Attachment 5.23

Area Plans Overview

May 2014

Contents

Executive Summary

Our proposed programme of works has sought to maintain the safety and reliability of the network, while keeping prices low as possible for our customers. We have deferred capex where possible, and ensured our cost estimates are accurate and efficient.

We have 28 separate plans for areas of our sub-transmission and transmission network. In total, we are proposing total capex of $1.583 billion over the period, comprising of:

- $1,331 million to replace major assets such as underground cables, zone substations and 11kV switchgear.
- $144 million related to augmentations of the shared network to meet demand of new and existing customers as well as other drivers.
- $57 million for associated support costs relating to strategic planning, control room and GIS data capture activities.
- $51 million for associated strategic property acquisitions.

The proposed capex is about 50 per cent lower than actual capex in the 2009-14 period. There are two primary reasons why we proposing less capex in the 2014-19 period:

- Last period was marked by a step change in capex to meet new utilisation and security criteria mandated by the NSW Design Reliability and Performance (DRP) licence conditions. Now that we have largely met this standard, our focus is on ensuring that we maintain our network performance.
- We have sought to minimise price pressures by reducing capex in the next period. We have actively considered scope and cost efficiencies that may be achievable in the next period, and have incorporated these into our capex forecast.

Despite this, there remains a need to replace degraded and aged assets to maintain safety and security on the network.

Introduction

Ausgrid has the largest sub-transmission network in Australia. Approximately 20 per cent of our modern day replacement value comprises transmission and sub-transmission assets. This means that unlike other jurisdictions, our network cannot be seen simply as a distribution network.

The purpose of this document is to provide a high level overview of capex we propose to invest in the 2014-19 period, under the Area Plans. This document is part of Ausgrid's regulatory proposal and contains the proposed forecast capex for area plans, with financial number expressed in 2013/14 dollar terms unless stated otherwise.

The document should be read in conjunction with other relevant attachments and documents provided in the 'supporting document' library of Ausgrid's regulatory proposal (support documents). These supporting documents are generally business-as-usual documents and we have provided these for the main objective of demonstrating that our investment decisions are based on an efficient and process. It must however be noted that these supporting documents have been prepared at a point in time and therefore reflects the forecast capex as at that time. The capex we have identified in our Area Plans is required to:

- Replace major assets that are in poor condition, or present risks to safety, environmental or other concerns.
- Reinforce parts of our network to meet increased demand from new and existing customers at peak times. This includes proposed capex to connect large customers to our sub-transmission network, where the nature of work is classified as an augmentation of the shared network.[1]

Area Plans do not set out our needs for replacements of small assets, as these needs do not have a material impact on the consideration of strategic options. For this reason, replacements of minor items (poles, individual circuit breakers) on the sub-transmission network are set out in our Replacement and Duty of Care plan proposed expenditure.

Our method for deriving the proposed program for the 2014-19 has drawn from our BAU process for identifying needs on our transmission and sub-transmission network. Our process is based on a detailed review of 28 areas of our sub-transmission network ("The Area Plans"). Each plan identifies the suite of projects required to address multiple needs in an area at the least cost. The Area Plans provide a 20 year outlook of capex requirements enabling us to choose the optimal strategy over the long term.

The following maps illustrate the 25 sub-transmission areas within Ausgrid's network.

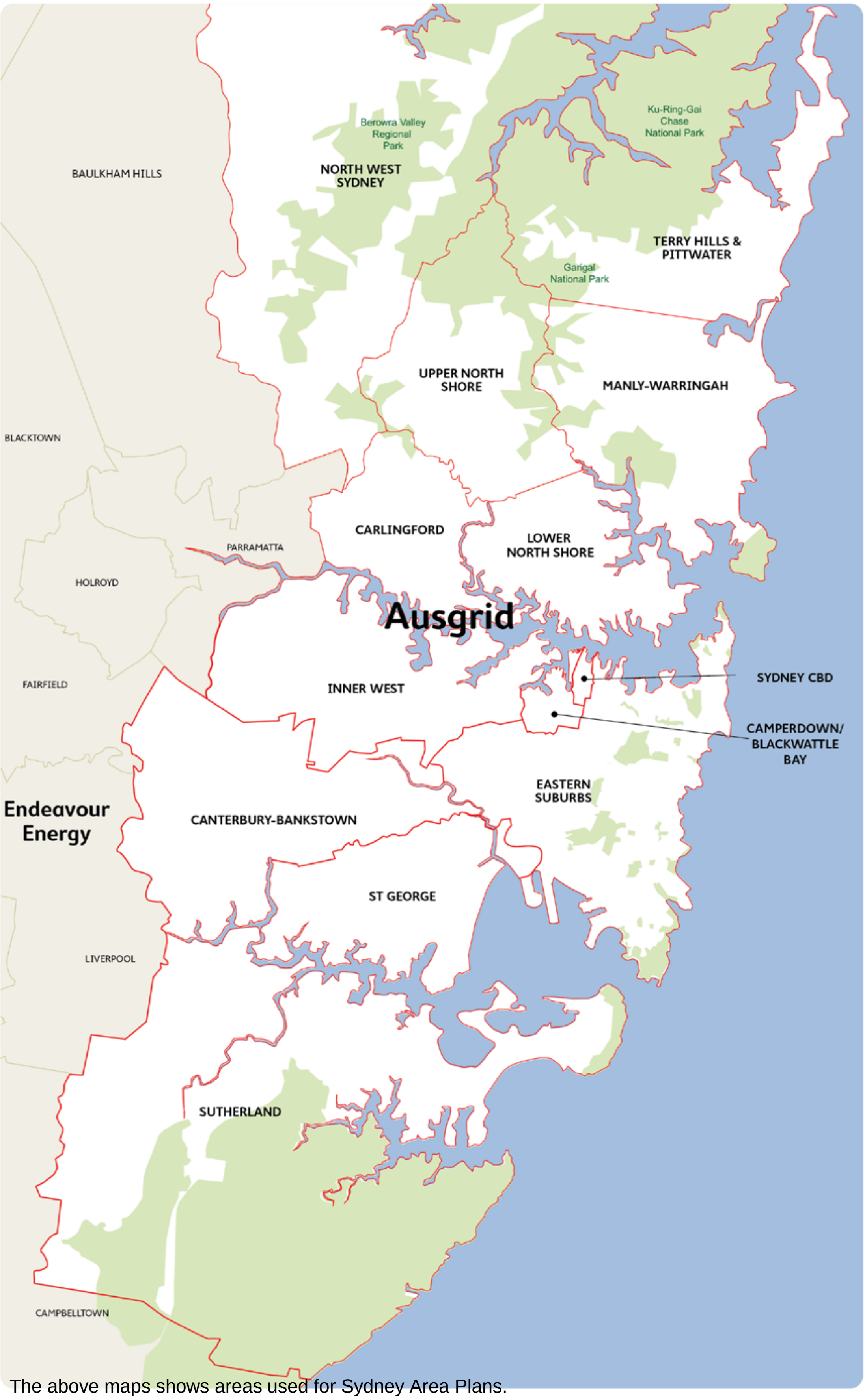
What are Area Plans?

Area plans identify our augmentation and major replacement needs on our sub-transmission network.

[1] Dedicated connection costs are funded by the customer, and have been excluded from the proposed capex.

The three transmission regions overlay the sub-transmission areas, covering the Sydney metropolitan area, the Central Coast and the Lower Hunter regions.

The map above shows Ausgrid's network area, with areas used for sub-transmission planning. For more detail on Sydney areas, see following map.



The above maps shows areas used for Sydney Area Plans.

