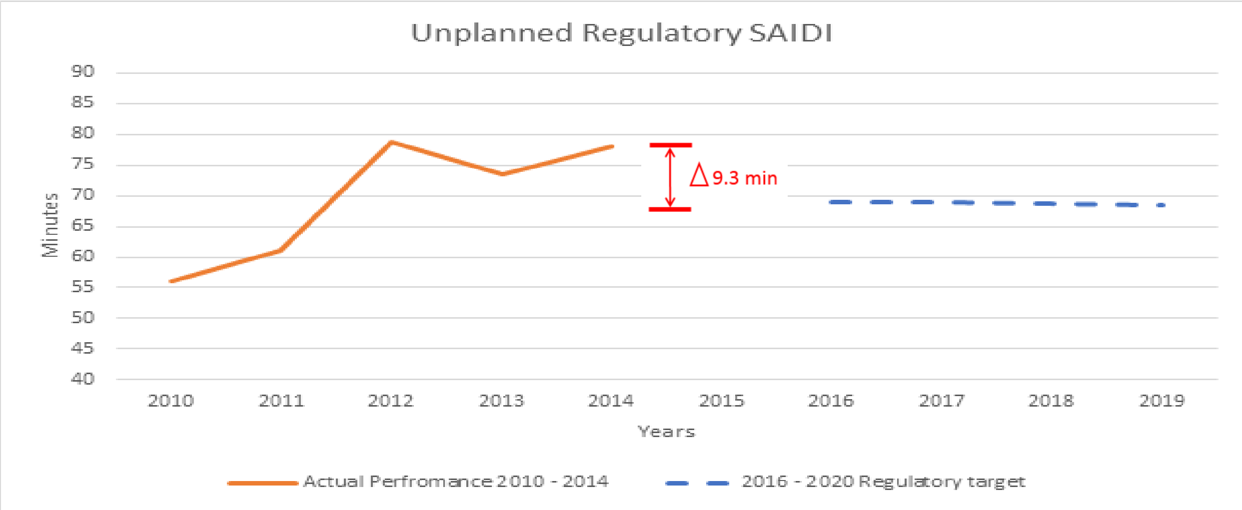


As already noted, the Rules and our customers expect us to maintain reliability for the regulatory period 2016 to 2020, as shown in Figure 7.

Figure 7 presents the target to maintain reliability in the next regulatory period, in the context of current network performance. Our target for the next regulatory period is based on our historical average performance over the past five years, and is estimated to average 68.7 minutes unplanned SAIDI for the period. Our performance for the last three years is well above this average, and was 78 minutes in 2014. Thus, to maintain reliability for the next regulatory period, we must return performance to our historic five year average, and close the gap from our current performance of nearly ten minutes.

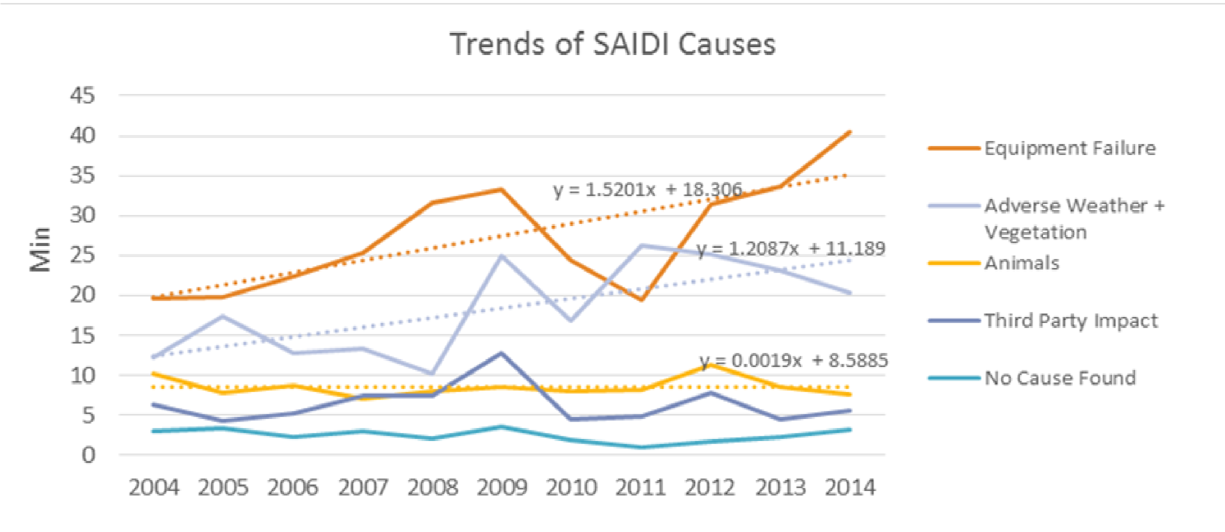
The purpose of this section is to provide a high-level explanation of how our expenditure plans combine to achieve the target of maintaining reliability at minimum life cycle costs. The first step in this process is to establish a path for returning future SAIDI performance to its historic average.

Figure 7: Historic SAIDI performance and proposed targets



In order to determine the most efficient way to achieve the target, we have assessed the SAIDI causes and their historical trends as shown in Figure 8.

