5.01

Ausgrid's proposed capital expenditure

Ausgrid

Contents

1 INTRODUCTION

The purpose of this document is to provide a summary of our proposed capital expenditure (capex) forecast for the next regulatory period. It supports our Regulatory Proposal to the Australian Energy Regulator (AER), provides context around our objectives, strategies and processes, and references other supporting documentation that provide further detail on, and justifies, our forecast.

This document should be read in conjunction with 'Chapter 5 – Capital Expenditure', of our Regulatory Proposal.

The capex forecasts in this document include direct costs for projects and programs. Capitalised overheads are shown separately as the capital support costs. All figures in this document are presented in 2018/19 real dollars.

The document has been structured to provide the context in terms of:

- ***Our capital planning process***

  The continued provision of network services that meet the evolving needs of our customers at the lowest cost, whilst ensuring long-term operational viability, remains the strategic objective of our capital investment. This aim is reflected in our capital planning process.

- ***Our alignment with the requirements of the National Electricity Rules***

  Our proposed capex program aligns with:

  i. National Electricity Law
  ii. The AER's requirements with respect to capex forecasts, methodology and assumptions as set out in the National Electricity Rules (Rules) – chapter 6 and schedule 6
  iii. The AER's Expenditure Forecast Assessment Guideline and the Regulatory Information Notice
  iv. Our License obligations.

  In total, we are forecasting to invest $3.1 billion in the 2019-24 period, 1.3 percent less than our expected spend in the current period.

- ***Replacement expenditure***

  Our requirement for replacement capex is forecast to be $1,673 million in the 2019-24 period, which is almost 54% of our total proposed capex. This amount is in line with the forecast spend for the current regulatory period and is broadly consistent with our long-term average.

  Our replacement capex includes 60 major projects (valued at $540 million) on our subtransmission network, and 203 replacement programs (valued at $1,132 million) predominantly on the distribution network. This capex is used to replace or extend the life of existing network assets as their ability to safely and reliably operate diminishes.

- ***Growth expenditure***

  Growth capex is required to meet our licence obligations to connect and maintain the quality and security of supply where loads are expected to increase.

Our requirement for growth capex in the 2019-24 period is forecast to be $241 million.

This is at similar levels to our forecast expenditure in the current period. Growth capex in the 2019-24 period is driven primarily by augmentation of subtransmission networks to support significant transport and information technology sector growth, combined with underlying localised growth on the high and low voltage network, as we gradually use up the capacity headroom created by the former licence conditions.

Our growth capex includes new connections capex of $52.2 million, augmentation major projects of $73.9 million, distribution augmentation projects valued at $98.9 million, and $16.4 million in distribution reliability investment.

Direct capex on growth comprises around 8 per cent of our proposed capex program. In the current 20014-19 period we will invest less than the regulatory allowance, and significantly less compared to the 2009-14 period, with an average of less than $50 million per annum compared to previous peaks of over $600 million per annum. In accordance with our connection policy we are expecting connecting customers to fund $585 million in connection costs directly attributable to them during the 2019-24 regulatory period, which will be reflected as contributed assets. Contributed assets replace capex that Ausgrid and the broader customer base are therefore not required to fund.

- ***Non-network expenditure***

  We propose to invest $548 million on non-network capex during the 2019-24 regulatory control period, which represents 18 per cent of our proposed total capex.

  Non-network capex comprises expenditure on assets that are not part of Ausgrid's network but are required to maintain, develop and support it. The non-network programs include Information Communication and Technology (ICT), the majority of the Operational Technology and Innovation programs (OTI) portfolio, fleet and plant. The focus of our non-network programs is to modernise our business in order to improve customer outcomes. The non-network capex program includes continued investment in ICT system upgrades to protect against cyber attack and meet cyber security compliance obligations. It also includes plans to refurbish our aged depots and offices which are at risk of non-compliance with workplace safety legislation, and to meet turnover and modernisation needs for fleet and plant.

- ***Capital program support cost***

  Capital program support costs are forecast to be $621 million for the 2019-24 period. This makes up 20 per cent of the total capital program.

  Capital program support costs include network planning costs and capitalised overheads such as management and corporate costs. This expenditure is required to support and deliver the replacement, growth and non-network capital programs. Capital support costs for the 2019-24 regulatory control period have been forecast based on the current level of support costs to direct capex labour, which stands at 64 per cent.

  Capital program support costs have decreased significantly since 2009. This has been driven by sustainable cost reductions arising from Ausgrid's Transformation Program. Capital support costs in the 2019-24 period will continue to fall, although less markedly, and this has been reflected in the forecast expenditure proposed.

We have worked hard to develop a capex forecast that is prudent and efficient, and balances the concerns and feedback from our stakeholders with our obligation to operate and manage the requirements to maintain a safe, reliable and secure network. We have taken significant steps to improve our efficiency from previous regulatory periods and we have made provision for further efficiencies to be gained over the 2019-24 period. To maintain our focus on identifying further

efficiencies we have factored in a 2% per annum decrease in labour costs for each year of the upcoming regulatory period, leading to a 10% reduction in 2024. This efficiency has already been factored in to the capex forecast and it is up to us to ensure this target is met.

Table 1 below presents the 15-year trends in actual and forecast capex from 2010 to 2024.

Table 1. Trends in actual and forecast capex

Category ($m, real FY2019)	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	F23	FY24
Replacement	565	657	795	602	370	313	300	283	360	415	399	345	290	306	333
Augmentation	452	596	597	385	181	56	35	16	25	16	27	52	47	30	34
Connections	59	71	78	74	54	43	16	8	9	9	11	13	11	10	8
Support	228	242	288	212	179	171	122	126	127	140	139	127	120	117	119
Network total	**1,304**	**1,566**	**1,758**	**1,273**	**784**	**583**	**473**	**433**	**521**	**580**	**576**	**537**	**468**	**463**	**494**
ICT and OTI	61	68	43	32	29	23	13	24	63	109	50	45	41	40	39
Property	113	65	50	23	33	14	11	12	34	102	38	44	46	44	36
Fleet	35	38	39	18	10	8	3	2	23	17	18	15	20	23	18
Plant	10	9	10	6	5	2	-	1	1	6	5	6	6	6	5
Non-network total	**219**	**179**	**142**	**78**	**77**	48	27	**39**	**121**	**234**	**112**	**111**	**113**	**113**	**98**
Total capex	**1,523**	**1,745**	**1,900**	**1,351**	**861**	**631**	**500**	**472**	**642**	**814**	**688**	**648**	**581**	**576**	**592**

Note: Numbers may not add to totals due to rounding.

2 CAPITAL PLANNING PROCESS

2.1 Objectives

Our organisational objectives are aligned with the National Electricity Objective (NEO) and our planning process guides the way in which we manage our assets to achieve them. They aim to promote efficiency in the way we invest in, operate and use electricity services, particularly with respect to:

- price, quality, safety and reliability and security of supply of electricity
- the reliability, safety and security of the national electricity system.

Table 2 outlines our corporate and asset management objectives and the specific capital planning objectives and measures.

Table 2. Capital planning objectives and measures

Organisational objective	Asset management objective	Capital planning objective	Capital planning measures
Keep the network safe for the public, customers and workers	Minimise the likelihood of safety incidents associated with the network assets or activities (public, customers and workers)	Eliminate safety hazards 'so far as is reasonably practicable' (SFAIRP). If it is not reasonably practicable to eliminate safety hazards, then reduce the risk to 'as low as reasonably practicable' (ALARP)	• Safety incident performance • Safety risk assessment (ALARP/SFAIRP) • Asset failure trends
Maintain current levels of network reliability and security	Minimise the likelihood of customer interruption and maximise the ability of the network to restore supply after an interruption.	Where the failure of an asset has the potential for unacceptable consequences, identify, evaluate and select appropriate action to be taken as close to the end of its functional life as possible, yet prior to the asset actually failing. Identify capacity constraints that will inhibit growth or prevent the network from being switched to restore supply following an interruption.	• Reliability performance (SAIDI/SAIFI) • Performance against Guaranteed Service Levels (GSL) • Asset failure trends • Net Present Value of unserved energy vs capex
Maintain affordability for customers	Maximise cost efficiency and competitiveness of capital costs	Use market tested unit costs and analysis to select the treatment that will provide an acceptable and sustainable outcome with the best cost-benefit.	Peer benchmarking, i.e. a reasonableness test of underlying unit costs (capex, opex)
Sustainable capital expenditure	Optimise the balance of total expenditure and risk	Investments targeting highest risk assets	System risk performance and trending

2.2 Strategy

We are committed to making prudent, efficient and commercially sustainable network investments. Our aim is to continually provide the functionality required to meet our specified performance and compliance requirements in a sustainable manner.

Table 3 sets out our capital planning strategies for achieving our organisational objectives.

Table 3.- Capital planning strategies

Organisational objective	Capital planning strategy
Keep the network safe for the public, customers and workers	Conduct risk assessments on the potential exposure from network assets or activities by incorporating leading and lagging information into the decision making process.
Maintain current levels of network reliability and security	Assess the impacts from loss of supply and consider system and non-system solutions. The benefit to customers in terms of reliability should outweigh the cost of mitigating any issue with an asset.
Maintain affordability for customers	Undertake whole-of-life cost analysis, assessment of risks and project costs for different options, including accepting the risks of a "do nothing" approach where appropriate.
Sustainable capital expenditure	Apply a risk-based approach to assessing the need for and prioritising investments. Target the highest risk assets first.

2.3 Our operating environment

Our operating environment is subject to increasing complexity. Technological advances and associated uncertainty are disrupting our business as usual practices. This is creating an operating environment that constantly requires us to consider and adapt to the ongoing impact of emerging technologies while ensuring the continued safe, reliable and secure operation of an ageing network.

Some of the factors that influence our ability to economically maintain the safe, reliable and secure operation of an ageing network include:

- Maintaining a truly customer-centric organisation that delivers industry best-practice customer service to ever increasing customer expectations and needs,
- A significant number of large customer connections associated with infrastructure investment for transport and growth around transport hubs,
- Emerging technologies requiring development of network components, configuration, monitoring and control systems,
- Evolving demand profiles and uncertainties associated with electric vehicle uptake, battery storage, distributed generation penetration, and isolated network development,
- Maintaining network risk at an acceptable level while complying with licence conditions in an increasingly capital constrained and price-sensitive environment, and
- Aid decision making and the management of forecasting and planning functions associated with an evolving network, by fully integrating and optimising systems to allow for greater data analytics.

Despite these operating environment challenges, our strategic objective remains the provision of network services that meet needs of our customers at the lowest cost, whilst ensuring long-term operational viability. We achieve this through:

- Considering tailored treatment options (e.g. life extension, thorough refurbishment/reinforcement, or replacement) when targeting investment, addressing the highest risk assets as a priority, and monitoring the performance and subsequent change in network risk,

- Considering ways to exploit existing network capacity (e.g. through load transfers, downstream network reconfiguration), and network alternatives (e.g. distributed battery storage, demand side management, network intelligence investment), before considering investments that grow the network.
- Using formal customer connection applications to optimise network investments by giving appropriate consideration to our obligation to connect, long-term supply needs, and security of supply requirements.
- Increasing use of demand management and innovative temporary solutions to defer investment where it is reasonably foreseeable that improvement in network or customer technology will present greater options for future decision making and improve costs for customers.