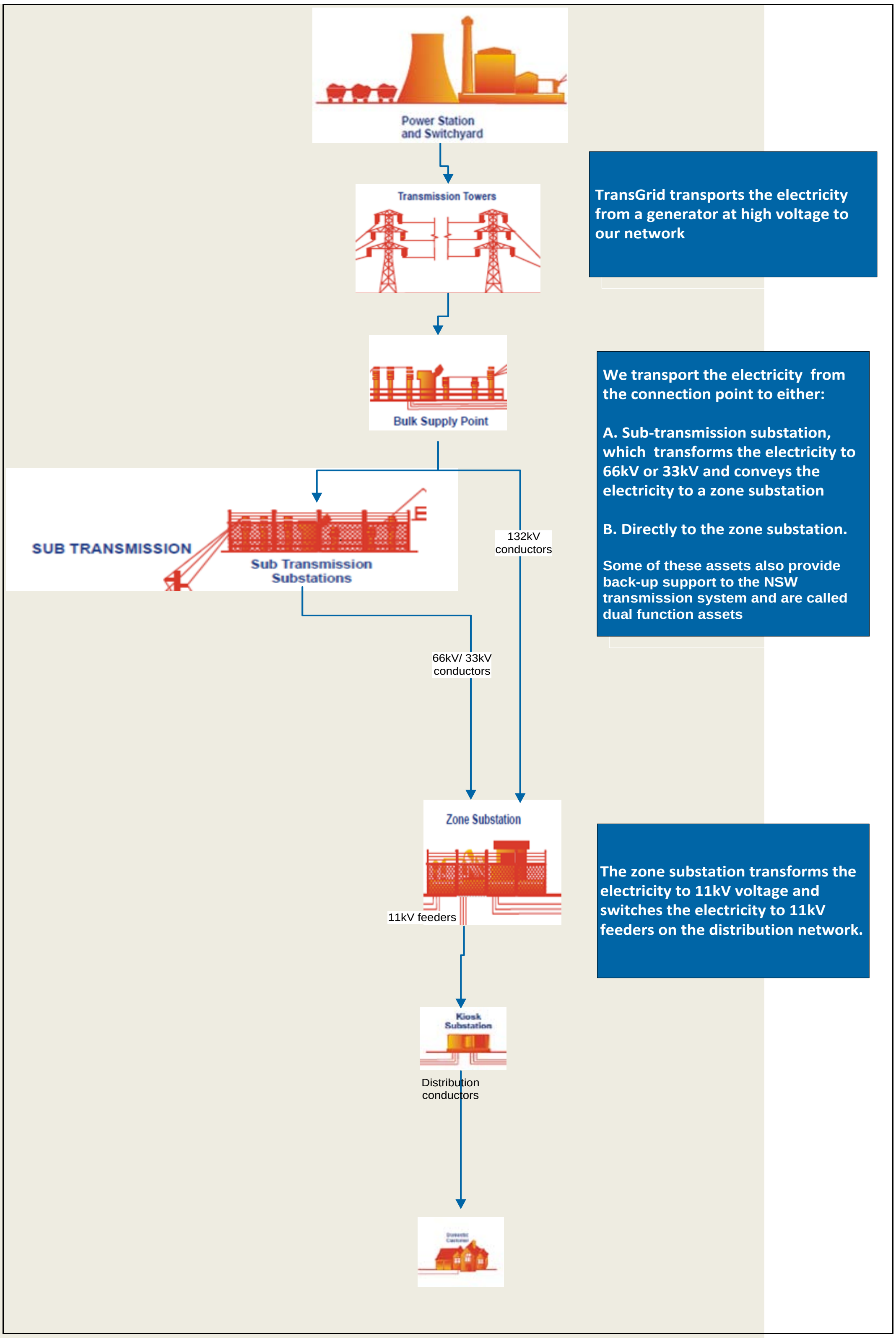
For the purposes of the 2014-19 regulatory proposal, we have undertaken a review of our most recent approved Area Plans to incorporate recent data, and to identify opportunities to reduce capex over the period. This is to ensure that our estimates are up to date, and that we have fully identified opportunities to minimise prices for our customers in the 2014-19 period.

Below we provide relevant background on our sub-transmission assets, the characteristics of our network, and the objectives of investment on the sub-transmission network.

How our sub-transmission network operates

The diagram on the next page provides a simple representation of our transmission and sub-transmission network including the assets used to convey electricity. The diagram shows that:

- We receive electricity at 132kV from TransGrid's bulk supply points. Unlike other distributors, we also provide transmission services through our own network assets. These assets operate in parallel with, and provide support to TransGrid's network. Supporting TransGrid's transmission network in this way represents a net saving to NSW customers compared with operating both networks independently.
- The electricity is transported through our transmission and sub-transmission network to Ausgrid's distribution system. Some of our large customers, such as mining and industrial businesses, are directly connected to our sub-transmission network.
- For the most part, electricity is conveyed at 33kV, 66kV or 132kV to our zone substations where it is transformed to a lower (11kV) voltage and passes through our distribution network to end users.


Power Station
and Switchyard
Transmission Towers
TransGrid transports the electricity from a generator at high voltage to our network
Bulk Supply Point
We transport the electricity from the connection point to either:
A. Sub-transmission substation, which transforms the electricity to 66kV or 33kV and conveys the electricity to a zone substation
B. Directly to the zone substation.
Some of these assets also provide back-up support to the NSW transmission system and are called dual function assets
SUB TRANSMISSION
Sub Transmission
Substations
132kV
conductors
66kV/ 33kV
conductors
Zone Substation
11kV feeders
The zone substation transforms the electricity to 11kV voltage and switches the electricity to 11kV feeders on the distribution network.
Kiosk
Substation
Distribution
conductors

Characteristics of the network

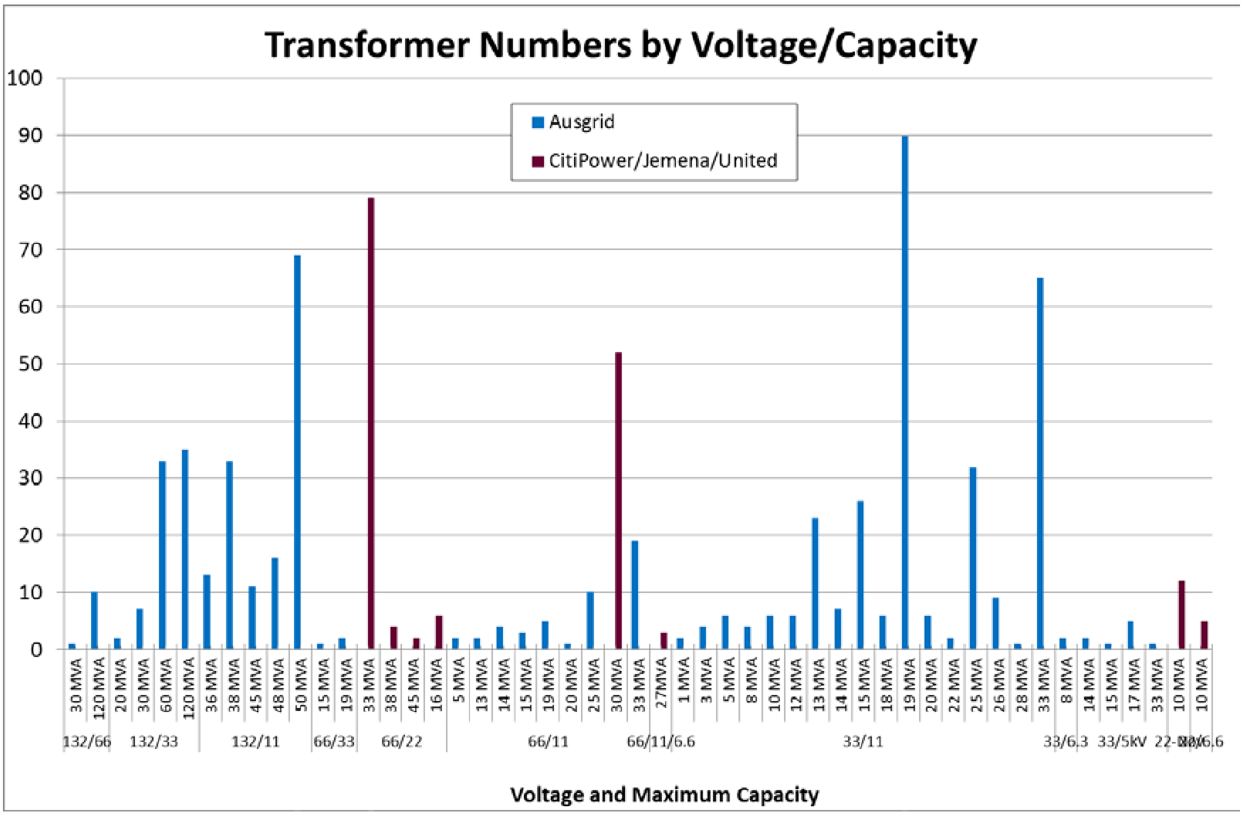
Unlike other jurisdictions, Ausgrid cannot be seen simply as a distributor. We have a number of assets that provide transmission services, and our sub-transmission network is the largest in Australia. A further characteristic of our network is that we construct and maintain our assets in the heavily congested city of Sydney, which adds greatly to the costs of operating our network relative to other peers.

Largest sub-transmission network in Australia

Much of our transmission network serves a “dual function”. Ausgrid’s dual-function network is defined as those assets with voltage 66kV and above that are owned by Ausgrid and operate in parallel with and provide material support to the TransGrid transmission network. These assets may either operate in parallel with the transmission network during normal system conditions or can be configured so that they operate in parallel during specific system conditions. Further information about dual function assets can be found in Planning Standard INV-STD-10033 Classification of Dual-Function Assets.