Figure 8: Causes of deteriorating trend in SAIDI performance



In targeting those areas where current unplanned SAIDI can be reduced to arrest the decline in network performance, we have focused on areas and in programs where we can deliver significant impact at low cost. In this regard:

- Equipment failure is the largest cause and is increasing, driven by the increasing volume of assets approaching the latter stages of their lives. This clearly needs to be a focus.
- Adverse weather and vegetation management, the second largest source of unplanned SAIDI, cannot be significantly influenced in a cost effective manner because:
    - Vegetation management has already been enhanced recently following legislative change; and
    - It is comparatively expensive to upgrade networks beyond their original design criteria to reduce the impact of weather on network performance.

- Animals, third party and “no cause found” are all smaller sources that have not shown any significant trend increase, and whilst some initiative may be cost effective, the overall impact on network performance will be limited.

Given the above observations, it is appropriate for us to focus our efforts on addressing the contribution of equipment failure to unplanned SAIDI. In addition, programs that reduce unplanned SAIDI for all sources may also have a significant impact. In this regards, Table 5 shows at a high-level, the relative contribution that can be made by the different capex categories to meeting target network reliability.

Table 5: Contributions to maintaining network reliability

Capex category	Contribution to reliability
Connections	Nil – Connects new customers and load
Augmentation	Medium – Reduces risk of load-shedding and asset failure through over-loading
Replacement	Strong – Replaces assets at end of life. Includes specific programs to address network performance
Non Network - Information Technologies	Medium – provides enablers or a foundation from which to address network performance
Non Network – Fleet, Depots	Low – Provides enablers or a foundation from which to address network performance

In this context, UE has prepared expenditure plans for the forthcoming regulatory period that combine to maintain reliability. We adopt a prudent holistic approach, recognising that we must find smarter ways of meeting our regulatory obligation to maintain reliability and meet our customers’ expectations. The primary areas that contribute to this outcome are Replacement, Augmentation and ICT capex, as follows:

- Replacement capex
  - Increased level of replacement capital expenditure on assets at end of life.
  - Targeted network performance programs to reduce the frequency and impact of faults.
  - Operational technology initiatives such as disturbance recorders to anticipate and avoid major faults.
- Augmentation capex to ensure sufficient capacity is available at times of peak demand to avoid interruption of supply to customers, maintaining the contribution to unplanned SAIDI at current levels.
- ICT investment for initiatives that facilitate faster supply restoration, and an Asset Management System upgrade to improve the effectiveness of asset replacement decisions

Collectively the capital expenditure program is forecast to maintain reliability at an average of 68.7 minutes unplanned SAIDI over the next regulatory period, and potentially beyond.

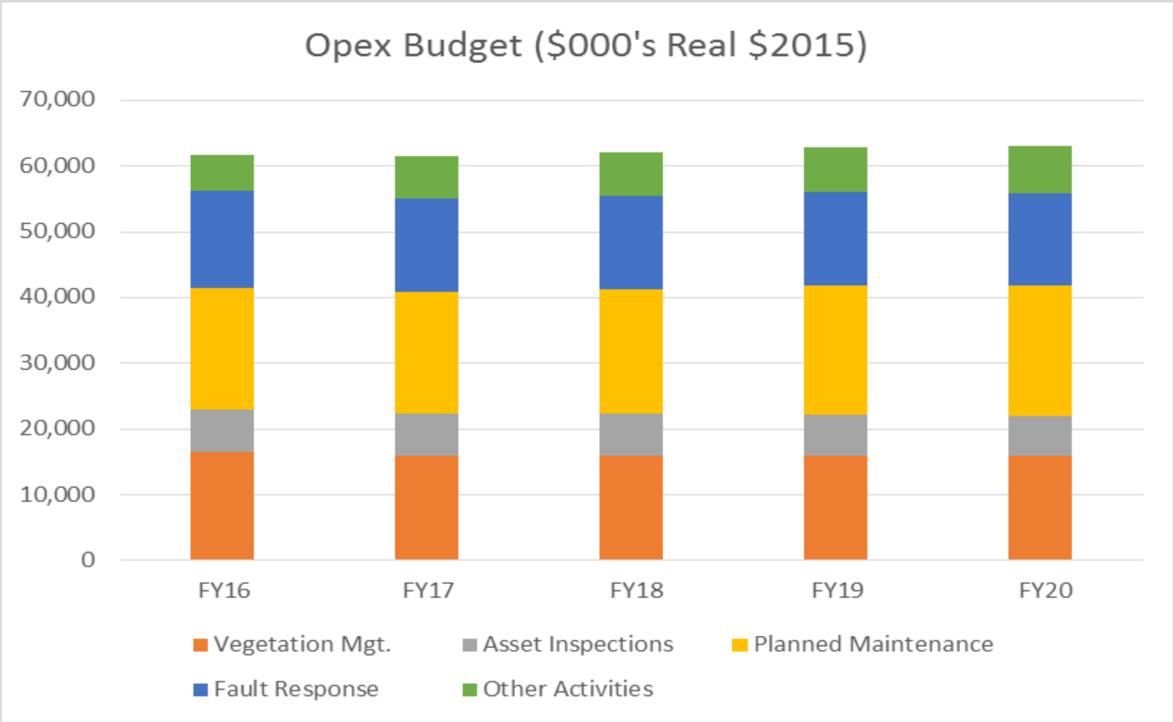
6. Expenditure Plan: Operating Expenditure

The capital expenditure program is supported by a program of asset maintenance – $61m in FY16 ($311m over FY16 – 20). These include maintenance expenditures required to operate or maintain the assets to achieve their original design economic lives and service potentials.