2.4 Our network

Our power supply network is summarised in our State of the Network diagram provided in Figure 1 and consists of:

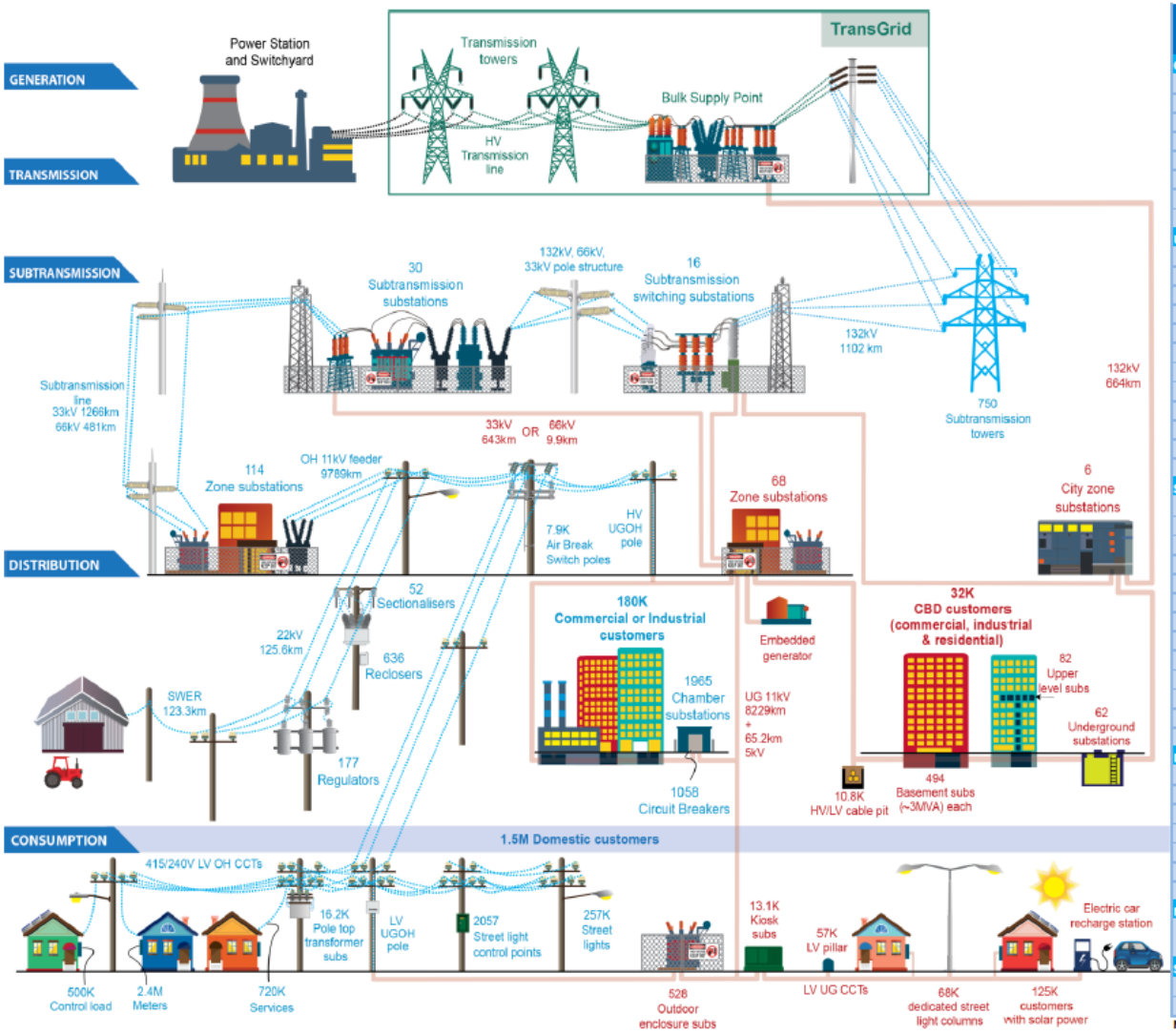
- a transmission and subtransmission system of 33kV, 66kV and 132kV assets,
- a high voltage distribution system comprising predominantly 11kV assets, as well as some 33kV, 5kV and 12.7kV Single Wire Earth Return assets,
- a low voltage distribution system of 400V assets (230V single phase),
- geographically dispersed transmission and subtransmission substations, zone substations and distribution substations across voltage levels from 132kV to 400V,
- associated control, protection, and telecommunication systems to manage the network, and
- metering and public lighting assets.

The network is described in terms of the quantity of assets that form the network, their age, the quantity exceeding their standard life, and the number of assets in high risk bushfire danger zones. The figure is intended to provide a high-level context and overview snapshot of the network.

Figure 1. State of the Network

State of the Network

February 2018



LEGEND	TransGrid	Ausgrid
	Power supply	Overhead Supply
		Underground Supply

Indicative asset counts as recorded in corporate systems.
Not validated for external reporting purposes.

Asset Category	Average Age	Std Life	% over Std Life	Qty	Units of M	Bushfire %
Overhead						
132 kV OH ccts	37.1	45	46.8%	1,102	km	66%
33 & 66 kV OH ccts	34.4	45	43.7%	1,716	km	56%
11/22 kV OH ccts	35.1	45	39.8%	10,038	km	61%
- Steel/ACSR/Quince	41.0	45	47.1%	2,211	km	73%
LV OH ccts	43.4	45	59.0%	13,074	km	21%
LV OH dedicated cct - lighting	51.9	45	79.7%	6,081	km	11%
Poles	36.2	45	42.3%	446,505	No	27%
Services Overhead	28.4	35	40.2%	720,016	No	17%
Underground						
132 kV UG cct - oil	43.7	45	36.4%	359	km	5%
132 kV UG cct - other	7.7	45	3.7%	305	km	4%
66 kV UG cct	4.0	45	1.1%	10	km	57%
33 kV UG cct - gas	51.0	45	81.9%	108	km	1%
33 kV UG cct - other	40.9	45	53.1%	535	km	9%
5/11 kV UG cct	32.3	60	9.7%	8,294	km	14%
LV UG cct	27.6	60	4.6%	6,163	km	22%
- CONSAC	43.6	60	2.5%	712	km	10%
- HDPE	53.3	60	18.6%	139	km	4%
LV UG dedicated cct - lighting	47.5	60	57.9%	1,270	km	13%
LV pillars	23.4	60	0.0%	57,383	No	34%
Services Underground	29.2	60	5.7%	232,057	No	32%
Substations - ZN & TS						
Sub-transmission Substation	42.7	60	15.2%	46	No	33%
Zone(ZN) Substation	38.1	60	14.3%	182	No	30%
City ZN Substation	28.9	60	0.0%	6	No	0%
132 kV CBs ZN & TS	8.6	45	1.2%	603	No	19%
66 kV CBs ZN & TS	7.7	45	0.0%	139	No	32%
33 kV CBs ZN & TS	23.9	45	30.6%	924	No	24%
5/11 kV CBs ZN	15.5	45	11.1%	4,003	No	17%
5/11 kV Switchboards ZN	30.7	45	34.8%	5,425	No	17%
Sub-transmission Transformers	29.3	50	6.7%	85	No	21%
132/11 kV ZN Transformers	16.5	50	8.5%	180	No	17%
66/11 kV ZN Transformers	25.8	50	10.0%	44	No	32%
33/11 kV ZN Transformers	32.1	50	27.1%	260	No	26%
Other (ind. Asset Intangibles)	0.0	-		-	-	0%
Distribution Centres - DC						
- Pole Substation	31.0	40	32.1%	16,222	No	56%
- Kiosk Substation	22.5	40	18.5%	13,128	No	15%
- Outdoor Enclosure Substations	40.9	40	54.1%	528	No	6%
- Chamber Substations	34.8	40	39.1%	2,603	No	3%
5/11 kV CBs DC	29.9	45	26.3%	2,460	No	3%
5/11 kV Switchboards DC	55.0	45	65.5%	847	No	0%
Distribution Centre Transformers	25.2	45	14.4%	34,110	No	32%
Meters						
Three Phase Meters (Types 5 & 6)	11.0	25	-	210,178	No	-
Single Phase Meters (Types 5 & 6)	26.5	25	-	2.123M	No	-
Streetlights						
Lights & Brackets (Ind. Connections)	35.9	20	16.2%	257,678	No	16%
Light Poles & Columns	28.7	45	29.7%	65,225	No	22%

Notes

1. Average Age from Asset Investment Outcomes (AIO) Dashboard and GIS extracts as at early February 2018.
2. Standard Life from NSW Treasury Guidelines 2002.
3. Distribution Substation numbers include control points.
4. Zone Substation supply is nominated as overhead if one or more supply feeders is overhead.
5. STS and ZN Transformers extract from AIO Dashboard as at early February 2018.

2.5 Planning

Our annual capital planning process is an integral element of the way we manage our assets and has been used to derive the capex forecasts for the 2019-24 regulatory period. We develop a rolling ten-year forecast of capital works on an annual basis. Table 4 provides a summary of the process. In the sections below, we show how it was used to derive the capital forecasts for 2019-24.

Table 4. Our capital plans and alignment to AER capex categories

Key input	Description	Replacement	Growth	Non-network
Area Plans	We identify major projects for our subtransmission network based on analysis of drivers such as asset condition, local peak demand growth, reliability, compliance issues and major customer connection activity.	✓	✓	
Replacement Plans	We identify replacement programs for distribution assets and piecemeal elements of our subtransmission network (which are not covered by Area Plans) based on asset condition and compliance issues.	✓		
Distribution Capacity Plans	We identify augmentation and connection capex for the high voltage and low voltage network based on local network capacity and the ability to supply peak demand. This also includes programs to address existing reliability issues (including licence compliance) on parts of the network that are not addressed by other programs or projects.		✓	
Non-network Plans	We identify ICT, OTI, property, fleet and plant programs based on assessment of compliance obligations, and the need to support business activities in efficient and innovative ways that improve delivery of services to achieve customer outcomes.			✓

The types of investment plans are each described in greater detail below.

a. Area Plans

We take a holistic approach to capital forecasting, looking at overall subtransmission network performance based on a risk assessment approach to assess and develop, where necessary, investments in the form of demand management initiatives or major projects.

We take into consideration asset condition, local peak demand growth, reliability, compliance issues and major customer connection activity. We then develop strategic network plans for 28 defined geographic areas, covering Ausgrid's network of 33kV – 132kV feeders, zone and subtransmission substations. The purpose of the Area Plan is to identify those cases where it may be beneficial to develop more holistic approaches which optimise the solution, avoid duplication of scope and support efficient delivery packaging.

Over recent years, the Area Plan process has evolved to include a risk-based probabilistic approach. Based on the most recent demand forecast information, asset condition and network performance, a cost-benefit analysis is developed to compare network and non-network (demand management) options to determine the preferred solution and the optimal timing of the project. This approach mitigates multiple facets of network risk and maximises the net economic benefit, which satisfies the RIT-D guideline requirements. As a consequence, an Area Plan review is now triggered by the risk assessment of the area rather than a five-year cycle of review as was previously the case. In addition to the Area Plan process, a yearly review of the preferred strategy is conducted

based on the latest available information to ensure it still provides the greatest net economic benefit. This approach maximises the efficiency of our future investment decisions.

In parallel with the Area Plan, major projects, smaller individual projects and programs are identified and considered on their individual merits. Where appropriate, they are consolidated with replacement or distribution capacity programs to avoid duplication.

This approach has the benefit of both developing more efficient combined solutions and addressing the risk of duplication of projects or programs across the network.

b. Replacement Plans

Replacement expenditure reflects the direct costs of capital works associated with replacing or extending the life of an existing network asset. We replace assets when they fail in service (reactive replacement - functional failure), or when our analysis shows that the customer benefit from mitigated safety, reliability, security and environmental risks exceed the costs of replacing the asset (proactive replacement – conditional failure or compliance needs). Our programs are based primarily on condition assessment; however, we also include consideration of other information such as asset risk and failure history particularly for poor performing asset sub-types.

Once we have developed a bottom-up forecast of the replacement needs, a top-down review is undertaken considering trends of assets over their standard life, using the AER's repex model to verify that these bottom-up forecasts are reasonable and in line with historic levels.

c. Distribution Capacity Plans

These are the direct costs of capital works to install new assets on our shared distribution network to meet demand at peak times, or to meet licence conditions relating to reliability. Further information on our strategies for growth capex and our programs are set out in Section 5. We have further divided our growth capex into 2 sub-categories as follows:

- Augmentation capex: This includes cases where we increase capacity or rearrange the shared distribution network in response to organic load growth (i.e. when the works are not in response to a specific connection application), to take advantage of existing capacity or for overall optimisation. This may be driven by general peak demand growth, existing capacity shortfalls or unreliable assets.
- Connection capex: Despite the NSW contestability framework and Ausgrid's connection policy, which generally requires connecting customers to fund and construct assets required for their connection, there are circumstances where Ausgrid funds the costs of connection driven, predominantly shared network augmentations. These include those related to smaller customers, where customer-funded connection costs are limited or standardised (eg customers <100A) and so do not fund the full cost of connection impacts directly. This category also includes the very small number of cases where connections, or components of connections are made non-contestable for safety or network integrity reasons and where Ausgrid carries out and funds the non-contestable component.

d. Non–network Plans

These are the direct costs of capital works for Information and Communication Technology (ICT), Operational Technology and Innovation (OTI) projects, non-network property, fleet and plant that support our network activity, meet corporate obligations or drive efficiency. Further information on our strategies and non-network programs is contained in Section 6.

We also forecast capital program support costs (overheads) for indirect costs that are not attributable to a specific project. We use our Cost Allocation Method (CAM) as a basis for allocating our total overheads to capital and operating expenditure. These costs include network overheads

such as planning and system control, and our corporate overheads. Section 7 provides more detail on our capital overheads.

Planning Approaches for Network Capex

Our planning approaches are reflected in business cases that assess the need, consider the options and timing, and provide a cost estimate for the works.

For major projects, our business case assessment is extensive and detailed.

When considering the subtransmission network, we apply a risk based probabilistic planning approach. In doing so, we evaluate current unserved energy instances and forecast the potential for insufficient supply in the future. To do so, we take into account:

i. Probability of equipment failure
ii. Network peak demand forecast
iii. Load duration curves
iv. Potential load transfer capability
v. Supply recovery time.