This means that our network cannot be seen simply as a distribution network. In Figure 2 below, it can be seen that Ausgrid has more than 7600MW of transformer capacity installed at subtransmission substations (STS). In other states this type of infrastructure is generally not owned by the DNSP, with the transmission service provided by the TNSP at a lower voltage.

Figure 2- Transformer Capacity Comparison[2]



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[2] Evans and Peck report: Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs

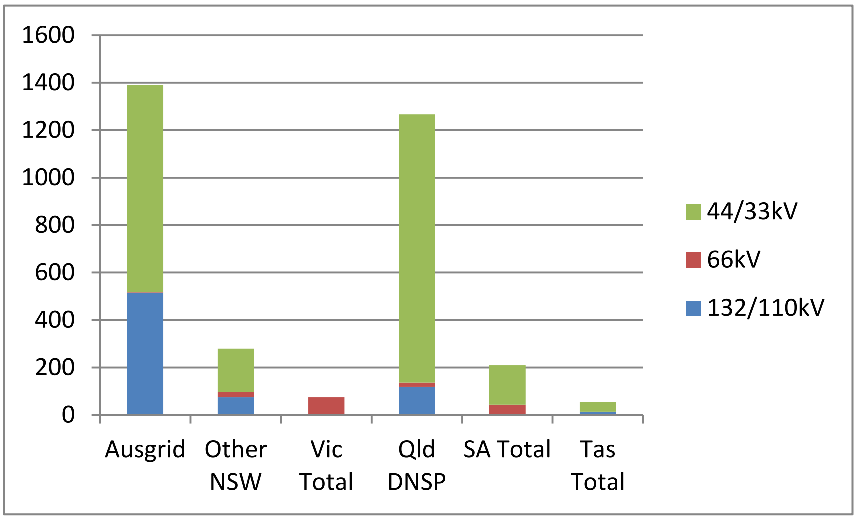
The implication is that Ausgrid is required to construct and maintain a greater volume of sub-transmission assets than other DNSPs in Australia, which impacts our capex and opex requirements over time.

While there is a mix of voltages in the various categories between states, the number of transformation steps in Victoria at the sub-transmission level again indicates the lack of an intermediate step between Transmission and Distribution, that is very small Sub-transmission Assets resulting in the Victorian system being much simpler than NSW.

High costs of construction

As a result of our highly congested location, our costs of constructing sub-transmission assets are higher than a peer transmission or distribution company. Sydney has a very high population density, resulting in the need to underground a significant proportion of the network. This has resulted in Ausgrid developing the largest underground transmission and subtransmission network in Australia. The relative size of the network can be seen in Figure 3, which shows that we have approximately 1400 kilometres of underground cable above 33kV.

Figure 3: Length of Subtransmission cables[3]



Density also plays a part in our costs of construction and maintenance for zone substations. Generally the cost of property and construction are higher in dense areas, and also impacts our available options for replacement. For example, piecemeal replacement of switchgear is generally not possible, and space to expand sites to allow for replacement works is not available or extremely expensive.

[3] Evans and Peck – Review of factors contributing to variations in operating and capital costs structures of Australia DNSPs

Objectives of investment on the sub-transmission network

Given the size and complexity of our transmission and sub-transmission network, we devote considerable time in developing long term plans that enable us to maintain reliability and safety at lowest cost over time.

Ausgrid's Network Investment Policy provides the overarching framework for investment in system assets. The Policy identifies Ausgrid's key investment objectives as:

- Comply with its obligations under Chapter 5 of the National Electricity Rules; the Design, Reliability and Performance Licence Conditions; and other applicable regulatory instruments;
- Manage business risks with particular regard to ensuring the safety of its employees, customers and the broader community; maintaining the reliability of supply to its customers; and protecting the environment; and
- Improve the efficiency of the business or produce a net benefit to the community.

Below we identify the key drivers of capex that require us to invest to achieve these objectives.

Augmentation to maintain network performance

A key driver of network performance is our ability to connect new customers to the sub-transmission network, and to address imbalances in supply and demand.

Our network is designed to instantaneously meet the demand for electricity from our customers at peak times. This occurs on hot summer days or cold winter days when customers use highly intensive energy appliances such air conditioners and heaters.

Over time, we need to 'augment' the shared network to meet increased demand from new and existing customers. There are 3 circumstances that drive "demand related" capex:

- Connection of large customers which necessitate deep augmentation of the shared network. Customers fund 'direct' connection costs for dedicated assets, however Ausgrid will fund augmentations arising from connection applications where the services provided by the asset will be shared by current and future users.

- Increase in aggregate demand from new and existing customers which necessitate augmentation of the shared network. This is termed 'reinforcement' of the network as the augmentation is not directly related to a new customer.

- Changes to voltage conditions on the network. Given our predominantly urban network this is a low proportion of demand related expenditure and mainly relates to new large connections or embedded generators.

Key obligations guiding our augmentation decisions

Schedule 1 of the NSW Design Reliability and Performance (DRP) licence conditions provides direction on when we augment the network to meet demand of new and existing customers. This includes:

- **We must ensure that the thermal capacity of our network elements is sufficient to meet the actual load.**
- **We must design the network to meet a security standard which enables us to provide adequate supply under credible contingencies and/ or maximum interruption times.**

Clause S5.1a of the NER also sets out requirements with respect to voltage limits

Our decisions to invest are derived (although modified as detailed in Section 2.2) from the deterministic criteria in Schedule 1 of our licence conditions and the NER. This is discussed in the box below.

Replacement to maintain infrastructure

A key driver of capex is to replace network assets that are degraded in condition, or which do not meet modern day compliance standards. Ausgrid has an obligation to ensure our network assets continue to provide a safe and reliable service over time.

The sub-transmission system is built with a high level of redundancy, meaning that a single asset failure will rarely result in a reliability incident. However, poor asset condition increases the probability of single asset failure, and increases the risk that coincident failures of two or more critical elements may occur.

Whilst such events are rare, they generally result in long duration outages to wide areas[4], which are extremely disruptive and costly to the community. The risks and consequences are increased significantly if the failed asset takes a long time to fix, as is the case for subtransmission and transmission underground cables.

Degraded assets can also present a risk to workplace and public safety, and to the environment. For example substation equipment can fail explosively damaging buildings and throwing debris over large areas. Uncontrolled leakage of fluid from transformers and cables is an environmental hazard and a contravention of the Environmental Operations Act.

The bulk of our replacement capex is on assets that are past their useful life, and whose poor condition and performance can no longer be addressed through maintenance. These assets are increasingly likely to fail in service, and present safety, reliability and environmental risks that cannot be mitigated through maintenance.

We also replace assets for 'duty of care' reasons. This is where the asset no longer meets modern day compliance standards, and where the issue cannot be resolved through a more cost effective solution. For example, we have a duty of care obligation to address asbestos and other health and environment risks.

Types of risks we face

"EnergyAustralia (Ausgrid) seeks to manage the risk arising from aging oil insulated HV circuit breakers… The general lack of arc suppression and controlled explosion venting in this type of equipment poses a health & safety risk."
Wilson Cook's (AER's consultant) review of our capex proposal in 2008.

[4] Such prolonged wide area outages would be expected to be large enough to be excluded events and thus will not directly impact on standard reliability performance measures.

Ausgrid undertakes a risk/cost assessment before making a decision to replace an asset. This is based on the likelihood and consequence of failure. In making judgements on the appropriate risk threshold, we are heavily influenced by our regulatory obligations to provide a safe and reliable network over time, and to manage other legislative requirements.

Key obligations guiding our replacement decisions

- **Workplace Health and Safety Act - We must ensure health, safety and welfare at work of all of our employees and non-employees, and to ensure premises and plant under control are safe and without risk to heath.**

- **Protection of the Environment Operations Act - We must not commit certain defined air, water, noise, waste or land pollution offences, and we must obtain environment protection licence for scheduled activities**

Benefits from previous investment

> *"The Panel believes that the networks have not had sufficient expenditure outlaid on them to adequately maintain them and to meet increased demand from growth."*
>
> Somerville Report into major outages in Queensland in 2004

Over the last few years, Ausgrid has invested heavily in rejuvenating a highly aged and heavily utilised sub-transmission network. We have implemented the first stages of our critical long term replacement programs, and have also restored the security of supply of the network in accordance with our new licence conditions.

The purpose of this section is to identify outcomes of investment in the 2009-14 period and the reasons for variation to forecasts. Examination of previous capex can provide insights into the proposed capex for the 2014-19 period, and the veracity of previous forecasting approaches. It is also a capex factor that the AER is required to consider as part of its review of whether the forecast satisfies the capex criteria.

1.1 Circumstances prior to 2009-14 period

During the 1990s and the early part of the 2000s, Ausgrid was unable to invest significantly on replacing or reinforcing sub-transmission assets. This was largely a result of insufficient allowances provided by our jurisdictional regulator, despite peak demand rising rapidly on the network.