Operation and maintenance of the network consists of five primary activities:

- Vegetation management: UE has regulatory obligations to maintain regulated clearance around its overhead network through vegetation management. These obligations have recently changed as a result of the Victorian Bushfire Royal Commission's finding from its investigation in to the Black Saturday bushfires of 2009. The resulting changes have increased UE's compliance costs due to additional tree clearing and the removal of exemptions that were currently in place for a transition period. New regulatory and customer driven changes have been included in the forecast and form part of the EDPR submission 2016 – 2020 as opex step changes, these comprise:
    - A new regulatory obligation from 21 May 2015 to comply with the Electricity Safety (Electric Line Clearance) regulation adding an additional $1.7M cost per annum.
    - Extra tree cutting services being made available to local councils to assist them to clear their backlog of tree cutting over the period CY2017 to CY2019.
- Fault response: UE maintains teams of responders ready to repair network faults. This includes faults right across the network from the zone substations through to the customer's premises. UE has increased its forecast for fault management in FY16 to align with historical trend.
- Asset inspection: These are UE's costs of maintaining its asset inspection cycles, including visual and measured inspections of all UE poles, and the measured assessments of the zone substations. The data from these inspections is then fed into UE's asset inspection data systems. UE has increased its investment in asset inspection to incorporate aerial inspections that were successfully trialled in FY15. A further $2.4M has been included as an opex step change over the next 5 year regulatory period for aerial inspections.
- Planned maintenance: UE optimises life cycle asset ownership costs through both periodic and condition based maintenance on all of its assets. A large component of the planned maintenance cost is associated with the zone substations, as well as the overhead lines. The ageing of network assets and a rising trend in cyclic maintenance is driving increases in ZSS defects maintenance, underground cable maintenance, LV cable repair and daytime appointments (customer driven). The forecast has reflected opex step changes to take effect in the next regulatory period 2016 – 2020 for:
    - Compliance with our obligation under the Electricity Safety (Network Assets) Regulations to inspect earthing systems every 10 years; additional neutral testing costs have been forecasted in 2019 and 2020 of $0.6M per annum
    - Application support costs for new Network Planning and Analytics solutions to analyse network operational data from AMI meters and other data monitoring devices to avoid the need for manual neutral integrity testing for all connection points on the network. Annual cost of $1.4M from 2019 onwards.

Figure 9: Opex Forecast



The current inspection and maintenance cycles are outlined in Appendix D.

7. Financial Implications

The above Capex and Opex plans are based on real values, expressed as 2015 dollars and exclude any real escalators that might apply. That enables changes and trends to be analysed based on the underlying drivers in each of the categories, without the time effect of money impacting the findings.

However, actual Capex and Opex needs to be paid in nominal dollars at the time, once inflation and other price escalators have been taken into account.

While the inflation assumptions are broadly consistent with government and other economic estimates for underlying inflation, it is likely that actual prices will be driven not by overall inflation but by price increases in particular inputs. Some input prices can vary significantly compared to the underlying inflation rate. Copper prices, for example, have fluctuated wildly over the last ten years (quadrupling between 2003 and 2006, falling back close to their original price, and then quadrupling again between 2009 and 2011). Also pertinent, growth in skilled wage rates in the construction sector have also outstripped inflation, meaning the labour force needs to deliver productivity/efficiency gains if excess price increases are not to be passed on. These potential variations in inflation, only make the long term Capex and Opex forecasts more uncertain.