We also quantify the safety or environmental risks for individual major projects. Major connections impacting the development of the subtransmission network are considered as part of the planning process.

Our planning approach examines all feasible options, including non-capex solutions such as corrective maintenance. We specifically consider whether demand management can delay individual projects. For replacement capex we consider whether demand management can be used to mitigate reliability incidents, and consequently defer capital investment.

We use individual condition assessment, trends and high level forecasting tools for asset categories that are comprised of large volumes of lower value assets, such as poles. In general, we examine the individual condition of assets and where it is not cost effective, the condition of a population of assets using condition measures such as failure rates, rather than individual condition assessments.

For growth capex associated with high voltage and low voltage assets, we apply modelling approaches that consider local network capacity and the ability to supply forecast peak demand under normal conditions. We also model the ability of the high voltage network to provide backup supply to customers during situations such as localised outages.

The reliability programs address existing poor performance of assets or the network that are not meeting licence conditions and that are not addressed by other programs.

2.6 Cost estimating

The unit cost estimates for the 2019 -24 regulatory period are characterised by transparency and a greater level of granularity, demonstrating improvements in approach and method. Our unit cost methodology incorporates efficiencies that have been identified from our previous experience with completing works of a similar nature.

For major projects, we use site specific estimates that provide a granular estimate of the costs for each stage of the project.

For programs containing a large volume of assets, we develop an average unit cost based on a typical scope for the program. We have improved our unit cost methodology to incorporate regional differences in delivering capital programs across our network. Our experience is that the cost of undertaking capital projects in the CBD and inner metropolitan areas of Sydney can be significantly higher than other parts of our network. By developing costs on this basis, we are now able to

provide stakeholders with more transparent information to understand any potential cost differences with our peers.

More information on our unit costs and cost escalation are provided in the following sections.

2.7 Cost Escalators

Capex is escalated based on the following cost categories:

- Labour
- Contracted services, which is further broken into:
  - Construction
  - General labour services
  - Professional services.
- Materials and land

Real cost escalators have been provided by BIS Oxford Economics (see Attachment RIN09). The escalation of Land related costs has been considered separately. The sections below outline the escalators and how they have been applied to capex.

Labour

Ausgrid proposes to use the NSW Electricity, Gas, Water and Wastewater Services Wage Price Index as the most appropriate forecast of real labour escalation. BIS Oxford Economics has forecast real increases as shown in Table 5. These have been applied to internal labour costs for the capex program.

Table 5. Forecast real increases in labour costs

Category	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Labour (EGWW)	0.52%	0.95%	0.88%	1.37%	1.74%	1.73%	1.33%

Source: BIS Oxford Economics, Attachment RIN09

Forecasts for this index are above general wage inflation due to several factors, including demand for skilled labour increasing as investment in the sector increases[1]. More detail is provided in Attachment RIN09.

Contracted Services

Construction

This category includes costs for contractors to build subtransmission substations and zone substations.

Ausgrid proposes use of the Non-Hydro Electricity Construction IPD index as the most appropriate forecast of real escalation for construction costs. It combines wages and key inputs such as copper and steel as they apply to the electricity industry. BIS Oxford Economics has provided a forecast of this index over the regulatory period as shown in Table 6.

Table 6. Forecast real increases in construction costs

Category	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Construction	-0.04%	-1.63%	-1.85%	-1.78%	-1.98%	0.55%	0.74%

[1] BIS Oxford Economics, Real Cost Escalation Forecasts to 2024/24, September 2017, p1.

The forecast indicates real reductions over the initial years of the regulatory period, followed by slight real increases. Overall, this forecast slightly reduces the real capex of the costs to which it is applied.

General labour services

This category includes the costs of contract labour associated with installing underground subtransmission mains; distribution substations and mains; and undertaking communications or system IT works. Major activities include contract cable laying, traffic management and general labouring services.

Ausgrid proposes the use of the NSW wage price index as the most appropriate forecast for general labour inflation. BIS Oxford Economics has forecast real increases as shown in Table 7.

Table 7. Forecast real increases in general labour costs

Category	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
General labour	0.51%	0.33%	0.02%	0.67%	1.01%	1.07%	0.78%

Professional services

This category includes the costs for contractors working on non-system ICT requirements in the areas of software, hardware and ICT facilities management. Ausgrid proposes use of the Computer System Design and Related Services index as the most appropriate forecast for inflation of professional services prices. BIS Oxford Economics has forecast real increases as shown in Table 8.

Table 8. Forecast real increases in professional services costs

Category	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Professional services	0.55%	0.50%	0.60%	1.35%	2.10%	1.92%	1.59%

Application of real cost escalators

The above escalators are mapped to asset categories based on the type of activity involved to complete works in those categories. Table 9 demonstrates how the escalators are mapped to the asset categories.

Table 9. Mapping of escalators to asset categories

Asset category	Escalator applied
Subtransmission and Zone Substations	Non-Hydro Electricity Construction IPD
Distribution Substations	General labour escalator is weighted to account for the share of labour costs in these asset categories. This comprises approximately 83 per cent. No real cost escalation is applied to the remaining 17 per cent of costs.
Subtransmission Overhead	
Subtransmission Underground	
11kV Overhead	
11kV Underground	
Communication Cable	
Communication Equip	
Other	Internal labour (EGWW)
Non-System: IT Software	Professional services
Non-System: IT Hardware	Professional services
Non-System: IT Facilities Management	Professional services

Materials & Land

In the past Ausgrid has built up materials escalation using forecasts of input costs and weightings of those inputs in equipment used to build and replace the network. For the forthcoming regulatory period this method yields a marginal real cost increase, however Ausgrid has taken the decision not to apply real cost escalation to materials except where it applies to land. BIS Oxford Economics has forecast real land price increases as shown in Table 10.

Table 10. Forecast increases in real land prices

Category	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Materials (non-land)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Land - Suburban	6.86%	3.09%	3.32%	4.13%	4.88%	5.52%	3.96%
Land - Industrial	1.70%	1.65%	1.75%	1.59%	0.67%	-0.08%	-0.34%
Land - CBD	8.20%	6.96%	6.17%	4.57%	0.77%	-1.49%	-2.07%

2.8 Investment prioritisation

Risk based investment prioritisation is one of the key stages in Ausgrid's governance process.

Ausgrid has a process to develop a risk-prioritised network-capital investment portfolio. The outcome of this process is the development of a Portfolio Investment Plan (PIP), representing the risk based capex forecast.

The ability to prioritise investments is an important factor in the development of our portfolio investment plan. The methodology we use for prioritisation has been developed to be a consistent and efficient way to transparently articulate the risk outcome associated with a particular investment scenario. The portfolio of needs (represented as projects and programs) are in the first instance ranked based on weighted risk scores derived from the application of the 'Capital Allocation Selection Hierarchy' (CASH) process. The CASH methodology involves the assessment and prioritisation of projects and programs according to the level of associated risk in order to develop recommendations for an optimal investment portfolio. The network risks considered in CASH are:

- Network asset condition;
- Public safety, environmental or regulatory impact;
- Network initiated fire risk;
- Network reliability impact;
- Community impact;
- Work health safety – employee risk; and
- Network capacity implications.

The weighted risk scores applied through the CASH process are further assessed to address avoidable risks in the network that would not necessarily be identifiable through the CASH process.

The objective of the prioritisation process is to identify those opportunities where targeted investments will maintain an acceptable level of system risk, whilst also ensuring that investments are prudent and mindful of the need to keep the cost of network services affordable for our customers. The prioritisation process is conducted in parallel with our planning processes, and each informs the other to help arrive at the resulting capital expenditure forecast.

Ausgrid's investment governance committees review the resulting portfolio and provide an initial top-down challenge process. This process tests the projects and programs, both for consistency of risk prioritisation and for deferral risk.

Further information about the prioritisation process can be found in the following documents:

- Attachment 5.03 Description of the Business Planning and Consolidation (BPC)

- Attachment 5.04 Prioritisation Investment Plan (PIP) process description
- Attachment 5.05 Investment Governance Framework.

2.9 Delivery

A key input into the development of the investment program is the Network Resource Demand (NRD) Plan. This plan considers the resources required to deliver the network investment portfolio, taking into consideration the work program, delivery models, utilisation rates and productivity requirements.

The resourcing and delivery of the capex program is discussed in Chapter 5 of our submission and further information can be found in Attachment 5.12 Resourcing and Delivery Strategy for 2019-24 period.

3 ALIGNING TO THE RULES

3.1 Capex objectives and compliance

We have prepared our capex forecast in keeping with what is required to achieve the capex objectives as set out in the NER. All forecast capex in Ausgrid's Regulatory Proposal has been treated in accordance with the Ausgrid's Finance Policy - Capitalisation (Attachment 5.22). There is no capex within the forecast that should have been treated as operating expenditure for 2019-24 period.

Table 11 below summarises the NER capex objectives which we have addressed via our proposal.

Table 11. Our compliance with the capex objectives

Capex objective	Rule	Comment
Meet or manage the expected demand for SCS	**6.5.7(a)(1)**	We prepared our demand projections by assessing historical demand trends and modelling the future demand, giving consideration to known load developments and econometric drivers as well as other key influencing factors such as emerging technologies, and network operating model advances. The demand forecast provided a key input to the capital expenditure forecast.
Comply with all applicable regulatory obligations or requirements associated with the provision of SCS	**6.5.7(a)(2)**	We are committed to maintaining our regulatory obligations though sustainable investment in our network.
Maintain the quality, reliability and security of supply of SCS, as well as the reliability and security of the distribution system through the supply of SCS	**6.5.7(a)(3)**	We manage our assets in a manner that ensures that the quality, reliability, and security of supply of our network are maintained.
Maintain the safety of the distribution system through the supply of standard control service	**6.5.7(a)(4)**	We manage our assets in a manner that ensures the safety of our workers, the public and the environment are maintained.

3.2 Capex criteria and factors

In determining whether the AER accepts our capex forecast, it must have regard to capex criteria set out in the NER. Table 12 shows how our capex forecast reflects these criteria.

Table 12. Our regard for the capex criteria

NER Capex criteria	Rule	How we reflect the capex criteria
Reflects the efficient costs of achieving the capex objective	**6.5.7(c)(1)(i)**	Ausgrid's unit rates are decreasing on average when compared to its historical values while maintaining safe and reliable levels of service
Reflects the costs that a prudent operator would require to achieve the capex objective	**6.5.7(c)(1)(ii)**	Ausgrid's unit rates are generally in line with or below industry benchmarks
Reflects a realistic expectation of the demand forecast and cost inputs required to achieve the capex objectives	**6.5.7(c)(1)(iii)**	Ausgrid uses well developed modelling of the various drivers of activity and network needs to inform its capex requirements. Ausgrid's cost inputs are efficient when market tested

In deciding whether the AER accepts our capex forecast, it must also have regard to capex factors set out in the NER. Table 13 below shows how our capex forecast reflects these criteria.