In our 1999 proposal, we noted that 12 per cent of sub-transmission substations were above their firm rating and that another 25 per cent were at 90 per cent of utilisation. Similarly we noted that 16 per cent of zone substations were above their firm rating and that 30 per cent of the total population were at 90 per cent or above utilisation.

By the mid 2000s, our sub-transmission network utilisation had further increased with demand on 35% of zone substations and 22% of subtransmission substations exceeding their firm rating in 2004. In some areas of the network such as the Hunter, more than 50% of major substations were loaded to above their firm rating[5].

This was approaching the utilisation levels that sparked large scale failures on the Queensland distribution network in early 2004. The disastrous impact of these outages prompted the Somerville inquiry in Queensland. The inquiry highlighted key reasons for network outages including:

- High system utilisation levels leading to inadequate contingent capacity.
- Operating equipment at levels which increased the probability of failure of the asset.

Restoring Supply Security Levels

[5] Forecast Summary2005.xls

It was in this environment that the NSW Government set new licence conditions for Ausgrid and other distributors intended to ensure supply security would be restored and maintained at prudent levels. The licence conditions set deterministic criteria (ie: a clear threshold at which we are required to invest) for augmentation decisions, and required compliance to be reached as far as practical by the end of the 2009-14 period.

The licence conditions set utilisation limits based on the thermal capacity (maximum heat at which equipment can be operated safely) of conductors and substations. They also required a minimum level of redundancy on the network, with greater back-up of the critical CBD areas where large scale outages can cause extreme economic consequences such as occurred in Auckland in 1998.[6]

Whilst progress was made in bringing the sub-transmission system into compliance between 2006 and 2009, project development and delivery timeframes meant that much of the work was scheduled for completion in the 2009-14 regulatory period[7].

Commencing in the early 2000s, Ausgrid also undertook extensive investigations of the health of our existing assets. This recognised that replacement and maintenance allowances had been set at a very low level during the 1990s and early 2000s, leading to emerging condition issues on the network. Funding had been directed at critical safety and environmental issues and replacement of failed assets, with effective condition management of major assets on the sub-transmission network being deferred over the period.

Our analysis showed that a large number of our assets were at high risk, in terms of safety consequences and reliability of the network[8]. As a result, Ausgrid commenced a targeted replacement strategy in 2006, with a significant replacement program proposed for the 2009-14 period.

1.2 Outcomes of investment in the 2009-14 proposal

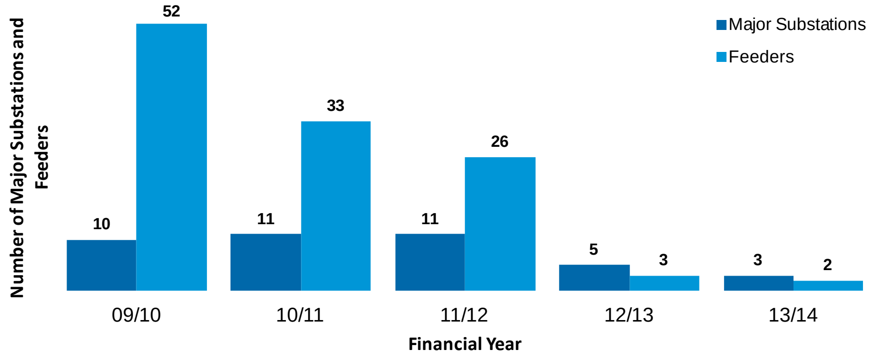
At a high level, Ausgrid undertook significant capex on the sub-transmission network in the 2009-14 period to restore supply security levels and replace aged infrastructure. The table below shows that we built a number of new zones and cables, which resulted in improved security levels, and replaced a significant amount of aged and degraded substations, cables and switchgear.

Program	Delivered
New major substations commissioned	30
Zone substations retired	16
Retirement of 33kV gas cable	156 km
Retirement of 132kV oil cable	28 km
11kV switchgear retirement	446
11kV switchgear replacement	168

6 Auckland experienced a 5 week blackout in 1998.
[7] Cost Impact of Licence Conditions, Energy Australia , May 2008
[8] For example, between December 2002 and March 2006 132kV feeders 908-909 required six outages to address failures and gas leaks and were out of service for 332 days.

Ausgrid has largely achieved the step change required restore supply security to the level in Schedule 1 of our licence conditions. This can be seen in the diagrams below which show how we steadily improved security standards of our substations in the 2009-14 period. Our response to licence condition compliance is illustrated in Figure 4.

Figure 4 – Major substations and feeders non-compliant with licence conditions



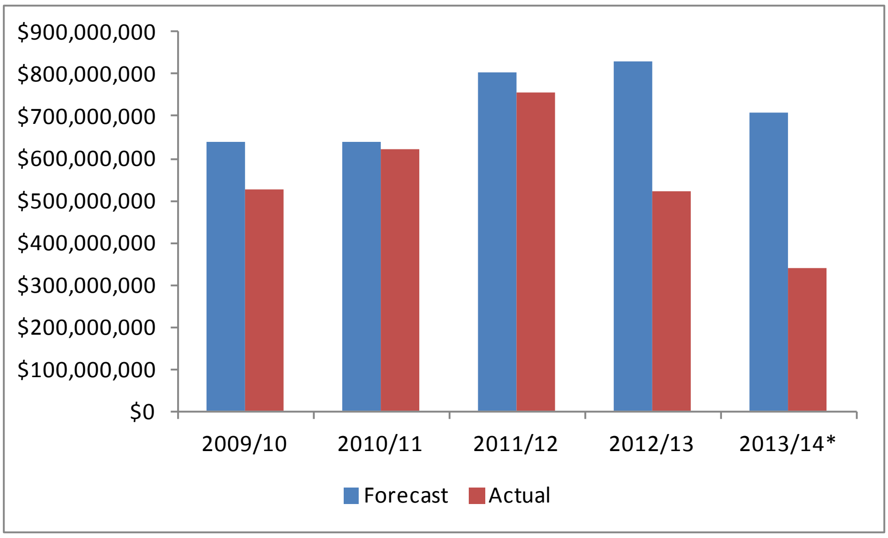
Improved security standards reduced the risk of wide area and prolonged outages for our customers over the 2009-14 period. In the period, we only have an average SAIDI of 13 minutes related to failure of assets on the sub-transmission network.

The low level of outages related to sub-transmission failure was also related to the significant inroads into arresting condition issues of assets on the network.

1.3 Variations to the capex forecast

Figure 5 below shows actual capex compared to forecast capex at the time of our 2008 proposal excluding property acquisitions and support costs. In total, actual capex was 24 per cent lower than forecast (by approximately $850 million).

Figure 5 – Capex 2009-14 (as incurred in $nominal)



* Actual FY2014 represents planned expenditure for FY2014 based on second financial quarter projections.

The key reasons for variation include:

- Lower demand and new customer activity – The underlying driver of lower forecast was the global financial crisis which suppressed commercial and residential housing activity, resulting in lower demand and connection activity. A further factor was the impact of high increases in network charges on the elasticity of demand at peak times. Further information on the reasons for variation from forecast demand is set out in supporting documentation for demand forecasts. Further information can be found in Planning Standard INV-STD-1022 – Demand Forecast.

- Prioritisation as a result of our capital reduction strategy – The diagram above shows that we significantly under-spent our allowance in the last 2 years of the period. This was a direct result of our capital reduction strategy implemented at the end of the period in response to price pressures faced by our customers. Our intent was to lower the price that customers would pay for network charges in the 2014-19 period by lowering the capex that would be rolled into the RAB at the end of the period. Our focus was on better targeting our replacement program, and reducing costs.

- Higher costs – We significantly under-estimated the costs of completing work in the period. This was a result of a number of factors including not undertaking more detailed design for complex projects (such as switchboard and cable replacements) and delays in project delivery resulting from resourcing constraints and extended project development times. As a response to higher costs, Ausgrid reviewed a number of project options and delivery strategies. This delayed a number of high value projects, including several cable replacement projects.

The central ways we have improved the forecast for the 2014-19 proposal are:

- Improved demand forecast methodology that can take into account factors such as price elasticity and weather correction of demand forecasts.

- Incorporating the deferrals and efficiencies from the capital reduction strategy into our forecasts for the 2014-19 period.

- More detailed costing including extensive analysis of potential efficiencies in scope and delivery particularly for 132kV cable projects.