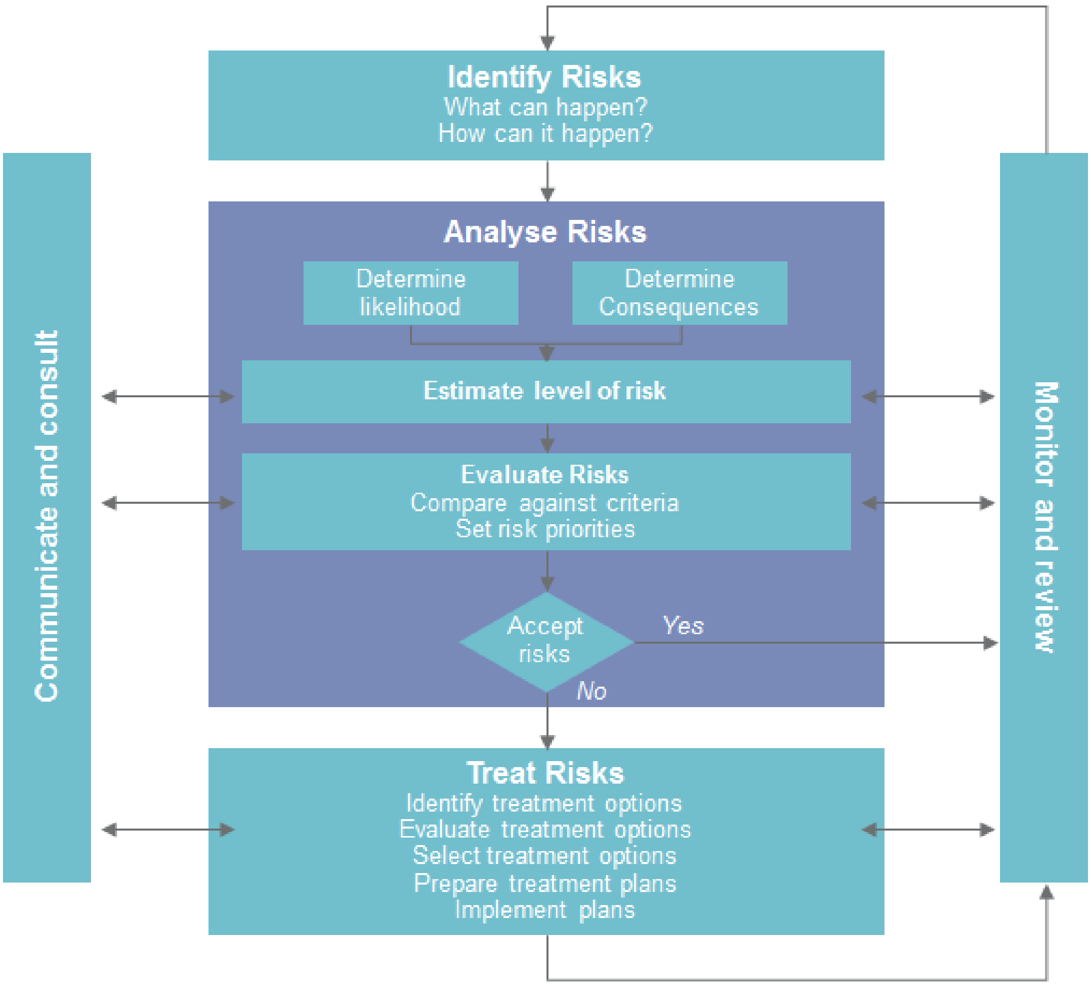
8. Risk Management

8.1. Summary

While the asset management processes are highly rigorous and analytical, any attempt to predict the electricity market over the next 10-30 years will face significant challenges. There are a large number of sources of uncertainty that create significant risks to UE's ability to manage its assets effectively over that period. Distribution assets will be greatly influenced by: changing weather and other environmental conditions that may cause asset degradation and public safety concerns; there will likely be changes in the market and new uses for electricity (e.g. solar panels, electric vehicles); as well as regulatory or customer demands for network changes (e.g. smart meters or underground cables). These external factors are all significant drivers of the capital and maintenance program, and any major shifts could significantly alter the Capex and Opex profiles going forward.

At UE, risks to the AMP are managed within the UE risk management framework and process (see Figure 16). Under this process, the relevant business units are required to comprehensively identify, analyse, evaluate, treat and monitor risks.

Figure 10: Risk Management Framework



8.2. Key risk areas to the AMP

While significant risks exist in the short-term management and execution of the AMP, the major risks and disruptors to UE are those that impact the long-term Capex and Opex program by significantly distorting or impacting the key capital drivers, such as network utilisation; asset condition; residential, commercial & industrial growth; service levels; weather/climate change; regulatory engagement; political environment; and, labour environment.

8.2.1. Network Utilisation

A number of factors have the potential to significantly impact the demand (and supply) of electricity across the network, impacting utilisation and the required capital investment to maintain or grow the network. Technology disruptors can shift long-term utilisation across the network and work in many ways –some increase demand (such as electric vehicles), while others reduce demand (such as solar panels, and energy efficiency legislation or action by customers).

- Plug-in electric vehicles are becoming commercially available from car dealerships in Australia. Designed to connect to the electricity distribution network for recharging, plug-in electric vehicles could surpass air-conditioning as the most influential customer appliance on electricity networks. While uptake rates are an important consideration for UE, the clustering and timing of electric vehicle charging is also important as it will directly impact the performance and utilisation of the electricity distribution network in specific locations at different times. It is estimated that plug-in electric vehicles driven an average daily distance of 40kms will increase the energy consumption of an average household by more than 30%, contributing 2.1MWh to the annual household energy consumption. Peak demand would also increase by up to 3.4kW.
- Embedded generation is becoming popular, driven in part by different government incentives supporting solar panel usage, as well as small wind generation and combined heat and power systems from natural gas. UE engaged Acil Allen and NIEIR to undertake an investigation into the uptake of various micro-generation technologies on the network. The results show additional volumes each year of photovoltaic solar cells which future plans will need to incorporate.
- Demand management activities help curtail growth across the network by improving consumer energy efficiency. New smart meters rolled out across the network have the potential to enable customers to more actively manage their own energy use through the provision of timely and relevant information about consumption rates and costs. Demand tariffs may have a significant impact on consumption patterns, as retailers pricing systems adjust to match prices with energy costs.