Table 13.- Our regard for the capex factors

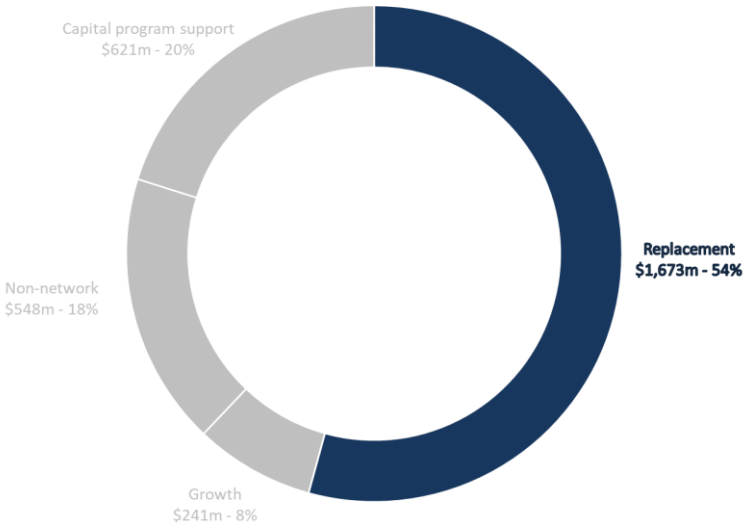
NER Capex factor	Rule	How we have had regard for the capex factors
The most recent annual benchmarking report that has been published under rule 6.27 and the benchmark capex that would be incurred by an efficient DNSP over the relevant regulatory control period	**6.5.7(e)(4)**	Our capital costing methodology follows a process of increasing accuracy as the level of engineering definition increases over the project development lifecycle. The costing methodology relies on market tested costs and benchmarked historical costs as appropriate to provide the most reliable expenditure forecasts. Volume forecasts are based on site specific scoping for major projects and modelled projections for volumetric investment requirements. We have given regard to benchmark unit rates for assessable repex via application of the AERs repex model and comparison with our proposed repex.
The actual and expected capex of the DNSP during any preceding regulatory control periods	**6.5.7(e)(5)**	Our capex forecast has been developed in the context of current expenditure and comparisons made across the categories of replacement, growth, non-network and support costs. Where there are changes in the profile from preceding regulatory periods, we have identified the underlying drivers so that these can be analysed further and better understood.
The extent to which the capital expenditure forecast includes expenditure to address the concerns of electricity consumers as identified by the DNSP in the course of its engagement with electricity consumers	**6.5.7(e)(5A)**	Customer consultation has been a key consideration in the development of our capex forecast. We have responded to stakeholder and customer research with a strategy to not only meet the regulatory requirements, but to incorporate responses to further customer expectations where clearly desired by customers and consistent with the other NER capex criteria/factors.
The relative prices of operating and capital inputs	**6.5.7(e)(6)**	We have analysed the relative prices of operating and capital inputs extensively to understand the underlying drivers so that we can direct our attention to key items. We continue to apply downward pressure to prices, with forecast prices being more efficient than our historical costs. This reflects our continual efforts to improve our efficiency.
The substitution possibilities between operating and capital expenditure	**6.5.7(e)(7)**	Our proposed capex is a result of rigorous options analyses which include consideration of operating expenditure as a substitute for capex. The preferred solution is selected based on its ability to: maintain network safety, security and quality of supply standards, meet our licence obligations, and be efficient and cost-effective.
Whether the capital expenditure forecast is consistent with any incentive scheme or schemes that apply to the DNSP under clauses 6.5.8A or 6.6.2 to 6.6.4	**6.5.7(e)(8)**	Our forecasting approach and the resulting capex forecasts are consistent with the design and objectives of the Capital Efficiency Sharing Scheme (CESS) and the Demand Management Incentive Scheme (DMIS). No incentive scheme or schemes under clauses 6.5.8A or 6.6.2 to 6.6.4 apply to our capex forecast.
The extent the capital expenditure forecast is referable to arrangements with a person other than the DNSP that, in the opinion of the AER, do not reflect arm's length terms	**6.5.7(e)(9)**	All capex forecasts are referable to Ausgrid and reflect arm's length terms.
Whether the capital expenditure forecast includes an amount relating to a project that should more appropriately be included as a contingent project under clause 6.6A.1(b)	**6.5.7(e)(9A)**	Our capital expenditure does not include an amount relating to a project which should more appropriately be included as a contingent project under clause 6.6A.1(b)

NER Capex factor	Rule	How we have had regard for the capex factors
The extent the DNSP has considered, and made provision for, efficient and prudent non-network options	**6.5.7(e)(10)**	Non-network options play a key role in the development of our capex forecast on the foundation of having "no regrets". In forecasting our capex, we need to ensure that any investments will be needed by consumers over the long term. The increasing role of Distributed Energy Resources (DER) and other technologies are gradually impacting our forecast capex program. In areas where we are aware of non-network alternatives to supply side solutions, we have adjusted our capex plans accordingly. In other areas, we have made allowances for the uptake of DER and technology and the impact that this will have on the network. We are also investing in new technology that will support the rapid identification of suitable non-network options, and enable their integration into the network.
Any relevant final project assessment report (as defined in clause 5.10.2) published under clause 5.17.4(o), (p) or (s)	**6.5.7(e)(11)**	Ausgrid has published 2 Final Project Assessment Reports in relation to projects which have forecast capital expenditure in the upcoming regulatory period. Both projects commence in the current period and are forecast for completion in the FY20-24 period. The Final Project Assessment Reports are: Addressing reliability requirements in the Enfield network area (published 16 February 2018) Addressing reliability requirements in the Inner West (published 16 April 2018) They are available at: https://www.ausgrid.com.au/Common/Industry/Regulation/Network-Planning/Regulatory-Investment-Test-Projects.aspx
Any other factor the AER considers relevant and which the AER has notified the Distribution Network Service Provider in writing, prior to the submission of its revised regulatory proposal under clause 6.10.3, is a capital expenditure factor	**6.5.7(e)(12)**	Ausgrid has not received any specific notification from the AER in relation to further capital expenditure factors required to be addressed in our Regulatory Proposal.

4 REPLACEMENT CAPEX

Our replacement capex comprises capital activity to replace, modify or extend the life of network assets. We forecast 1,673 million on replacement programs in the 2019-24 period comprising of major projects, replacement programs, network property, operational technology, as well as GIS, switching and control costs. Direct capex on replacement comprises around 54 per cent of our proposed capex as illustrated in Figure 2.

Figure 2. Replacement capex as proportion of total capital program in 2019-24 **($m, real FY19)**



The aim of our replacement investments is to maintain the safety, reliability, and security of supply performance of the network in a cost efficient and sustainable manner. Our replacement decisions are based on addressing key risks entrenched in asset condition and inherent design issues. We assess the consequences of keeping assets in service in terms of the contribution to safety, loss of supply and security of supply risk. Our assessment includes consideration of asset age and condition, long term failure trends, and technology advances, together with the changing shape of the future network.

Included in our replacement investment profile are programs addressing safety, environmental and security compliance obligations that are not necessarily related to historical failure or replacement rates, for example oil containment systems, security systems and feeder earthing programs. SCADA, network communications and protection relay replacements are largely driven by the condition and obsolescence of system components and the inability of these systems to continue to support a modern power network.

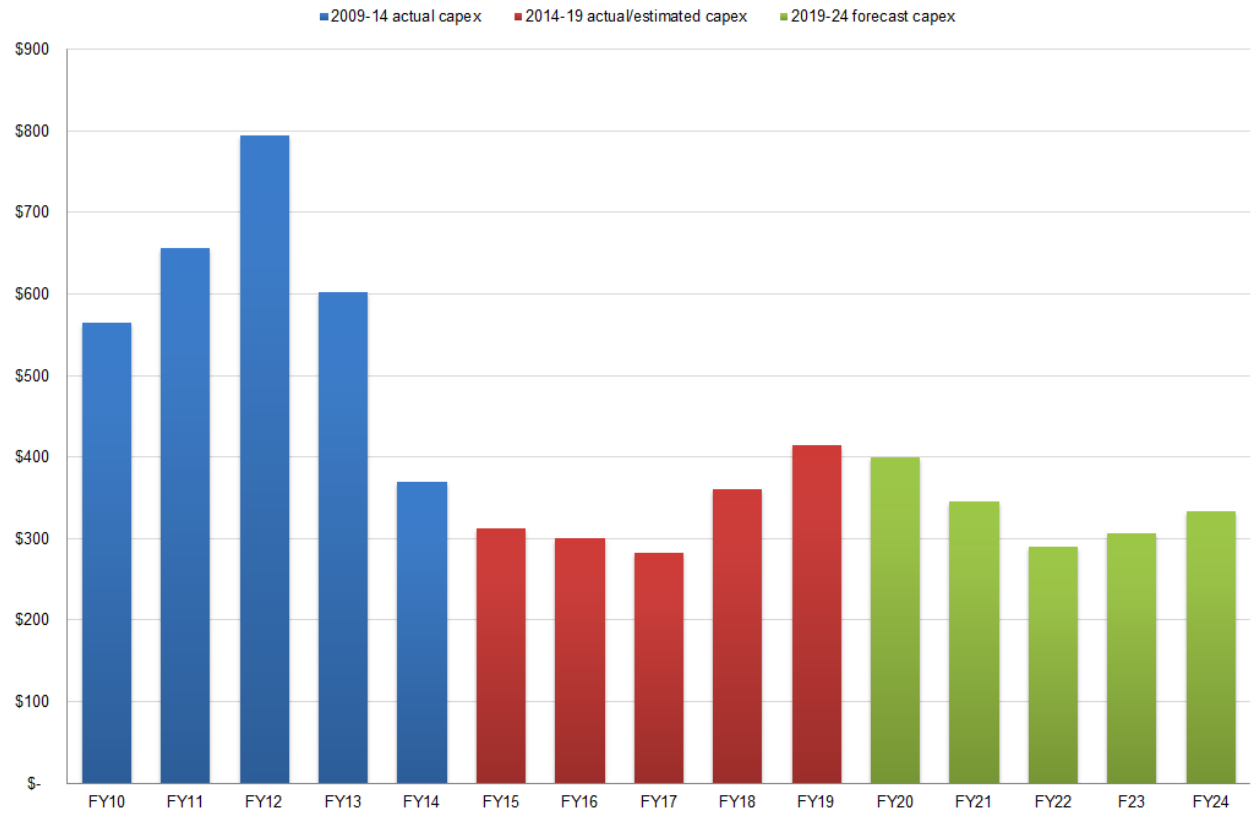
The purpose of this section is to provide context on our replacement program including:

- The forecast expenditure context and trends
- A comparison to the AER's repex model
- The replacement strategy and decision-making approach
- The program composition, and
- A summary of our investment programs including major projects.

Further information can be obtained from other attachments supporting our capex proposal, including our project justifications for replacement programs (Attachment 5.13) and for replacement driven major projects (Attachment 5.14).

The figure below presents total 15-year trends in actual and forecast replacement capex for the periods FY2010 - FY2024.

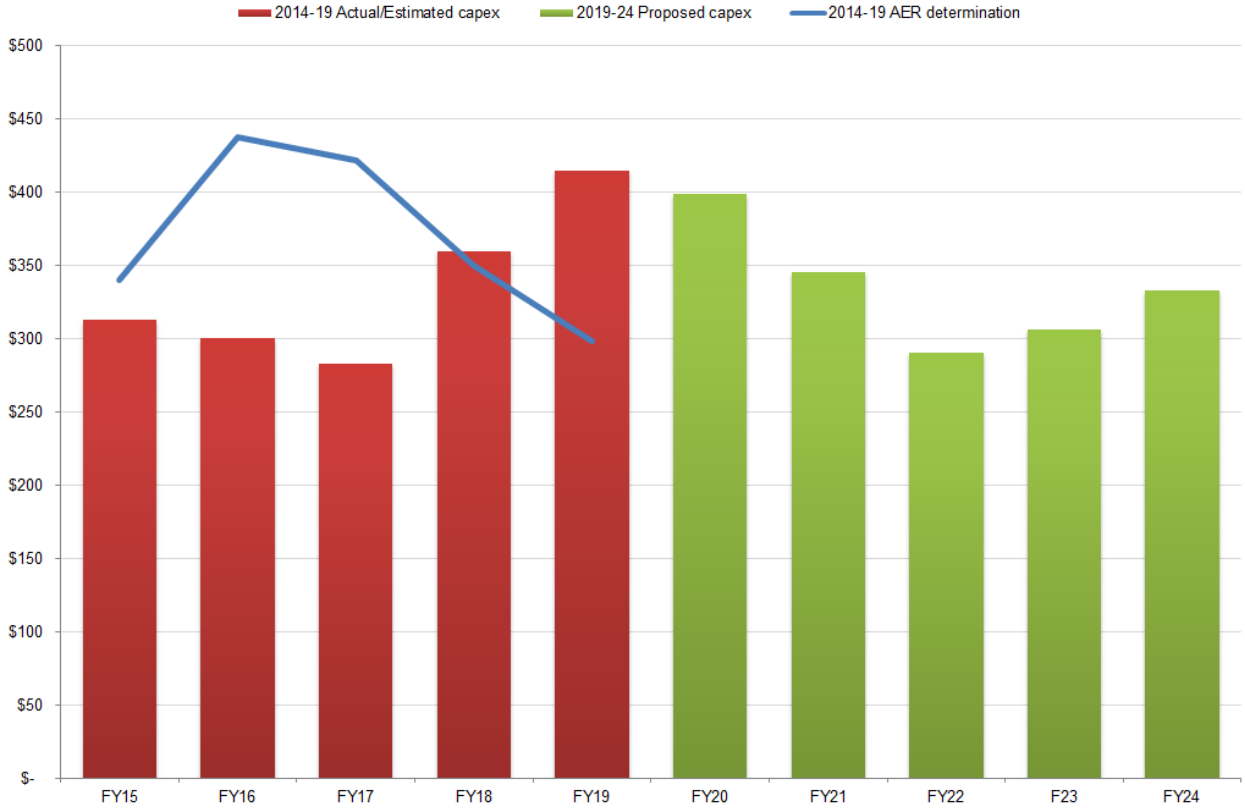
Figure 3 . – Replacement capex ($m, real FY19)



4.1 Forecast expenditure context and trends

Our forecast replacement capex is consistent with the 2014-19 regulatory period forecast spend. As can be seen in Figure 4 below, the replacement capex declines in 2021/22 and 2022/23 due to fewer major projects in these years. The higher capex in 2020/21 and 2021/22 relates to a number of concluding major projects and $41.3 million of expenditure associated with the replacement of our legacy distribution management system with an Advanced Distribution Management System (ADMS) that commenced in the final years of the 2014-2019 regulatory period.