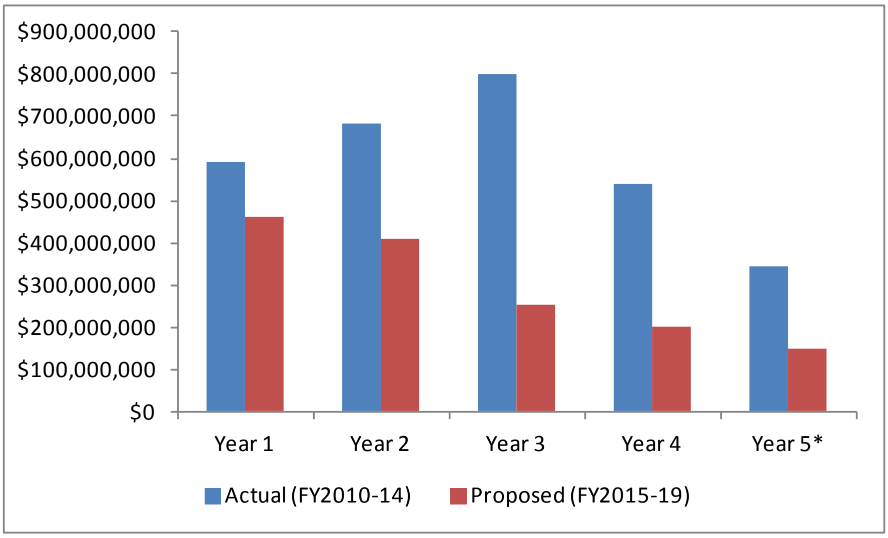
Circumstances in 2014-19

Our focus is on maintaining our performance in light of increased demand and deteriorating assets. Our proposal has been geared at finding efficiencies to reduce price pressures.

The purpose of this section is to identify the key circumstances driving Ausgrid's capex in the 2014-19 period. In turn, this can provide insight into the proposed capex at a high level compared to actual expenditure in the 2009-14 period.

The diagram in Figure 6 below shows that Ausgrid's forecast capex is significantly below actual expenditure in the 2009-14 regulatory period. In total, proposed capex will be approximately 50 per cent lower than actual expenditure in the previous period (by $1,483 million excluding property acquisitions and support costs). The diagram also shows that capex is highest in the beginning of the period, and then ramps down significantly at the end.

Figure 6 – Capex 2009-2019 ($2013/14)



* Year 5 of Actual (FY2010-14) represents planned expenditure for FY2014.

In the section below we show that the focus of our network strategy in the 2014-19 period, and the drivers of capex in the 2014-19 period include:

- Replacing assets – the key driver of capex is deteriorating condition of certain technology types that give rise to large reliability and safety risks, such as oil and gas filled cables and compound switchgear.
- Maintain capacity and supply security – The reduction in capex reflects a return to 'steady state' capacity investment, having largely restored reliability and security to the appropriate level, as reflected in our licence conditions.

Despite this we still have pockets of demand growth on the network mostly as a result of new connections downstream from the sub-transmission network.

- Minimise price pressures - We have sought to defer expenditure by prioritising the program to the full extent possible by improving input information, and by identifying potential efficiencies in scope and costs.

2.1 Replace problem technology types

In the previous period, we made significant inroads into arresting the deterioration of assets on the sub-transmission network. We focussed on replacing technology types that had a reasonable likelihood of failure, and high safety or reliability impacts. The volumes and costs of these critical assets, requires long term asset management strategies. The work carried out during 2009-14 focussed on the highest risk assets as part of a longer term program.

Despite the significant replacement works already undertaken, the performance of some asset classes has continues to deteriorate and significant quantities of these 'high risk' assets are still on the network. These include:

- Gas filled 33kV cables: Gas leaks from these cables have been increasing over the 2009-14 period despite our targeted replacement program. The high failure rates and significant repair times present a risk of high consequence outages as was demonstrated by the Enfield black out (see Box 1 below).
- Oil filled 132kV cables: Oil leaks have been contained as a result of our 2009-14 programs, however there still remains a significant population of these assets and continuing leaks are inevitable. Leakage is a leading indicator of poor asset health, and an environmental hazard that may contravene the Environmental Operations Act. Our future program is targeted at removing cables which have the greatest risk of polluting waterways such as Sydney Harbour.
- Switchgear: We have the oldest switchgear in Australia. The underlying technology gives rise to considerable safety risks including explosive failure. Our immediate program is targeted at insulation condition, age and locations with high consequences of failure.

As discussed below, our capital reduction strategy has carefully considered how we prioritise the replacement of these assets, so as to reduce capex in the 2014-19 period. Further information on our replacement programs for these asset types is provided in Strategic Asset Prioritisation documents for these technology types, which are then used as an input into our individual Area Plans.

Box 1: Enfield black out

On 2 February 2010 a major outage occurred at Enfield zone as a result of the failure of two of three 33kV gas pressure cables supplying the substation.

The feeder failures resulted in supply interruptions on the 2nd and 3rd of February impacting about 12,500 customers. The initial impact of the interruption on individual customers was mitigated by rotating load shedding, and by extensive use of transportable generators (25 generators totalling 15MVA of capacity were deployed in the first 2 days).

As feeder repairs were expected to take about a week, the medium term recovery strategy included the installation of a transportable substation and the reconfiguration of the distribution network to provide additional supply to the area. Fortunately after jointing work was completed, the 33kV feeders were re-pressurised without problems allowing the 33kV supply to be restored on the 7th February.

It should be noted that whilst the Enfield outage had a significant impact on the community, Enfield is one of Ausgrid's smaller zone substations, which limited the impact of the outage and the magnitude of works required to manage the impacts of the outage. In addition the repair times for the failed 33kV cables were relatively short.

Consequently the Enfield incident was at the lower end of the range of potential consequences of simultaneous subtransmission feeder failures. This shows the importance of maintaining a reliable and safe sub-transmission network.

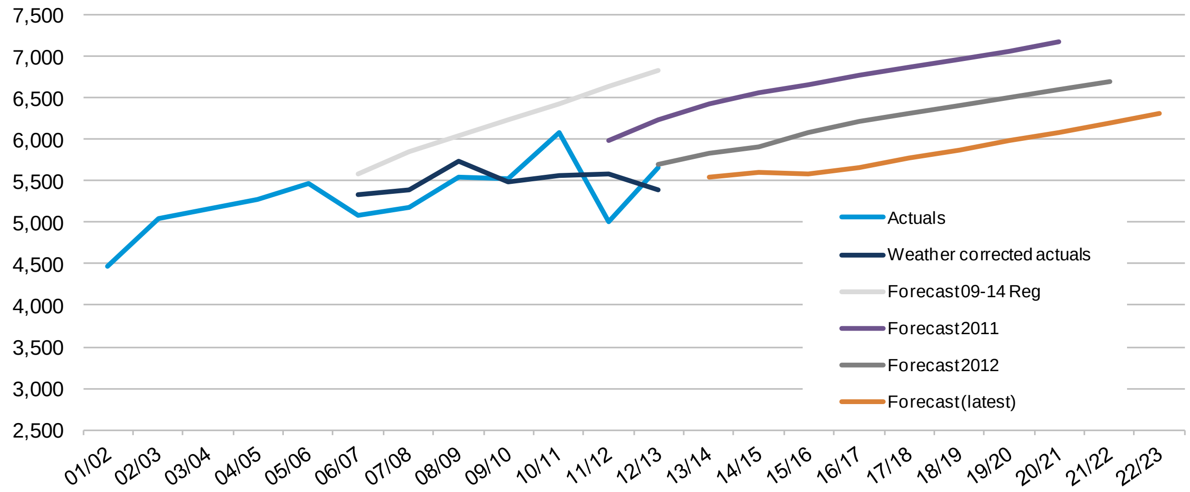
2.2 Maintain capacity and supply security

Proposed augmentations of the transmission and sub-transmission network are significantly lower than the previous period. This is largely a result of having substantially restored reliability and security to the appropriate level, as reflected in our licence conditions in the 2009-14 regulatory control period. Also, in anticipation of changes to the NSW Licence Conditions, the trigger for investment in relation to underground subtransmission cable systems and Subtransmission Substations was relaxed by the application of risk similar to that applied to overhead cable systems and Zone Substations, up to a maximum of 10MVA. There is a small backlog of works to achieve the n-2 security standard in the CBD.

Our lower levels of capacity investment mark a return to 'steady state' investment. Our focus is on reinforcing the network to meet growing demand on parts of our network, such that we continue to comply with the new licence conditions which require a minimum level of reliability.

In the next period we expect peak demand to slowly rise on our network, compared to the almost flat trend experienced in the 2009-14 period. Our analysis shows that demand from new and existing customers will rise as a result of improved economic confidence and lower network prices. Together this will promote higher demand from existing customers and more customer activity ("spot loads"). Our summer coincident system peak demand forecast is depicted below. The comparison with forecasts from five years ago in Figure 7 below shows the benefits of steadily improving normalisation techniques.