8.2.2. Asset Condition

UE assets have a theoretical life expectancy which varies greatly by asset and broadly guides replacement investment expectations. Actual replacement activity however is based on a monitoring and inspection regime, with all assets undergoing inspection on a regular schedule – in the case of poles, once every 5 years. This leads to uncertainty around the actual asset replacement program as:

- an assets true life expectancy is not really known, especially as weather and operating conditions can have a significant impact and many assets are only just now reaching their end-of-life so there is little historical data or evidence as to their true life expectancy;
- the data quality and insights that asset inspections provide is limited, particularly when asset characteristics are difficult to access or assess, or in the case where assets have non-linear deterioration profiles.

8.2.3. Residential or Commercial & Industrial Growth

Post global financial crisis the general economic environment has been relatively quiet and there has not been a substantial level of growth and investment within the UE region at either the residential level or the commercial and industrial space. However, the long-term growth remains hard to predict, particularly in the commercial and industrial sector where activity can be lumpy – several large projects can significantly alter the Capex spend requirements for new connections. In addition, while the urban growth corridor has not been focused in the UE region, there are large areas of undeveloped land that could be opened up for new developments over the next 10 years.

8.2.4. Service levels

Numerous factors could have a large influence on the service levels UE is expected to deliver across the network, in particular:

- Customer expectations: UE aims to optimise for all its stakeholders, and successfully balance customer expectations of service levels with the optimal cost and return to shareholders. This, however, is hard to identify and customers are likely to continue to shift and oscillate their preference. At present, customers are particularly concerned about high electricity prices, and there is pressure on distribution networks to reduce their performance improvement Capex amid claims of 'gold plating'. However, a lack of performance investment by the distributors is likely to see reliability decline and customer preferences swing back towards further network investment. UE will have to observe customer behaviours and shift its asset management approach as preferences oscillate.
- Bushfire risk mitigation: Recent weather extremes only underscore the predicted shift towards more severe fire seasons in Victoria. The number of 'very high' and 'extreme' fire danger days is expected to increase (two new categories – 'very extreme' and 'catastrophic' – have now been added), while fire seasons are expected to start earlier, end later and be more intense throughout. The operational implications of the Powerline Bushfire Safety Taskforce (PBST) and the introduction of the f-factor penalties will change the way distributors manage the network – impacting reliability on total fire ban days, increase operating maintenance costs to reduce fire risks, and potentially leading to further preventative investment such as pole fire mitigation projects.

8.2.5. Extreme weather conditions

Climate change continues to emerge as a major issue for Australian electricity distributors. This is characterised by:

- continuing periods of extreme temperatures;
- an increase in the number of days where extreme winds are experienced;
- decreasing annual rainfall; and,
- an increase in fire danger due to drought, high temperature and strong winds.

This will have a notable impact on the network over the long-term, affecting asset performance (both short-term performance, as assets break down in extreme heat, and long-term performance, with over used or dry assets reaching their "end of life" earlier than expected) and requiring additional investment to maintain network performance.

8.2.6. Major regulatory/customer requirement disruptions

Major regulatory changes or demands by customers can increase the capital investment required across the network. For example:

- The Victorian Government has mandated the roll out of smart meters across the State, impacting UE's 660,000 customers. While the roll out was funded through an additional levy on customers (and not at the network's expense) approximately 90% of smart meters that have been rolled out are now highlighting power quality variations at the customer's premises. UE has a legislative obligation to fix these power quality issues, even though they have not been causing known problems. In addition the AMI business case assumed that the life expectancy of the meters and communications technology was approximately 10 years, however given it is relatively new technology this is yet to be tested. Careful monitoring is required from 2020 to manage any potential exposure.
- There is likely to be growing pressure to lay new cables underground, particularly in new suburbs, as the community seeks to avoid overhead networks that are perceived as an "eye sore". A significant shift towards underground cables could dramatically increase the costs of replacing assets, or rolling out new cables. There are even calls in some areas to move existing cables underground – this would require significant additional investment from the networks.

8.2.7. Political Environment

Electricity remains a highly topical political issue, with both State and Federal Governments having significant influence over the regulatory environment. As electricity price increases from the last few years take their toll, politicians are more likely to respond to consumers voicing their opinion. These increases have been driven by increases across the value chain – fuel sources, generation, transmission and distribution – but as the most regulated part of the value chain the distribution and transmission sectors are likely to be most at the mercy of changes in the political tide/direction.

8.2.8. Labour Environment

UE, like many other organisations, needs to ensure that it has the labour resources to maintain the network on an ongoing basis. There are several potential risks.

- Ageing workforce: as the workforce continues to approach retirement age, UE may struggle to find the right skill set to replace the existing workers – some of whom have worked on the UE network (in various incarnations) for decades.
- Competitive employment environment: the mining boom over the last 5-10 years has led to a short of engineering and other technical skilled resources, with potential employees being lured away from traditional utility jobs in the city to higher paid opportunities on the mines.
- “The Intelligent Utility” promise: when UE aggressively recruited to support its new operating model in 2011, it promised prospective employees an innovative and well-resourced work culture and environment. As organisational realities start to take hold, there is a risk UE will be unable to fulfil this promise to employees, and employees will seek other opportunities elsewhere.
- Adaptability: as new technologies and processes emerge across the network, the UE workforce needs to be able to adapt and re-skill in order to utilise the technologies to their fullest, and drive better network performance.