Figure 4. Replacement capex ($m, real FY2019)

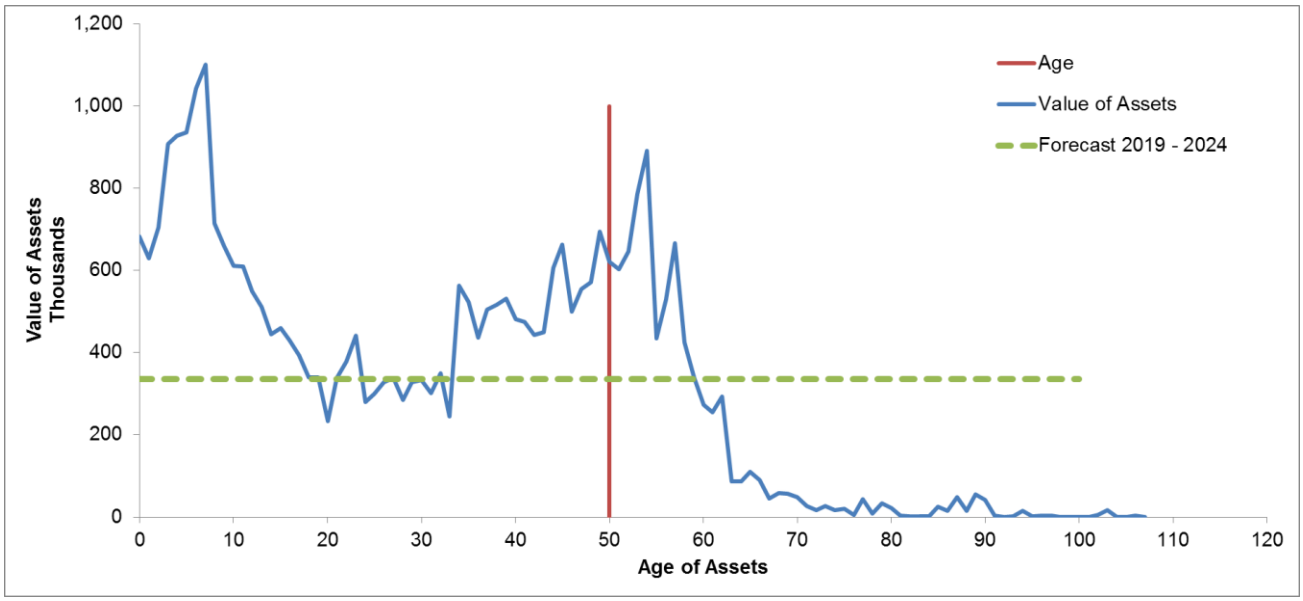


As part of our high-level checks, we assessed whether it is reasonable for replacement capex to be at similar levels to the previous period. Over the current period, the age of our network assets has increased overall despite $1.8 billion of investment in replacing assets.

Through targeted investments and maintenance (which is operating expenditure) we have been able to manage the safety and loss of supply risks associated with an ageing network. This suggests that the current level of replacement capex together with the operating expenditure on maintenance programs is sufficient to maintain current network performance in the short run.

Our top down modelling also confirms that our proposed replacement capex is at the lower range of sustainable capex. We used RIN data to show that it would cost $34 billion to replace all of our assets, assuming we embed the efficiencies we have made in the 2014-19 period. We assumed that on average, assets live between 55 and 60 years (for different asset categories but noting that standard lives are generally 50 years). Based on this analysis we determined that a steady replacement capex would be about $600 million to $740 million a year. Our replacement program is closer to $335 million a year, despite 25 per cent of our assets being older than 50 years, as can be seen in Figure 5 below.

Figure 5. Replacement value of Ausgrid's network by age of asset



This information suggests more capex will be required in the future than we are proposing for the 2019-24 period. However, our current experience is that some assets may operate beyond 50 years as a result of effective maintenance practices. Delaying investment may also provide opportunities to retire assets or make different replacement decisions in the future due to changing demand for electricity and by utilising renewable energy generation and storage.

4.2 AER Repex model comparison

Ausgrid has undertaken analysis to assist in providing a top down evaluation of the proposed capital replacement using the AER's repex model. Ausgrid supports the use of the repex model as a reasonable method to apply a top down evaluation of the bottom-up forecast replacement expenditure.

Ausgrid retained Nuttall Consulting to apply the repex model based on the AER's recent (public) regulatory review approaches as closely as possible. This included analysis and calibration across a number of scenarios using historical, forecast and benchmark data.

The historical data that was used to build the model has been taken from the last three years (2014/15 – 2016/17), this was to ensure that the results are reflective of the most current practices and is believed to be consistent with the AER's preferred approach. However, we believe that a four-year window (2015/16 – 2017/18) is more appropriate as 2015/16 and 2016/17 were impacted by Ausgrid's transaction and are considered below trend.

The repex model considers six asset categories which consist of 68% or $1,107 million of our proposed replacement expenditure, these categories are:

- Poles
- Overhead conductors
- Underground cables
- Service lines
- Transformers

- Switchgear

Of the proposed replacement expenditure 32% was not assessed as part of the repex model as it does not fit into one of the defined categories or is not age related. The comparative results for the assessable categories are set out in the table below:

Table 14. – REPEX comparative results

Scenario	*Forecast Assessable Repex (2019'Millions over FY2020-24)*
Ausgrid forecast repex (assessable component)	1,107
Repex model - Historic Unit Cost*/ Calibrated* Lives	1,279
Repex model - Forecast Unit Costs#/ Calibrated* Lives	1,027
Repex model - Benchmark Unit Costs*/ Calibrated* Lives	1,283

* (calibrated using FY15-17 historic data)
# (calibrated using FY20-24 forecast data)

Ausgrid's forecast assessable repex is approximately 13% lower than modelled repex, if using either historic or benchmark unit costs as understood by Nuttall Consulting. Even without adjustment for a number of categories where we believe that there is a risk based argument for higher replacement volumes, modelling using forecast unit rates is within 7% of Ausgrid's forecast. These outcomes support Ausgrid's forecast being considered reasonable when assessed at a top down level. Comparison of forecast repex to the modelled scenarios indicates that, on average, Ausgrid's forecast repex unit costs are approximately 20% lower than both Ausgrid historic and the (public) AER benchmark repex unit rates. This has been achieved by a material productivity gain reflected in our forecast unit costs of our proposal.

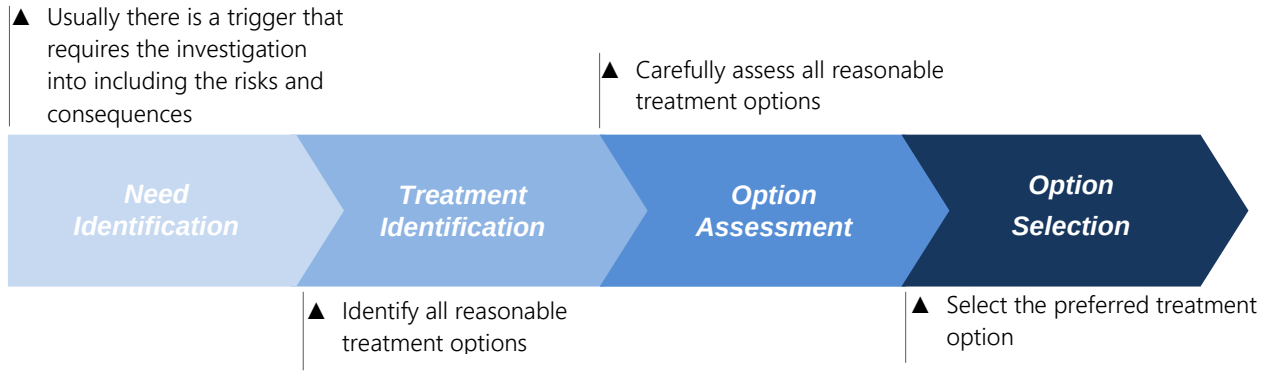
We therefore believe that the repex modelling undertaken by Nuttall Consulting supports the reasonableness of our proposal. Further detail on the repex outcomes are justified within Attachments 5.13 and 5.14.

4.3 Replacement strategy and decision making approach

Ausgrid's strategy and approach are based on managing network assets in a safe, reliable, affordable and sustainable way to provide supply to customers. Our approach is therefore aimed at making prudent investment decisions such that our assets do not cause harm to any person, have a minimal environmental impact, meet agreed service performance outcomes, and are consistent with providing for the current and future needs of our customers.

The process for considering and selecting the optimal treatment strategies is provided in Figure 6**Error! Reference source not found.**

Figure 6. – Treatment strategy selection process



Replacement drivers / Need Identification

Our replacement programs have been developed to target and treat risks where the benefits of ameliorating the risks outweigh the costs. Our approach to risk management is embedded in our asset management decision making process and applies across all asset classes.

Our key replacement drivers include:

- Functional failure – where an asset has failed while in service. This is triggered by either asset condition or a weather event such as a storm.
- Conditional failure – where inspections and analysis shows the asset is at risk of functional failure and the consequence of that failure could impact safety, property, the environment or reliability.
- Compliance – Our analysis shows that the asset does not comply with modern day safety or environmental standards and is therefore creating an unacceptable level of exposure or does not comply with prescribed legislation.

We also consider in our decision making process the ongoing support including the availability of technical support and spare parts as well as the needs of a modern network. In all cases, we undertake a thorough review of the risks and consequences to inform our view of the appropriate treatment.

The majority of Ausgrid's replacement expenditure arises from the risk of asset failure. Failures of network assets can result in the following consequences:

- Injury to the public, customers and to network workers,
- Loss of supply (unserved energy) resulting in disruption to businesses, essential services and other customers,
- Damage to the environment,
- Damage to property.

In applying the principles of asset management to develop the replacement strategies for network assets, we utilise Failure Mode Effect and Criticality Analysis (FMECA) to assess the risks associated with asset failure. Where the risk of failure is unacceptable, Ausgrid's approach is to prevent failure through the monitoring of asset condition and to implement mitigation before the failure is realised, i.e. via retirement or replacement. The optimal timing for retirement or replacement is therefore determined when the likelihood of failure reaches a point where the risk is unacceptable.

We have undertaken in-depth analysis of major network components (major transformers, 11kV switchboards and 132kV fluid filled cables) to assign a specific failure probability distribution. When combined with repair times, the unavailability (unserved energy) of the cable along with the other impacts noted above can be used to inform replacement decisions.

We have a number of asset replacement programs driven by emerging issues unrelated to the condition of the asset. These programs target assets with inherent design deficiencies, or configuration issues, or both. For example, SCADA, network communications and protection relay replacements are more often driven by the obsolescence of system components and the inability of these systems to continue to support an evolving electricity network. We also consider the replacement of technology assets that are susceptible to the threat of cyber-attacks so that we can maintain a secure network.

A number of replacement works are required due to the need to meet safety and environmental compliance obligations. The replacement of these assets forms part of a strategic plan that is unrelated to historical replacement rates and is therefore difficult to model using repex. This includes upgrading of oil containment systems, security systems or substation fire systems.

Capital treatment option selection

Once asset risks are understood we consider the appropriate risk treatment approach which may include capital or operational expenditure. The selection of the treatment approach also considers the changing network outlook so that we do not either over invest in assets which may have reduced utilisation in the future or under invest, leading to a significant step change in future investment requirements or risk exposure. Table 15 provides a summary of the typical options considered in selecting the appropriate treatment.

Table 15. – Treatment options

Treatment Option	Description
1. Repairs or modifications	Where it is both cost effective and feasible, we may under a repair or modification. This generally includes operational expenditure to restore the asset to a workable condition or improve the safety or functionality of an asset.
2. Life extension (refurbishment or reinforcement)	Life extension involves a partial replacement or refurbishment to extend the life of the asset and defer the majority of the capital cost after the asset has deemed to be conditionally failed. Examples where this treatment is appropriate include staking a pole, tower refurbishment or vacuum circuit breaker conversions to extend the life of switchboards. The costs of the approach and the condition of the asset are considered to determine whether life extension is an effective treatment.
3. Replacing like for like	Replacing an asset with another which provides a similar function and equivalent utility to the asset being replaced. For example replacing a deteriorated wood pole with a new wood pole.
4. Replacing like with new technology	In some cases like for like replacement is no longer possible as the existing technology being utilised has become obsolete. Improvements in technology can often result in a significant step change in benefit when compared to like for like replacement. Examples include insulated conductors (as opposed to bare conductors), SF6 or air insulated equipment (as opposed to oil insulated equipment) and polymer insulators (as opposed to porcelain insulators).