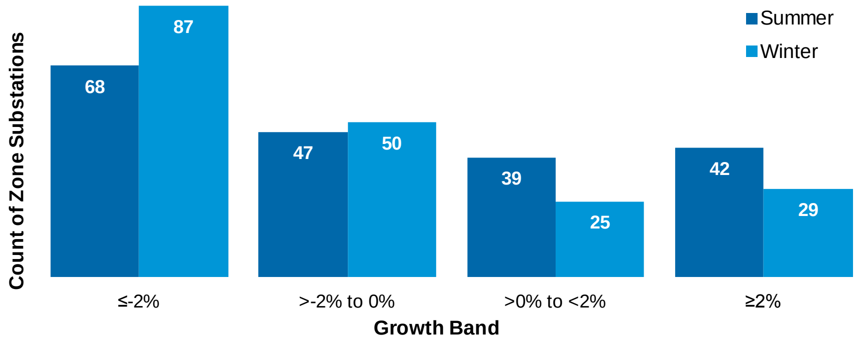
Figure 7 - Ausgrid summer system peak demand (MW)



It is important to recognise that system peak demand is a poor proxy for estimating the level of augmentation works. Capital works generally arise from the need to meet localised growth in individual areas, meaning that diversity of growth rates across the network is very important to understanding the reasons for augmenting the network.

The diagram below in Figure 8 shows that a significant part of our network is expected to experience growth rates of 2 per cent or above per annum in the 2014-19 period.

Figure 8 – Localised growth rates



Further information on our spatial demand forecast method and outcomes is provided in supporting documents.

2.3 Focus on efficiencies to minimise price pressures

A key focus of our proposal is to minimise price pressures faced by our customers in the 2014-19 period. This has been in response to the price shocks experienced in the 2009-14 period. As part of our capital reduction strategy, we have re-considered the following aspects of our planning approach:

- We have updated and re-analysed condition data to identify opportunities to reduce capex in the period by deferring replacement of assets.
- We have improved our demand forecasting capability to ensure we correctly capture the benefits from reduced peak demand growth
- We have adopted revised risk criteria for certain augmentation investments, reflecting our expectation of greater flexibility in future planning criteria.
- We are proposing a broad based DM program to reduce overall system demand, and reduce further the need for growth capex in the longer term.

We have also focused heavily on identifying potential for cost reductions in delivering the program. There are two ways we have sought to find cost efficiencies:

- We have examined whether the scope of works could be minimised to reduce costs. We have examined whether there could be efficiencies in scope required to deliver the programme.[9]

- We have examined the costs involved in completing the works and sought to consider any efficiencies that may be achieved in delivering the projects.

[9] Further details of efficiencies are detailed in 1419 Regulatory Reset, Transmission Mains Replacement program

Our forecast process

We have a planning framework based on current good industry practice to make long term investment decisions. For the 2014-19 proposal we have undertaken further detailed reviews of our BAU plans to find deferrals and efficiencies to minimise price pressures to our customers.

The purpose of this section is to provide an overview of the process used to derive the proposed capex for the 2014-19 period.

Our sub-transmission planning process enables us to develop the network in the most efficient way in the long term. At a high level, we constantly review our architectural design on the transmission and sub-transmission network. This includes standard voltages and designs on the network. Our long term network architecture document provides an overview of the present strategic direction for the network.

After considering the architectural strategy, our next step in the planning process is to develop 28 individual Area Plans. For each area, we assess all strategic drivers of investment that are likely to impact the development of that section of the network.[10]

Area Plans are a staple of our business as usual (BAU) subtransmission planning. In the sections below we describe the process we use for BAU, and how we refined this approach for the purposes of providing an accurate and prioritised forecast of capex for the 2014-19 period:

- Section 3.1 – Describes our approach to undertaking detailed strategic reviews of our 28 area plans. These are undertaken on a rolling 3 year basis, and identify the preferred development strategy to address future needs.

- Section 3.2 – Describes our annual 'desktop' reviews of projects based on current information such as demand forecasts and asset condition.

- Section 3.3 - Shows how we have introduced additional 'checks and balances' for the purposes of developing the 2014-19 proposal. This is to ensure that we submit the most accurate estimate of capex, and incorporate potential efficiencies from our capital reduction strategy. In undertaking this exercise, we have incorporated the most recent data on demand forecasts and cost input assumptions. Further information can be found in Planning Standard INV-STD-10022 – Demand Forecast.

[10] Small replacements such poles and individual outdoor circuit breakers are not expected to impact the preferred strategy for an area, and are managed via replacement programs detailed in the replacement plans.

3.1 Area Plan strategies

On a rolling 3 year basis, our system planners undertake detailed reviews of the 28 areas of our network. This includes 3 regional plans that have a particular focus on the operation of our transmission network.

The Plans identify capital needs over the long term (20 years) based on drivers such as increased demand, new customers and asset condition. Our planners identify feasible development strategies to address needs as they arise, and use Net Present Value analysis to identify the least cost option.

Below we describe the triggers for investment, how we assess future needs, and how we select the most efficient option. More information on our process is contained in the document Planning Standard INV-STD-10019 – Area Planning which is part of the input folder in the Area Plan supporting documents.

Trigger for investment

In our introduction we noted that we incur capex to ensure we provide adequate network performance and maintain compliant infrastructure. To meet these objectives, we identify triggers for investment with reference to our underlying obligations and risk tolerance.

Type	Trigger
Network Capacity	Ausgrid's planning criteria sets out when we undertake augmentation of the sub-transmission network to meet increased demand from existing and new customers. Our trigger for investment is based on Schedule 1 of our DRP licence conditions where we must ensure that the thermal capacity of network elements is sufficient to meet actual demand, that we maintain acceptable system voltages and that redundancy is appropriate for the different segments of our network. In anticipation of changes to the licence conditions, additional risk was applied as discussed in Section2.2.
Maintain infrastructure	Our asset management strategy and risk management framework provides guidance on when we replace assets to manage the degradation in the condition of network assets. This is based on the likelihood and consequence of failure. In making judgements on the appropriate risk threshold, we are heavily influenced by our regulatory obligations to provide a safe network, and to maintain reliability over time. There is also a need to upgrade or replace assets to manage risks. This work may relate to issues such as managing environmental or safety issues such as pollution and asbestos issues.

Assessment of needs

Our needs analysis starts with an examination of the current state of the network in terms of capacity, design and condition of assets on the network. We then consider the following drivers:

- Increases in demand from new and existing customers –We determine whether there is sufficient capacity on our existing assets to meet forecast demand on localised sections of our network. A key input to our assessment of needs is the spatial demand forecast, which incorporates information on committed new customer connections,[11] and which considers the impact of broad based DM projects. In addition, our Area Plans considers the potential capex related to large new connections (eg: mining customers) that may proceed but which are not committed at the time of the review.[12]

- Condition of assets on the network – We undertake extensive analysis of the condition of common technology types. We identify existing technical records on assets including failure information and maintenance data. We use this information to identify likelihood and consequences of failure to identify options to manage asset deterioration and whether replacement is required. Replacement requirements are reviewed on a portfolio basis, to enable prioritising of the program to address risk. The timing of replacement becomes an input to the Area Plan detailed review of needs.[13]

Select efficient option

We then identify feasible strategies that could address the needs over time. It is important to consider needs and solutions on a holistic basis to avoid implementing short term, narrowly focussed options which may be less efficient over the longer term.

Our Area Planning approach looks at a range of feasible strategies to address the need. This includes consideration of demand management to address the issue.

We undertake net present value (NPV) analysis to identify the least cost 'preferred' strategy for the area. This involves costing of the works programs using discounted cash flows. The output of our process is a list of project timings and costs over a 20 year period for each Area Plan. Further information can be found in Planning Standard INV-STD-10024 Economic Appraisal.

Each plan is documented, and describes the context for the plan; identifies the needs that are driving investments; the potential solutions to address those needs; outlines the options that have been considered; and establishes the preferred investment plan for the area based on economic assessment of these options.

3.2 Annual review and initiation of projects

As part of BAU processes, we undertake a review of our Area Plans on an annual basis. The purpose is to incorporate most recent information and to provide the most current list of projects and timings. This review takes into account:

- Latest spatial demand forecast information –We incorporate latest spatial data on demand growth for each of our 225 zone substations and 29 subtransmission substations. The data is normalised for weather and other variables, and incorporates latest information on customer connections and econometric factors. This data is also used in our load flow analysis of our subtransmission feeder network to identify future feeder capacity issues.

- Latest replacement needs - We incorporate latest failure data and performance information to re-assess whether the timing of replacement projects should be changed.

- Delivery projections – We include latest delivery times on projects in accordance with detailed development and delivery schedules.