9. Glossary

Term	Description
Ampere	unit of electrical current flow, or rate of flow of electrons.
CAIDI	an international index, which measures the average duration of an interruption to supply for consumers that have experienced an interruption. Usually calculated on a per annum basis.
Circuit Breaker (CB)	a device, which detects excessive power, demands in a circuit and cuts off power when they occur. Nearly all of these excessive demands are caused by a fault of some description on the network. Most of these CB's attempt a reclose after a fault.
Conductor	is the 'wire' that carries the electricity and includes overhead lines, which can be covered (insulated), or bare (not insulated), and underground cables, which are insulated.
Current	the movement of electricity through a conductor, measured in amperes (A).
Distribution Substation	is either a building, a kiosk, a ground substation or pole substation taking its supply at 22, 11 or 6.6kV and distributing at 400V.
Feeder	a physical grouping of conductors that originate from a zone substation circuit breaker.
Frequency	on ac circuits, the designated number of times per second that polarity alternates from positive to negative and back again, expressed in Hertz (Hz)
Fuse	a device that will heat up, melt and electrically open circuit after a period of prolonged abnormal current flow.
High Voltage	voltage exceeding 1,000 volts (1kV), generally 22, 11 or 6.6kV.
Insulator	supports live conductors, is made from a material that does not allow electricity to flow through it.
KVA	the kVA, or Kilovolt-ampere, output rating designates the output that a transformer can deliver for a specified time at rated secondary voltage and rating frequency.
Maximum Demand	the maximum demand for electricity, at any one time, during the course of the year.
MAIFIe	Momentary Average Interruption Frequency Index (event); an international index, which measures the average number of interruptions of less than 1 minute that a consumer experiences in a given period.
Outage	an interruption to the supply of electricity.
SAIDI	System Average Interruption Duration Index; an international index, which measures the average duration of interruptions to supply that a consumer experiences in a given period.
SAIFI	System Average Interruption Frequency Index; an international index, which measures the average number of interruptions of more than 1 minute that a consumer experiences in a given period.
SCADA	Supervisory Control and Data Acquisition.
Transformer	a device that changes voltage up to a higher voltage or down to a lower voltage.
Voltage	electric pressure; the force, which causes current to fl ow through an electrical conductor.
Zone Substation	a major building substation and/or switchyard with associated high voltage structure where either; voltage is transformed from 66 or 22kV to 22, 11 or 6.6kV.

Appendix A: Abbreviations

Abbreviation	Description
AAC	All Aluminium Conductor
ABC	Aerial Bundled Conductor
ACR	automatic circuit reclosers
ACSR	aluminium conductor steel reinforced
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ARMC	Audit and Risk Management Committee
ALARP	As Low As Reasonably Practicable
AMI	Advanced Metering Infrastructure
AS/NZS	Australian Standard/New Zealand Standard
CAIDI	Customer Average Interruption Duration Index
CC	Covered conductors
CCA	Copper Chrome Arsenate
CCT	Covered Conductor Thick
COWP	Capex and Opex Works Program
DOA	Delegations of Authority
DMS	Distribution Management System
DSPR	Distribution System Planning Report
DUOS	Distribution use of System
EE@R	expected energy at risk
EPA	Environment Protection Authority
ESELC	Electricity Safety (Electric Line Clearance) Regulations
ESMP	Electricity Safety Management Plans
ESMS	Electricity Safety Management Schemes
ESNARS	Electricity Safety (Network Asset Regulations)
ESV	Energy Safe Victoria
EWOV	Energy and Water Ombudsman Victoria
FMECA	Failure Mode Effects and Criticality Analysis
GIS	Geographical Information System
GSL	Guaranteed Service Level
GWh	Gigawatt hour
HBRA	High Bushfire Risk Area
HSEQ	Health Safety Environment and Quality
HV	High Voltage

Abbreviation	Description
kA	Kilo Amps
kV	Kilovolts
LBRA	Low Bushfire Risk Area
LCMP	Life Cycle Management Plan
LCTA	least cost, technically appropriate
LTNPQS	Long Term National Power Quality Survey
LV	Low voltage
MAIFIe	Momentary Average Interruption Frequency Index event
MV	mercury vapour
MVA	Mega volt ampere
MVLC	Medium Voltage Line Covering
MW	Megawatt
NGER	National Greenhouse and Energy Reporting System
NIEIR	National Institute of Economics and Industry Research
PAS	Publicly Available Specification
POELS	Private Overhead Electric Lines
POW	Program of work
PQ	Power Quality
REALM	Risk Evaluation and Loss Method
RIT-D	Regulatory Investment Test – Distribution
RTU	Remote Telemetry Units
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAP	Works Management System
SCADA	Supervisory, Control and Data Acquisition
SECV	State Electricity Commission of Victoria
SPIAA	SPI (Australia) Assets Pty. Ltd
STPIS	Service Target Performance Incentive Scheme
SWER	Single Wire Earth Return
TCPR	Transmission Connection Planning Report
URD	Underground Residential Development
VCR	Value of Customer Reliability
ZSS	Zone Substation