Treatment Option	Description
5. Installation of new/upgrading of assets (non-augex)	A number of replacement works are required due to the need to meet safety and environmental compliance obligations. These installations do not fit the definition of Augmentation Expenditure (augex) but are required as part of the network and are generally related to civil rather than electrical installations. This includes the installation/upgrading of fire and oil containment systems, security systems (e.g. fences), and feeder earthing. Where electrical assets can be retired through investment to reconfigure the network at reduced cost, these options can become the preferred option.
6. Non-network alternatives	A non-network option may be found to offer a cost-effective alternative to undertaking investment in the network. Demand management can involve either the voluntary moderation of customer electricity demand at peak times or the supply of electricity from generators and storage batteries connected at customer's premises or to the distribution network.

Replacement Program types

Our replacement programs are categorised into three main program types; planned, condition based and reactive. Ausgrid also refers to planned and condition based programs together as proactive programs. Proactive programs involve the treatment of assets that have been identified and assessed as posing an unacceptable risk for their continued operation.

Our **planned programs** are based on a methodical assessment of the inherent asset risk including a thorough assessment of the asset condition. Planned programs are considered when a problem with a group or type of assets has been identified which applies to the entire subset of the population within that group. Therefore within a planned program, the entire population of assets requiring replacement is known up front and can be appropriately prioritised using captured risk information.

Once the commitment of undertaking planned treatments has been made, minimal additional condition information is required. Some condition information may still be utilised to set priorities and ensure no further escalation in risk.

Condition-based programs comprise those replacements where the condition of the asset has been identified during inspections or condition assessments as no longer meeting the minimum standards for delivering its function safely and reliably within the network. Condition based programs are suitable for assets that can be reliably monitored for condition and are generally applied to mitigate the risk of asset failure before a failure can be realised.

A condition-based approach requires a deep understanding of both asset risk and asset condition against this risk. Ausgrid undertakes Condition Based Maintenance (CBM) as part of its preventative maintenance program to develop an understanding and monitor asset condition.

Reactive programs involve replacement or life extension to address asset risks that arise and are not covered by proactive programs. While the proactive programs have been developed to address known or forecast asset issues, not all risks can be forecast or predicted. Additionally, given the level of risk being mitigated, a reactive approach may provide a more appropriate cost benefit outcome when compared to the cost of a proactive program. Reactive programs are required when:

- An asset has failed and it is not technically feasible or cost effective to repair,
- New asset information leads to the need for short term treatment not covered by existing proactive programs.

Any of the above triggers may result in an unplanned project to reactively treat an asset. When new information drives the need for new investment not covered by an existing proactive program,

Ausgrid may choose to establish a new proactive program and reallocate funding from the reactive program.

The program types and associated assessment approach is summarised in Table 16.

Table 16. – Program types

Treatment Option	Description
1. Reactive program: - generally following functional failure	Reactive treatment is suitable when: • Asset criticality is low and asset failure is acceptable, or • The cost in implementing additional controls outweighs the benefit, or • To allow for additional risks which arise during the period and are not forecast in conditional or planned programs. An example is underground cables, where safety, supply security and reliability can be maintained.
2. Condition-based program: - through asset condition assessment against acceptable risk criteria	Condition-based treatment is suitable when: • The risk mitigation gained (benefits) outweighs the cost, and • Risks can be linked to time or asset condition, and • Condition based maintenance is technically effective and cost effective. An example is poles, where the risks posed may be high, asset deterioration is understood and can be effectively and efficiently assessed via testing.
3. Planned program: - assets with known and already unacceptable condition issues	Planned treatment is suitable when: • The risk mitigation gained (benefits) outweighs the cost, and • Further monitoring of condition does not add value, or • Condition based maintenance is NOT technically effective and/or cost effective. An example is the replacement of oil filled circuit breakers, where the risks posed by individual assets are already well understood and unacceptable and lengthy planning periods may be required for replacement.

Prudent and Efficient Investment

Ausgrid's planned maintenance programs consist of routine inspections, methodical testing, condition assessments and servicing. The data collected as part of these maintenance programs helps inform the need for replacement. In some cases there may be an option to undertake maintenance based repairs, however, as the condition of assets decline, the cost to continue to maintain the asset rises. Whilst a number of assets can continue to be maintained, a point is reached where it is more efficient to replace the asset than continue maintenance.

Once this point is reached a number of options are considered:

- Replacement program – assets that do not meet the criteria for continued service as identified above may be added to a replacement program.

- Area plan – at subtransmission sites, where there are the potential for multiple capital expenditure requirements, a holistic review of the area is conducted. These plans take into account other options and consider other drivers, such as load conditions, that would affect the need for the asset in the future. A cost benefit and sensitivity analysis is undertaken, which includes an assessment of the cost of unserved energy and other potential consequences to identify the optimal investment timing. The option for demand management is also considered along with the deliverability, resource availability and coordination with other investment works to improve overall cost efficiency. The Area Plan process may result in a recommendation for a major project.

A Regulatory Investment Test – Distribution (RIT-D) or Regulatory Investment Test – Transmission (RIT-T) is conducted as part of the major project development and justification process as required under the National Electricity Rules. If during the course of this test a non-network option is found to offer a cost-efficient alternative to the preferred network option, the non-network option will be adopted.

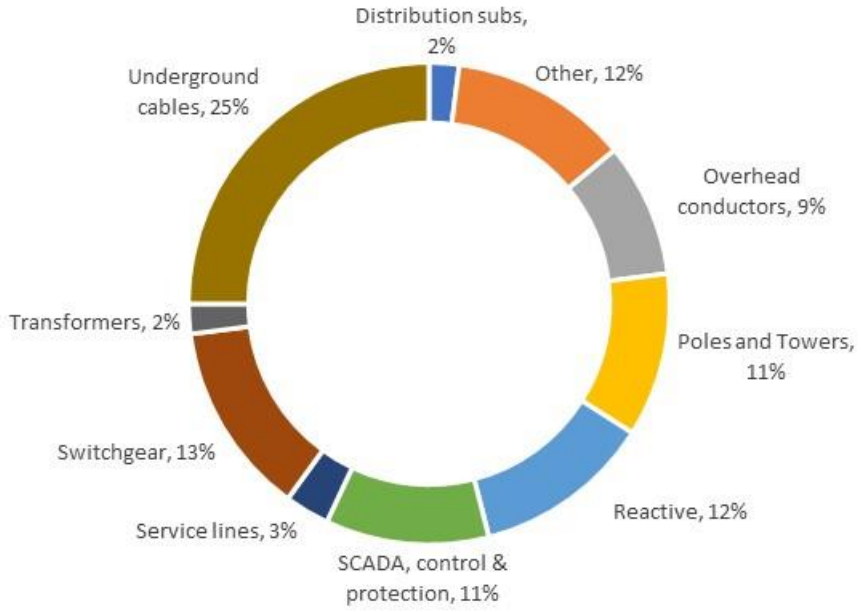
4.4 Program composition

Replacement program composition

Our replacement capex includes around 60 major projects (valued at $540 million) on our subtransmission network, and around 200 replacement programs (valued at $1,132 million) predominantly on the distribution network. The composition of our forecast replacement expenditure is shown in Figure 7.

The forecast expenditure for replacement also includes $105.6 million in direct costs for land purchases ($36.1 million), project switching and control activities ($38.9 million) and subsequent project asset data maintenance ($30.6 million) to enable delivery of these works.

Figure 7. Proposed replacement expenditure program composition



4.5 Replacement program summary

A summary of the combined replacement programs is presented in Table 17. The summaries present information on key drivers, forecast expenditure, relative network and safety impact, range of options considered, basis of the volume forecast, unit cost trend, and the expected investment benefits.

Table 17. Summary of combined replacement programs

	 Need	 Forecast expenditure	 Network impacts	 Safety impacts	 Options	 Volume	 Unit rate	 Benefits
Distribution poles	Condition	$139M	Low	High	Life extension or Replace	Modelled	Declining	Maintain public and worker safety
Transmission structures	Condition	$30M	High	Moderate	Life extension or Replace	Declining	Steady	Maintain network reliability
Pole top structures	Condition	$24M	Low	High	Life extension	Trending	Steady	Maintain public and worker safety
Overhead conductors	Condition, Compliance and Type	$105M	Low	High	Replace	Prioritised list	Declining	Maintain public and worker safety
Underground cables	Condition and Type (Consac / HDPE)	$117M	Low	High	Replace	Prioritised list	Increase	Maintain public and worker safety
Service lines	Condition and Type (Bare / PVC)	$49M	Low	High	Replace	Prioritised list	Steady	Maintain public and worker safety
Transformers	Condition	$33M	Low	Low	Life extension or Replace	Prioritised list	Steady	Maintain reliability and public and worker safety
Switchgear	Condition and Type	$127M	Low	High	Life extension or Replace	Prioritised list	Declining	Maintain public and worker safety

	Need	Forecast expenditure	Network impacts	Safety impacts	Options	Volume	Unit rate	Benefits
Distribution subs	Condition, Compliance and Type	$45M	Low	Moderate	Life extension or Replace	Prioritised list	Steady	Maintain public and worker safety
SCADA & Protection	Condition, Compliance and Type	$79M	Moderate	Moderate	Replace	Prioritised list	Steady	Maintain reliability and public and worker safety
Other	Condition, Compliance & Type	$123M	Low	High	Life extension or replace	Prioritised list	Various	Maintain reliability, environmental compliance and public and worker safety
Reactive	Functional failure	$219M	Various	Various	Life extension or replace	Trending	Various	Maintain reliability, environmental compliance and public and worker safety
11kV Switchgear Replacements	Condition and Type (compound)	$149M	High	High	Replace	Prioritised list	Individually Tested	Maintain reliability and public and worker safety
33kV Switchgear Replacements	Condition and Type (bulk indoor oil)	$28M	High	High	Replace	Prioritised list	Individually Tested	Maintain reliability and public and worker safety
Subtransmission cable replacements	Condition and Type (oil and gas)	$227M	High	High	Replace	Prioritised list	Individually Tested	Maintain reliability and environmental compliance
Other Substation Major Projects	Condition	$32M	High	High	Replace		Steady	Maintain reliability, environmental compliance and public and worker safety

	Need	Forecast expenditure	Network impacts	Safety impacts	Options	Volume	Unit rate	Benefits
Advanced Dist Mgnt System – ADMS	Condition, Compliance and Type	$41M	High	Moderate	Replace	One-off	Market Driven	Platform for Improved Network Operation & Connection of DER

4.6 Supporting documents

Further information about the replacement capex program can be found at:

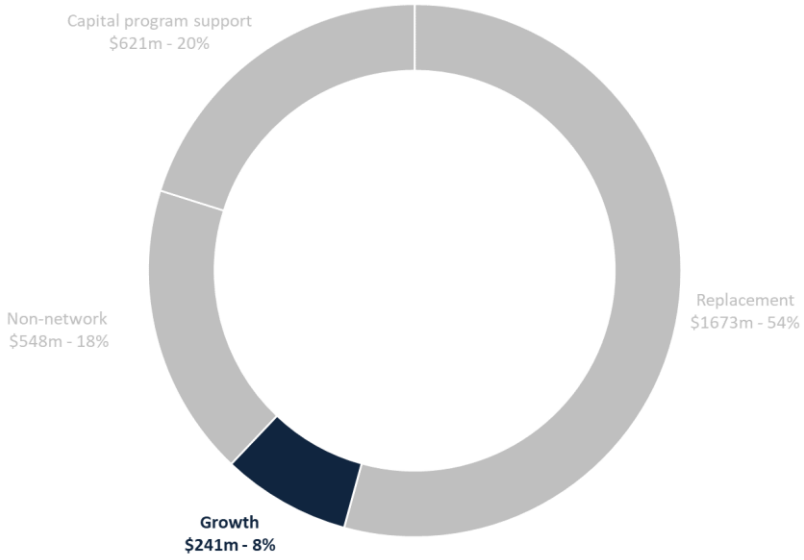
- Attachment 5.13 Project justifications for replacement and duty of care programs (including the OTI program and ADMS project in Attachment 5.13.L)
- Attachment 5.14 Project justification for 11kV switchgear, 33kV switchgear and subtransmission cables replacement
- Attachment 5.15 Nuttall review of repex.

5 GROWTH CAPEX

Our capital program has materially shifted away from the need to invest for growth of the network. Our growth program is required to meet our licence obligations to connect customers and maintain quality and security of supply. Included in the scope of the growth programs are new connection projects and augmentation projects on both the subtransmission and distribution networks.

We forecast $241 million on growth programs in the 2019-24 period. Direct capex on growth comprises around 8 per cent of our proposed capex as illustrated in Figure 8.