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[11] We make adjustments as part of our spatial demand forecast to recognise that some of these connections may not proceed even if committed.

[12] To provide a reasonable forecast of expenditure we calculated the probable estimate of capex related to known but uncommitted large connections. Our methodology has been to ascribe a probability to each project, and to multiply this by the expected augmentation costs involved.

[13] We use a similar framework for identifying replacement needs across our network. Further information on our method for developing replacement programs is contained in our Replacement and Duty of Care Plans overview.

The output of the 2013 review is the “2013 Area Plan Review”, which identifies each project and the Area Plan to which it relates. The schedule also lists whether a project has been added, removed or amended as a result of new information or more detailed planning.

The review document is used as a basis for development of capital forecasts. Importantly, the review document provides the trigger to initiate individual projects through to the project delivery stage.

3.3 Additional checks and balances to derive the 2014-19 forecast

To ensure that our forecast expenditure provided a realistic expectation of expenditure for the 2014-19 proposal, we performed a ‘check and balance’ process to ensure we could provide the most realistic estimate of capex for the period, and which met our objective of keeping prices as low as possible. As part of this process, we:

- Calculated other costs not included in the forecasts of an individual area plan such as system property and communication capex.
- Undertook a thorough review of the program to ensure that the forecast was accurate and up to date, and incorporated potential efficiencies so as to minimise price pressures for our customers.

Land acquisition and communication costs

Land costs are considered in the options assessment undertaken in individual area plans. This ensures that we adequately account for all costs associated with feasible options in order to select the least cost solution to address needs. However, for operational purposes, land costs are not identified in the final project list for an Area Plan. Rather, the forecast capex associated with land acquisition is separately accounted for in our system property requirements.

The Area Plans also do not identify the forecast capex associated with communication technologies on the sub-transmission network.

Thorough review of program

In preparing our capex forecast we have undertaken a thorough review of the program to ensure that the forecast capex is accurate, assumptions are up to date, and we have incorporated efficiencies to the full extent possible.

- Deferral opportunities - Although our licence conditions are currently mandatory, Ausgrid took the approach of applying additional risk in some circumstances as described in Section 2.2. with the effect of reducing some augmentation capex. This reflects our expectation that the licence conditions will change during the 2014-19 period. Opportunities to defer replacement projects through prioritisation were examined in assessing replacement needs.
- Efficiencies on forecast costs - We undertook a detailed examination of our cost estimates, including a greater level of detail on our design costs. This includes design options for high value projects such as sub-transmission cables including detailed route assessments.
- Latest data on demand forecasts - We updated our spatial demand forecasts to incorporate latest information based on summer 2012-13 demand and reviewed the program to ensure that project timing was still appropriate to meet demand.

Summary of program

The majority of capex is to replace deteriorated and safety risk assets on the network. Our program also contains some capex to meet the demands of new and existing customers in high growth areas.

We are proposing $1,583 million over the 2014-19 period. The purpose of this section is to provide a summary of the major types of investment on the network.

At a high level it can be seen that replacement comprises the vast majority (90 per cent) of proposed capex for the 2014-19 proposal. Of total augmentation costs, large customers account for 17 per cent of forecast capex. It should also be noted that dual function assets which provide backup transmission services account for $360 million which is almost 23 per cent of the program.

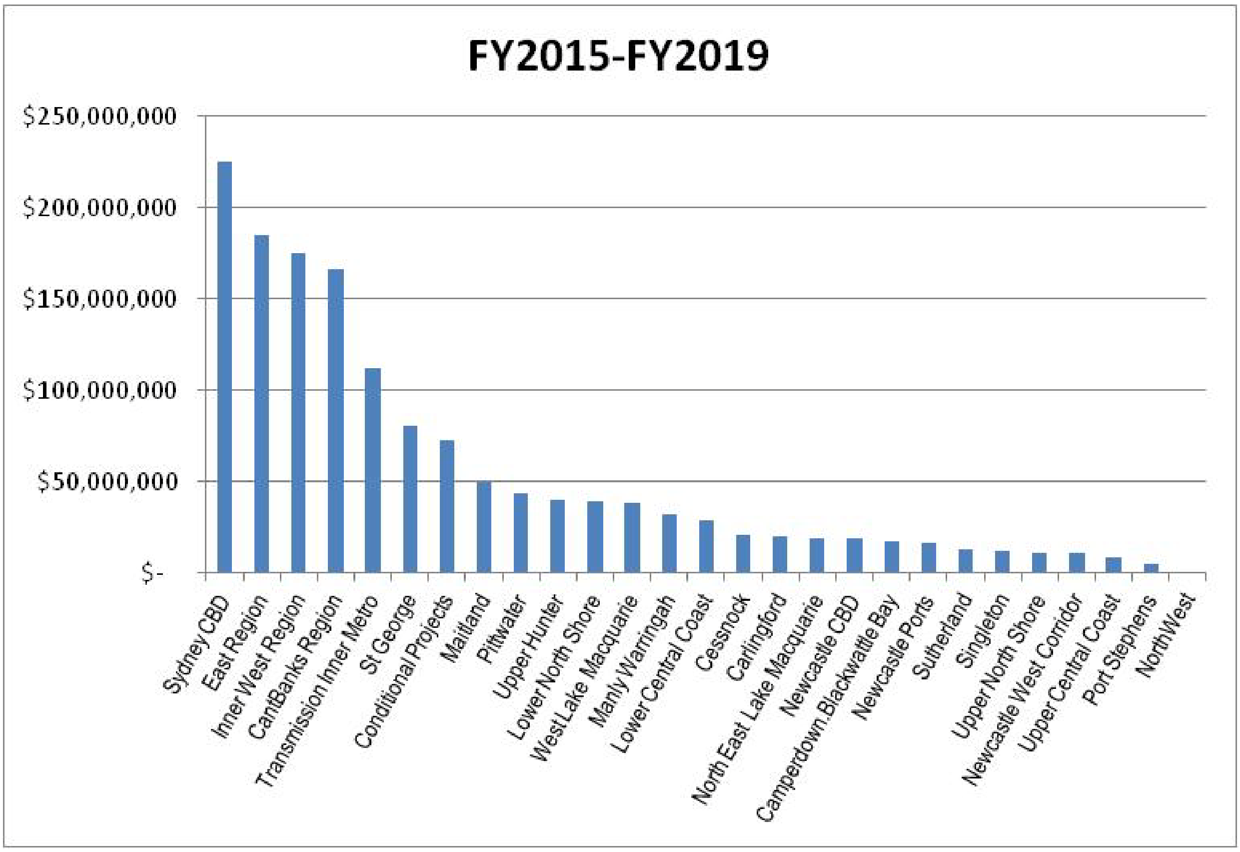
	2014-15 ($'000)	2015-16 ($'000)	2016-17 ($'000)	2017-18 ($'000)	2018-19 ($'000)	Total ($'000)
Replacement	**393,727**	**376,009**	**243,011**	**193,761**	**124,046**	**1,330,554**
Augmentations	**67,722**	**32,795**	**9,312**	**8,837**	**25,404**	**144,070**
Reinforcement	40,899	14,358	3,315	3,947	14,336	**76,856**
Large Customer Connections	2,275	4,170	4,365	4,890	11,067	**26,767**
Other Compliance, Duty of Care, etc	24,548	14,267	1,632	0	0	**40,446**
Strategic Property Plan	**9,994**	**5,808**	**4,847**	**13,447**	**17,279**	**51,376**
Support Costs	**13,549**	**12,842**	**11,160**	**9,632**	**9,583**	**56,765**
Planning Forecasting and Compliance	7,009	6,923	6,505	6,460	6,391	**33,288**
Switching and Control	3,427	3,050	1,917	1,581	1,181	**11,156**
GIS Data Capture	3,113	2,869	2,738	1,591	2,011	**12,322**
Total	**484,993**	**427,454**	**268,330**	**225,678**	**176,312**	**1,582,765**

As part of our supporting documents, we have provided a project list which sets out the proposed timing and cashflows for the projects included in our 2014-19 capex forecast.