Appendix B - List of Substations - United Energy

No.	ZONE SUBSTATION		TELEPHONE	ADDRESS	No Trans	TYPE*	CLOSE TO	MELWAY	SUB	REGION
1	Box Hill	BH	9890 7779	Middleborough/Canterbury Rds	3	Totally Indoor	Creek	61-G1	BH	North
2	Beaumaris	BR	9589 5192	Reserve Rd/ Gramatan Ave	2	Totally Indoor		86-C6	BR	South
3	Bentleigh	BT	9557 5678	Wheatley Rd	2	Totally Indoor	Creek	68-D11	BT	North
4	Bulleen	BU	9850 6617	Thompsons Rd/Waratah Dr	2	Totally Indoor	River	33-A6	BU	North
5	Burwood	BW	9808 1229	Highbury/Morton Rd	3	Indoor#	Creek	60-J7	BW	North
6	Caulfield	CFD	9211 1401	Neerim Rd	2	Indoor		68-D4	CFD	North
7	Clarinda	CDA	9545 6713	Corner of Clarinda & Cleeland Rd.	2	Indoor		78-H3	CDA	North
8	Cheltenham	CM	0583 5676	Reserve Rd	2	Indoor		77-E11	CM	North
9	Carrum	CRM	9772 8741	McLeod Rd - opp Illawong Crt	3	Outdoor#	Lakes	97-K6	CRM	South
10	Doncaster	DC	9898 4319	Eram Rd Box Hill North	3	Outdoor	Creek	47-G4	DC	North
11	Dandenong	DN	9792 1478	Lace St Doveton	3	Outdoor	Creek	90-J11	DN	South
12	Dandenong South	DSH	9791 7061	Hammond/Greens Rds	3	Outdoor	Drain	95-B3	DSH	South
13	Dandenong Valley	DVY	9768 2026	Abbotts Rd	3	Indoor	Creek	95-D8	DVY	South
14	Dromana	DMA	5987 2064	Collins Rd	1	Indoor	Creek	160-D5	DMA	South
15	East Burwood	EB	9802 5748	Highbury Rd	3	Outdoor#		61-H8	EB	North
16	Elsternwick	EL	9528 2408	Kooyong Rd	2	Indoor#		67-J3	EL	North
17	East Malvern	EM	9571 2833	Sycamore St	2	Indoor		69-B2	EM	North
18	Elwood	EW	9531 5421	Austin Ave/Mitford St	2	Totally Indoor	Creek	67-C3	EW	North
19	Frankston South	FSH	5971 1442	Frankston-Flinders/Robinsons Rds	3	Outdoor	Reservoir	102-G10	FSH	South
20	Frankston	FTN	9786 5069	Wright/Claude Sts	2	Outdoor		99-G7	FTN	South
21	Glen Waverley	GW	9560 8474	Bogong Ave	3	Outdoor#		71-A4	GW	North
22	Hastings	HGS	5979 1791	Barclay Cr/Callinan St	2	Outdoor	Creek/Sea	154-J6	HGS	South
23	Heatherton	HT	9551 2483	Warrigal/Kingston Rds	3	Outdoor		78-C10	HT	North
24	Gardiner	K	9889 5298	Burke Rd (Nth side SE Fwy)	2	Indoor#	Creek	59-H6	K	North
25	Keysborough	KBH	9769 1000	Cheltenham Rd (behind Downer dep	1	Indoor		89-H9	KBH	South
26	Langwarrin	LWN	9785 9317	Duiker Ct/McClelland Dr	2	Indoor		103-F1	LWN	South
27	Lyndale	LD	9795 2390	Halton/Gladstone Rds	3	Outdoor#		81-C11	LD	South
28	Mentone	M	9583 7021	Savona/Riviera Sts	2	Indoor		87-B5	M	South
29	Mordialloc	MC	9580 2138	White St/Warren Rd	3	Outdoor	Creek/Sea	87-F11	MC	South
30	Mulgrave	MGE	9560 9912	Wellington Rd (West side AFL Park)	3	Indoor#	Creek	80-H2	MGE	North
31	Moorabbin	MR	9555 1791	South Rd/Lonsdale Ave	2	Indoor		77-B4	MR	North
32	Mornington	MTN	5975 2310	Moorooduc/Tyabb Rds	2	Outdoor	Creek	146-E5	MTN	South
33	North Brighton	NB	9596 4513	Nepean Hwy/Milroy St	2	Indoor	Creek	67-H9	NB	North
34	Notting Hill	NO	9544 9860	Gilby/Lionel Rds	2	Outdoor		70-G7	NO	North
35	Noble Park	NP	9798 3787	Corrigan Rd/Wallarano Dr	3	Indoor#		89-C5	NP	South
36	Nunawading	NW	9878-0837	Springvale Rd/Stuart Cr	3	Outdoor#		48-F7	NW	North
37	Oakleigh	OAK	9568 7778	Dalgety/Atkinson Sts	2	Indoor	Creek	69-G5	OAK	North
38	Oakleigh East	OE	9569 7795	Railway Ave/Hamilton St	2	Indoor#		69-J10	OE	North
39	Ormond	OR	9570 2098	East Boundary Rd	2	Indoor		68-K9	OR	North
40	Rosebud	RBD	5986 8699	Eastbourne/Boneo Rds	2	Outdoor		170-A3	RBD	South
41	Surrey Hills	SH	9890 3779	Alexandra Cr/Canterbury Rd	2	Indoor		46-H11	SH	North
42	Sandringham	SR	9555 5518	Highett Rd	2	Indoor#		77-A8	SR	North
43	Springvale South	SS	9551 2679	Tootal/Heatherton Rds	2	Totally Indoor		79-F12	SS	North
44	Sorrento	STO	5988 9542	Langdon/McFarlane Aves	2	Totally Indoor		157-F12	STO	South
45	Springvale	SV	9546 8098	Centre Rd (behind SVTS)	2	Outdoor	Creek	79-J4	SV	North
46	Springvale West	SVW	none	Centre Rd (behind SVTS)	2	Indoor	Creek	79-J4	SVW	North
47	West Doncaster	WD	9857 8253	Paul/Kingsnorth Sts	3	Indoor#	Creek	32-J12	WD	North