Figure 8. Growth capex as proportion of total capital program in 2019-24



The aim of our growth investments is to manage our network capacity constraints to ensure we can continue to connect new customers, achieve the permanent network supply needs, and maintain security and quality of supply requirements. In developing our forecast, we have minimised network augmentation and growth investment by optimising the utilisation of the existing network capacity and identifying demand side solutions to resolve network constraints. The relaxation of the deterministic network planning requirements in the NSW licence conditions have also played a role in the reduction of our growth capital expenditure forecast from previous levels.

A key input to our growth forecast is our underlying demand and connection projections. Low demand growth resulting in modest increases in system utilisation, offset by energy efficiency and solar PV penetration, is generally supressing the need for network augmentations. However, we have experienced an increase in large customer connections, principally public infrastructure (new roads and railways) and data centres. We are also seeing localised growth due to redevelopment adjacent to transport hubs. This is resulting in spot loads with associated localised augmentation and network development requirements.

The purpose of this section is to provide context on our growth program including:

- The forecast expenditure context and trends
- The growth strategy and decision-making approach
- Growth program types and composition, and
- A summary of our growth investment programs.

5.1 Forecast expenditure context and trends

The figures below present total 15-year trends in actual and forecast growth capex for the periods FY2010 - FY2024. The growth capex figures exclude contributed assets and capital contributions from customers.

Figure 9. Augmentation capex (m, real FY19)

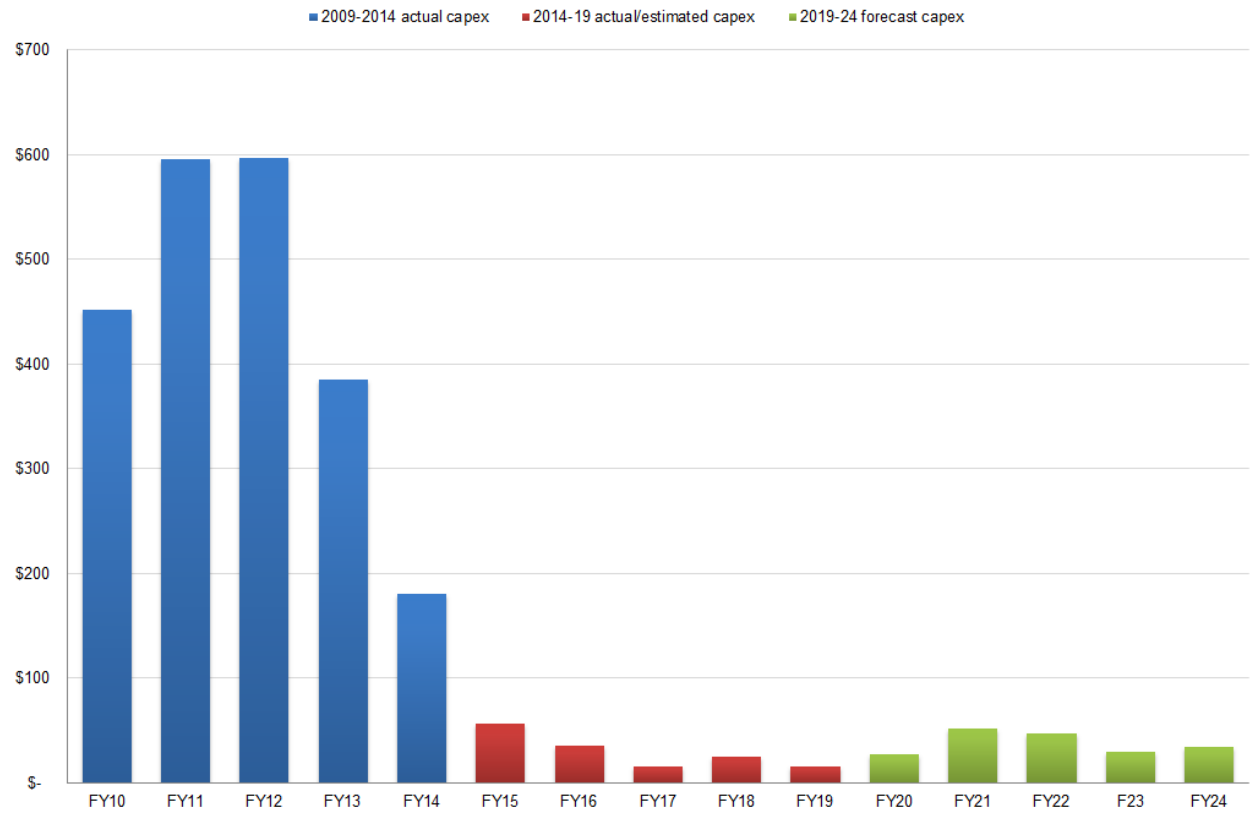
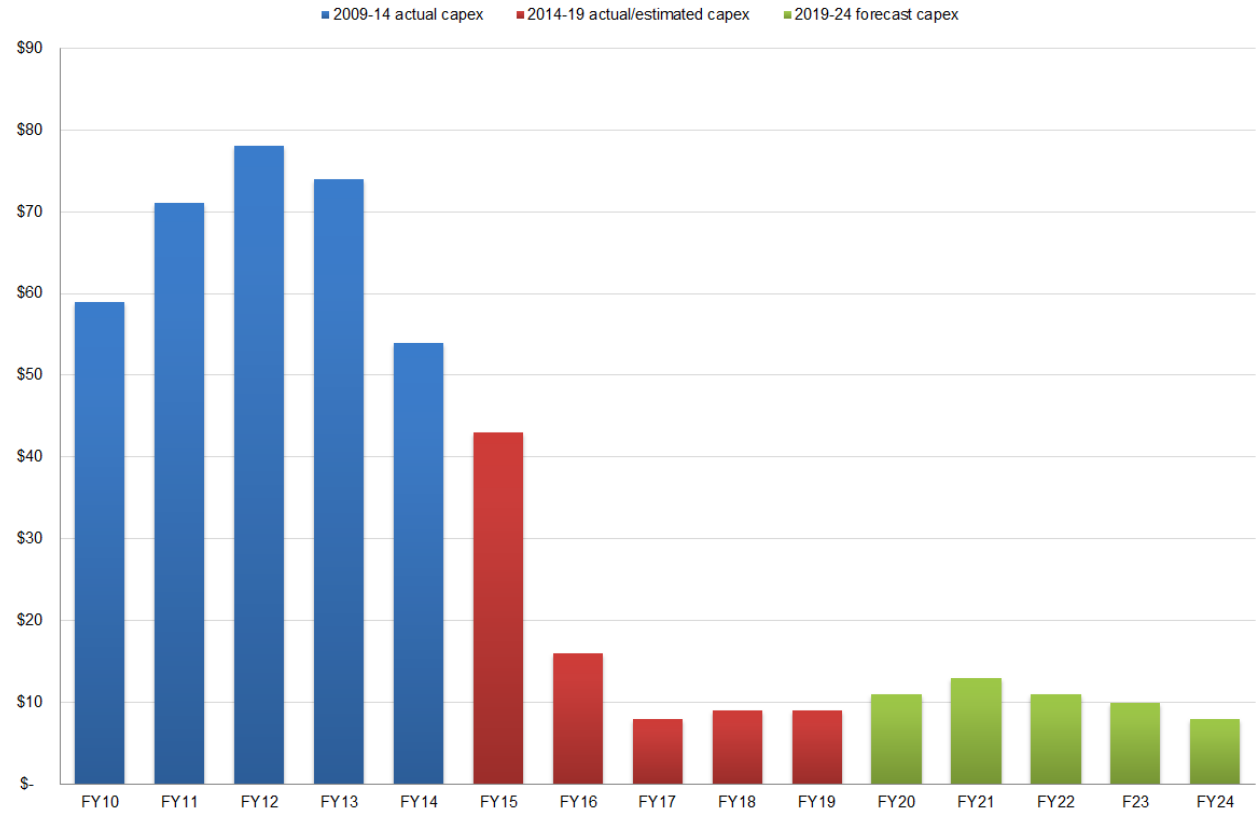


Figure 10.: Connections capex (m, real FY19)



5.2 Growth strategy and decision making approach

In this section, we outline our strategy and approach for identifying growth programs and projects.

Our strategy and approach reflect our efforts to manage our assets in a way that facilitates the connection of new customers and maintains the security and quality of supply, at the lowest cost to our customers. We do this through optimising the utilisation of our existing network and planning augmentation only when we have exhausted deferral opportunities and there are no other viable solutions that would be lower cost than augmenting the network.

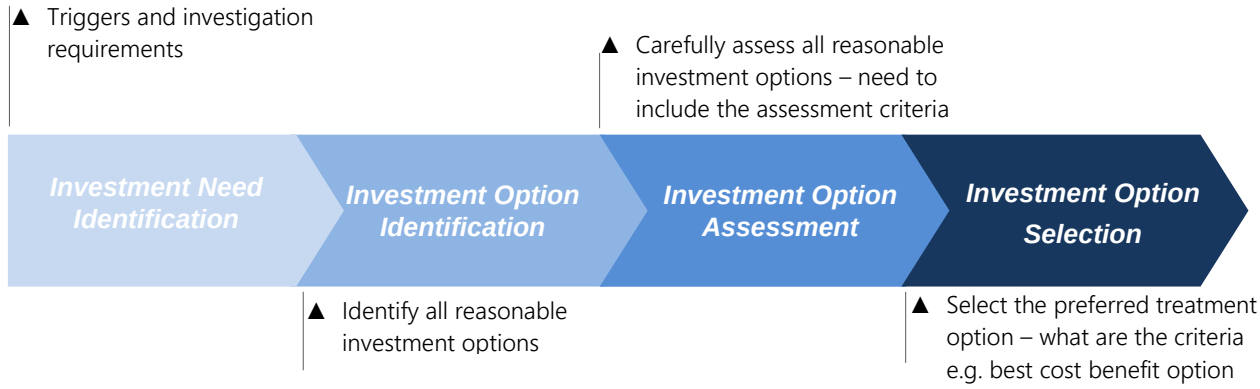
New connections capex covers those cases where Ausgrid funds upstream works which are triggered by additional connections to our network, but which are not specifically funded by the connecting customer as direct connection assets due to their small size / high volumes, or works which are deemed non-contestable due to safety, network integrity or physical asset security reasons.

The need for **augmentation capex** is determined by assessing the adequacy and security of the network to meet forecast demand and network reliability obligations. These assessments are:

- Area Planning process for Subtransmission;
- Network contingency studies for HV; and
- Overloaded asset investigations for LV; and
- Reliability performance investigations.

Our investment decision making process is governed by our Company Procedure that outlines the requirements to obtain approval at various stages of our Network Investment Governance process. The process is summarised at a high level in Figure 11 below.

Figure 11. Investment approval requirements



The process has previously been implemented by means of deterministic planning criteria but Ausgrid has now transitioned to a cost benefit methodology in order to promote efficient investment across the asset base by promoting:

- Risk management: Quantifying and managing uncertainty
- Transition from net present cost to net present benefit for options comparison
- Optimised project timing
- Ability to adapt quickly to changes in the planning environment

5.3 Growth program types and composition

Growth program types

Our growth programs are categorised into two main program types, new connections and augmentation, with both divided into sub-programs.

Ausgrid's Connection Policy[2] directs our approach to **new connections**. This involves selecting the option with the best cost/benefit ratio that also meets the technical standards for the works required to make a new connection or connection alteration. Our network policies, standards and legal obligations determine the minimum requirements that we need to meet.

New customers connecting to our network are generally required to construct and fund the cost of dedicated connection assets. These are referred to as contestable services and are provided by an Accredited Service Provider (ASP). The ASP scheme is administered through the NSW Government. The assets created by this process are classified as contributed assets as they are gifted to Ausgrid on commissioning. They do not add to either our capital expenditure requirements or regulated asset base.

Notwithstanding the customer funded nature of the majority of connection works, there are circumstances where Ausgrid funds the costs of connection driven, predominantly shared network augmentations. These include those related to smaller customers where direct customer funding connection costs is limited or standardised (e.g. customers <100A) and so may not directly fund the full cost of connection impacts. This category also includes the very small number of cases where connections, or components of connections, are made non-contestable for safety or network integrity reasons and where Ausgrid funds and carries out the non-contestable component of the works. These works are classified as standard control services

[2] Attachment 5.17 Connection policy

New connection capex is categorised as:

- Major connections, and
- High voltage (HV) & low voltage (LV) connections.

We have identified approximately 20 subtransmission customer connections that are expected to be completed over the 2019-24 regulatory period where we expect to complete a small proportion of the work as non-contestable works. These cases are primarily subtransmission cable terminations into live 132/33kV substation basements where Ausgrid will carry out the work for safety, network integrity and physical asset security reasons. These connection projects have been included in the expenditure forecast and amount to approximately $10.8 million over the regulatory period or about $2 million per annum.