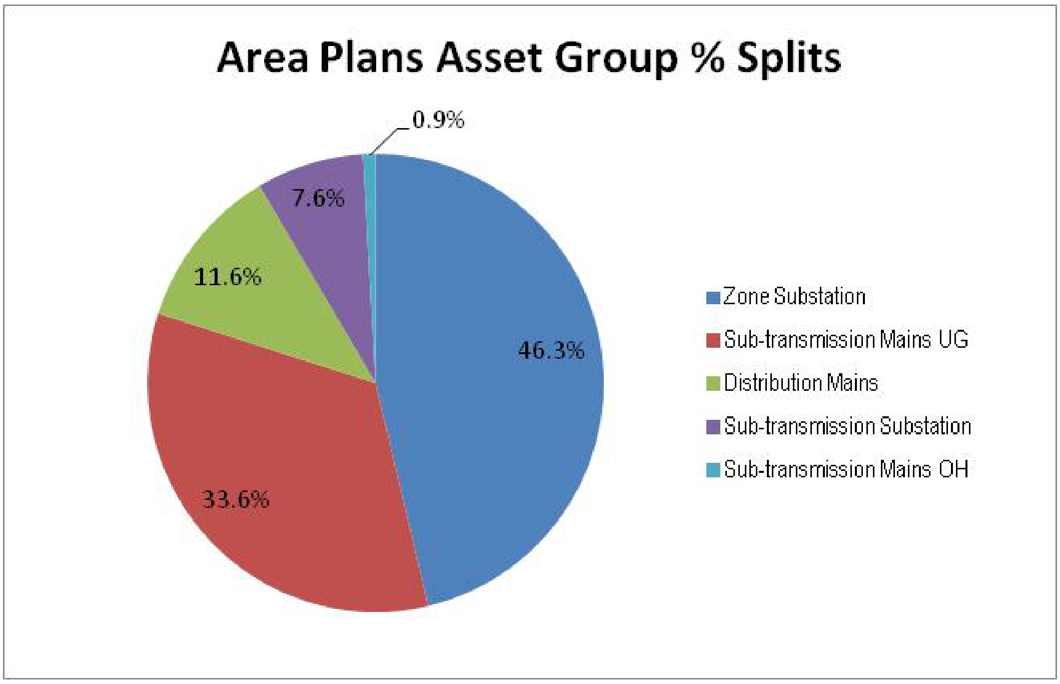
4.1 Investment profile

The diagram below shows that the Sydney CBD, Eastern Suburbs, Inner West and Canterbury-Bankstown areas account for 51% of the total proposed capex. In the Eastern Suburbs, Inner West and Canterbury-Bankstown, the capex relates primarily to a number of significant substation and subtransmission mains replacement projects. The Sydney CBD capex will involve completing the construction of the new Bligh St zone substation and associated feeder works.

Appendix A to this overview provides a summary of the proposed capex for each area, and revisions arising from our more detailed review of timings, design and unit costs. The summaries cover the first five years in each case. In our supporting documents, we have attached the original Area Plan, which sets out the underlying need and options considered at the time that the area was reviewed. The Area Plans provide a 20-year outlook of capital investment in each case.



In terms of assets, zone substations accounts for the most expenditure, followed by 132kV cable. It should be noted that we have also needed to invest $51 million in system property to purchase major substation sites.



4.2 Major programs

Replacement work (condition driven) accounts for about 90 per cent of the proposed capex. Underground subtransmission (132kV and 33kV) cable and substation switchgear replacement are the major elements requiring replacement.

Despite being condition based, these types of projects are not always direct (like-for-like) replacements. In some cases the most cost effective option involves a new installation that address multiple drivers (including capacity issues), or allows load to be transferred away from aging equipment so the equipment can be retired rather than replaced. Following are some key types of replacement driven projects:

- 132kV oil filled cable replacement / retirement. A key example is the replacement of 132kV feeders 92FA, 92FB, 90XA and 90XB with a new pair of cables across the Parramatta River between the suburbs of Homebush Bay and Meadowbank. The use of high capacity circuits enables 4 existing cables to be replaced with 2 new circuits.
- 33kV gas pressure cable replacement / retirement. These cables are typically in sets of three or four circuits from a 132/33kV subtransmission substation, directly connected to 33/11kV transformers at a zone substation. Sometimes it is most cost effective to replace these directly. However, at Enfield it is more cost effective to build a new 132/11kV zone substation and take supply from the nearby 132kV overhead line, 910/911. This approach allows for the retirement of the existing 33/11kV Enfield zone substation, including the three 33kV cable circuits from Canterbury subtransmission substation, and so addresses multiple asset condition based drivers at the zone substation as well as the cables.
- 11kV switchgear replacement / retirement. The 11kV switching equipment at around 30 zone substations (about 15% of our substations) requires replacement or retirement during the 2014-19 period due to equipment condition. Solutions include: replacement in the existing building if practical, replacement in a new building or transfer load to another zone substation and retire the aged 11kV switchgear.

4.3 Estimating costs

As part of our supporting documentation, we have provided material related to how we determined costs associated with undertaking the proposed projects. Works on the sub-transmission network can have a range of costs depending on the work undertaken. For example:

- Brownfield work is far more expensive than new greenfield development.
- Work in highly congested areas such as the CBD is significantly more expensive than other areas.
- The costs of laying sub-transmission cables vary greatly with the route and conditions.

For this reason, the concept of a single unit cost is not appropriate when considering the costs of completing works on the Ausgrid's network. As a consequence, our unit cost methodology is undertaken at a very detailed level, which allows us to accurately estimate costs for a package of works.

4.4 Impact on other plans

The proposed program is expected to have a minimal net impact on current reliability levels. The focus of the program is on maintaining the improved reliability levels and security standards achieved through the 2009-14 period.

The bulk of expenditure over the 2014-19 period relates to the replacement of subtransmission cables and 11kV switchgear. The inherent redundancy of the system means that failures of subtransmission cables will generally not impact on system reliability, unless simultaneous outages occur to several circuits supplying an area. Whilst this is a low probability occurrence it would be expected to result in widespread outages of significant duration.

11kV switchboard failures are sufficiently rare that they are not regarded as "credible" contingencies and subsequently redundancy is not provided to cater for such incidences. On the rare occasions that switchboard failures do occur, they result in widespread, long duration outages. The duration and extent of outages arising from switchboard and cable failures would typically be excluded events for reliability reporting purposes and consequently would not be included within standard reliability statistics or considered as part of reliability plans.

The major potential reliability impacts of the subtransmission works program arise from the provision of additional zone substations or transformer groups which facilitates increased 11kV network segmentation through the formation of new 11kV feeders. Such Increased segmentation in one area is generally offset by increases in network length in other areas resulting from network and customer growth. The net impact of such changes, impacts on 11kV network reliability and is considered in the reliability plan and STPIS targets.

Appendix A Area Plan Summaries

The following table provides a summary of the forecast capex by plan ($ 2013/14). Also following are summaries for each area outlining the basis and details of capex requirements.

Fiscal year	2014/15	2015/16	2016/17	2017/18	2018/19	Overall Result
BPC Project	($'000)	($'000)	($'000)	($'000)	($'000)	($'000)
Transmission Inner Metro	38,739	19,757	14,843	18,420	20,031	111,789
Sydney CBD	53,807	49,032	48,160	38,084	36,154	225,237
East Region	24,731	33,227	33,711	64,489	28,957	185,115
St George	14,274	11,792	20,088	21,104	13,355	80,613
Sutherland	12,203	240				12,443
CantBanks Region	28,604	63,039	45,373	18,135	11,617	166,769
Inner West Region	60,659	78,903	28,491	2,774	4,324	175,151
Camperdown.Blackwattle Bay	3,769	3	530	11,482	1,176	16,960
Lower North Shore	36,477	2,970			20	39,467
Upper North Shore	5,760	3,863	1,632			11,254
Carlingford	1,893	11,521	6,021	281		19,716
Pittwater	9,970	8,910	21,699	2,503	744	43,827
Manly Warringah	4,138	22,546	3,644		1,851	32,179
NorthWest					966	966
Lower Central Coast	13,550	14,571	574			28,695
Upper Central Coast	5,928	2,816				8,743
Newcastle CBD	16,610	1,132	433		517	18,692
Newcastle Ports	6,298	10,107				16,405
Newcastle West Corridor	37	1,113	7,465	978	1,283	10,877
West Lake Macquarie	33,863	4,330	0			38,193
North East Lake Macquarie	5,063	2,316	2,017	8,812	1,156	19,364
Maitland	14,375	18,287	6,356	897	9,647	49,562
Cessnock	8,352	8,775	3,231			20,358
Port Stephens	4,494				157	4,652
Singleton	11,460	902				12,362
Upper Hunter	16,021	3,854	3,890	9,749	6,426	39,940
Conditional Projects	21,971	30,425	4,167	4,890	11,067	72,520
Critical Protection Communications Program	8,401	4,372				12,774
Total Area Plans	**461,449**	**408,804**	**252,323**	**202,599**	**149,450**	**1,474,624**
Property Acquisitions	**9,994**	**5,808**	**4,847**	**13,447**	**17,279**	**51,376**
Total Support Costs	**13,549**	**12,842**	**11,160**	**9,632**	**9,583**	**56,765**
Planning, Forecasting and Compliance	7,009	6,923	6,505	6,460	6,391	33,288
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