*NOTE Totally Indoor - Transformers and HV CBs indoor
Indoor - Distribution Bus HV CBs Indoor
Outdoor - All HV CBs outdoor

#NOTE Transformers have sound enclosures fitted on all sides, radiators may be/may not be enclosed

Appendix C – Current Inspection & maintenance practice

	Asset	Current inspection & maintenance practice	Current pro-active replacement practice
Sub-transmission and Distribution Network	Underground Cable	66kV sheath test – 2 yearly LV - 11 to 22KV – 5 yearly	Condition based and frequency of failure.
	Vegetation control	Inspection and cutting – 2 yearly (HBRA). Pre summer inspection – 1 yearly (HBRA) Inspection and cutting – 2 yearly (50% of the LBRA)	HV ABC for overhanging trees
	Connector & Conductor	Thermal surveys – annual, 3 & 5 year cycle Targeted inspection	Replacement of damaged and aged conductor and connectors
	Poles, attachments, lines & pole top structures	Detailed Inspection – 3 yearly (HBRA), 5 yearly (LBRA) Pre-summer drive by inspection - 1 yearly (HBRA), Mid cycle drive by inspection – 5 yearly (LBRA)	Condition based & replacement of priority maintenance. Replace fog pin insulators
	Overhead line capacitors	Functional check – 1 yearly	No planned replacements required.
	HV Outdoor Fuses Surge Arresters	Thermal Surveys – 3 year cycle Asset Inspection – 5 year cycle	Unacceptable fuses and arresters to be replaced.
	Automatic Circuit Reclosers	Maintain – 5 yearly	Control box batteries replaced 5 yearly
	Public lighting minor	Relamp – 4 yearly and 8 yearly PE cells	
	Earthing systems	Test – 10 yearly in non CMEN areas	Condition based
	Thermovision	Thermal surveys – annual, 3 & 5 yearly cycle	Condition based
Distribution Substations	Non-Pole Dist. Sub	Inspect – 5 yearly	Condition based
	Indoor Switchgear	Inspect – 5 yearly Maintain – 4-10 yearly	Condition based; Replacements

	Asset	Current inspection & maintenance practice	Current pro-active replacement practice
	Pole Type Transformers & Oil Test	Detailed Inspection – 3 yearly (HBRA), 5 yearly (LBRA) Pre-summer drive by inspection – 1 yearly (HBRA) Mid cycle drive by inspection – 5 yearly Oil Test - DGA on Tx >-1500 KVA 2 yearly	Condition based Targeted > 60 years old.
	Overhead switches	Inspect – airbreak & remote controlled switches 5 yearly, manual gas switches 10 yearly	Condition based
Zone Substations	Inspect station	By operators – monthly, by technician/thermal survey – yearly	No planned replacements required
	Battery	Maintain – battery 3 monthly, chargers 12 monthly	Eight battery chargers replaced annually based upon condition.
	Circuit Breakers	Maintain on service duty & type (4-8 years) Test every 4 years if CB is > 40 year old	Planned replacement program
	Overhead switches	Maintain disconnectors 4 yearly	Replacements based upon an annual load growth capital planning review.
	Instrument Transformers	First Responder – mthly, Technician - annually	Condition based
	Transformer	Oil Test Annually; if DGA is deteriorating inspect 6 mthly	Refurbishment program to extend lives.
	On Load Tapchangers	Maintain 2-6 yearly	Condition based
	Supervisory cables	Inspection aligns with pole inspection cycle. Copper testing – 2 yearly Fibre testing – 7 yearly	Replacement program for all metallic supervisory cables.
	Capacitors	Inspect – 6 monthly	Condition Based
	Earthing systems	Continuity test – 5 yearly, Design test – 10 yearly	Condition Based & Ten Yearly Review
	Protection and Control (Non-numerical only)	Electromechanical relays – 3 yearly inspection Analogue relays - 6 yearly inspection Digital relays – 9 yearly	Replacement at end of useful life subject to performance (reviewed annually)