We expect approximately 100,000 extra HV and LV customers to connect to the network over the 2019-24 regulatory period. These connections will require investment in upstream distribution network augmentation of approximately $70 million over the regulatory period to ensure loads and voltage on the shared network are within acceptable limits and overall supply reliability levels are in the distribution network are maintained.

Augmentation programs involve investments related to general load growth.

The augmentation investment requirements are categorised as:

- Major projects (area plans)
- Distribution augmentation, consisting of HV, distribution centre (substation) and LV distributor reinforcement
- Reliability.

Major project augmentation investments are aimed at catering for those areas which are expected to experience large scale growth. This may be driven by the impact of large loads on existing shared subtransmission assets, by consolidation of many smaller increases in load in an area, or a combination of both. When the maximum demand forecast and probabilistic network availability modelling indicates that the load will grow to exceed the capacity for a sufficiently large proportion of the time, a project is considered in response. Consideration is also given in some cases to the redundancy of the network to meet operational requirements.

The High Voltage augmentation budget is based on the forecast peak demand excluding block loads (above approx. 1MVA), which are generally considered to be addressed by customer funded works during the connection process, so that the impact of underlying rate of growth can be isolated, and customer funded connections are not duplicated. Distribution centre and LV distributor reinforcement take place when load data and/or modelling indicate that maximum loading has already been exceeded.

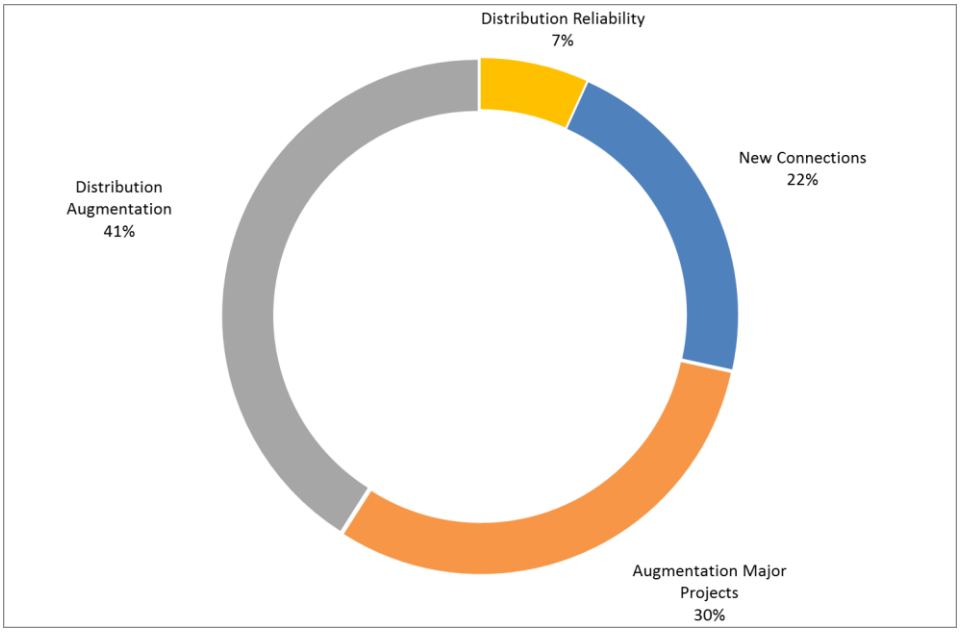
Reliability projects typically address parts of the network with a sustained history of poor reliability performance that do not meet the licence conditions or where there are wide area impacts to other significant shared infrastructure and the community benefit outweighs the investment cost.

Growth Program composition

Our growth capex composition includes new connection capex of $52.2 million, augmentation major projects valued at $73.9 million, distribution augmentation program of $98.9 million and a program to manage high voltage reliability non-compliance of $16.4 million. Our total growth capex amounts to $241 million.

The majority growth expenditure is on augmentation works associated with the reinforcement of our subtransmission and HV distribution networks. Figure 12 provides a summary of our growth expenditure program composition.

Figure 12. Proposed Growth Expenditure Program composition



5.4 Supporting documents

Further information can be obtained from other attachments supporting our Proposal, including

- Attachment 5.16 Project justification for augmentation major projects
- Attachment 5.17 Connection policy and
- Attachment 5.07 Electricity Demand Forecasts Report.

5.5 Growth project/program summary

Table 18 presents a summary of our growth projects and programs.

Table 18. Summary of growth projects

	 Need	 Forecast expenditure	 Reliability impacts	 Options	 Volume	 Costing	 Benefits
New Connections	Obligation to connect	$52.1M	Low	Capacity utilisation, network rearrangement or augmentation, ,	Some site specific and some modelled based on connection size and volumes	Site specific based on established estimating method. Modelled based on historic costs	Customers connected and able to take desired supply in timely manner
Augmentation Major Projects	Supply security and reliability	$73.9M	High	Demand side management or augmentation	Site specific modelling based on spatial maximum demand forecast	Site specific based on established estimating method	Meet customer reliability and security expectations
Distribution augmentation	Reliability and quality of supply	$98.9M	High	Demand side management network rearrangement or augmentation	Modelled based on spatial maximum demand forecast	Modelled based on historic costs	Meet customer reliability and quality expectations and licence obligations
Distribution Reliability	Reliability of supply	$16.4	High	Network reconfiguration and remedial reliability works	Modelled based on # of historic non-compliances	Modelled based on historic costs	Meet reliability licence condition obligations

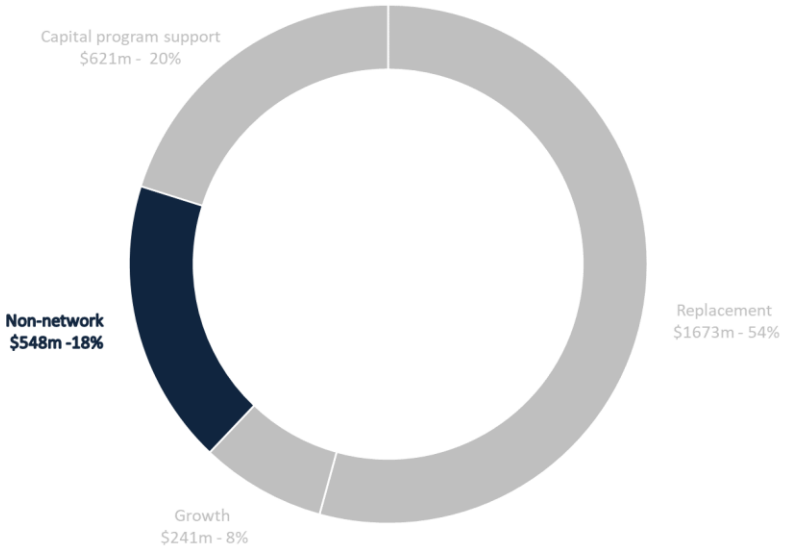
6 NON-NETWORK

6.1 Trends and drivers

Non-network capital expenditure comprises expenditure on assets that are not generally part of Ausgrid's network but are required to maintain, develop and support the network. Non-network capital expenditure is disaggregated into ICT, OTI, property (depots and offices), fleet and plant.

We propose to spend $548m (real FY2019) on non-network capital expenditure during the 2019-24 regulatory control period. Direct capex on non-network comprises around 18 per cent of our proposed capex as illustrated in **Error! Reference source not found.**. The focus of our non-network program is to modernise our business to improve customer outcomes through improved operational technology and innovative network management solutions, upgraded ICT systems with enhanced cyber-security and upgraded aged depots and offices which are at risk of non-compliance with workplace safety legislation.

Figure 13. Non-network capex as proportion of total capital program in 2019-24

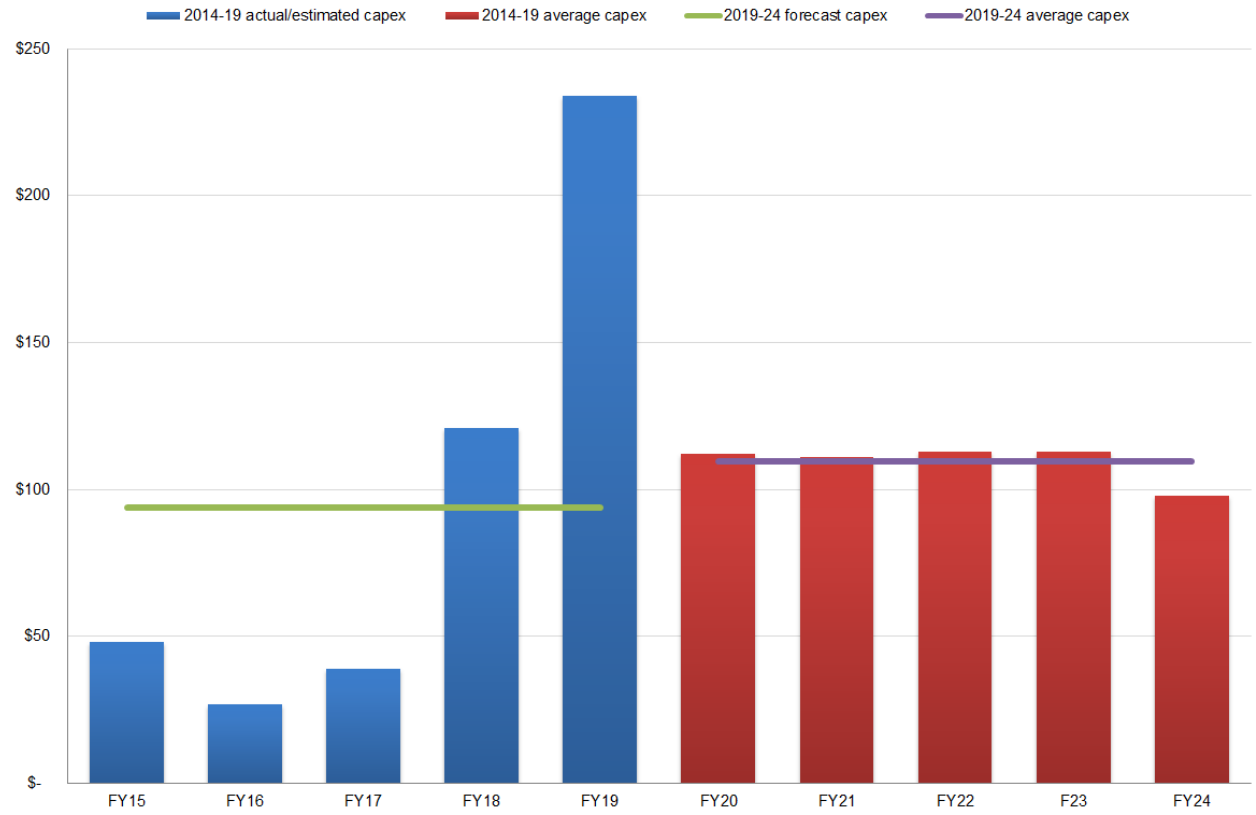


Our proposed non-network capex of $548 million is 18 per cent more than we expect to spend in the current period. We expect to spend a total of $470 million on non-network capex in the current period. This is 41 per cent more than the regulatory allowance of $332 million for 2014-19 regulatory period. We discuss the reasons for this variance in the sections below. Despite an allowance of $197 million, our actual spend over the first 3 years totalled $114 million.

Table 19. Proposed non-network capex ($m, real FY2019)

Non-network capex	2019/20	2020/21	2021/22	2022/23	2023/24
ICT & OTI	50.2	45.4	40.8	40.0	39.2
Property	38.3	43.6	46.2	44.1	36.2
Fleet and plant	23.8	21.6	26.3	29.4	23.1
Total	112.3	110.6	113.3	113.5	98.5

Figure 14. Non-network capex ($m, real FY2019)



6.2 Technology and Innovation progams

Information Communication and Technology (ICT) underpins our critical business processes and the proposed capital expenditure programs reduce the risk of potential failure and/or unplanned production outages. We forecast that we need to invest $157 million (real FY2019) on ICT in the 2019-24 period. We are forecasting to spend a further $58 million on Operational Technology and Innovation (OTI) projects. In total, we are forecasting to invest $216 million on ICT and OTI.

Ausgrid's ICT programs aim to ensure compliance with regulatory requirements including critical infrastructure licence conditions, to provide customers and employees with improved access to information and data, and to improve data driven decisions.

Complex and integrated ICT environments are a mandatory investment for businesses such as Ausgrid that are required to make robust and informed technical and economic decisions about their assets and operations.

ICT systems have an expected useful life, which generally coincides with when the vendor reduces or withdraws support. Retaining systems beyond this point will result in additional maintenance costs and system reliability risks, impacting on efficiency and resilience. Based on the size and maturity of the application, software vendors will normally provide "extended" or "sustaining support" (where available) for up to one to two versions less than the current version of the application. However, continuing to operate the business on applications older than this will result in the following risks:

- Core applications no longer being supported by vendors;
- Increased cyber security exposures;
- Increasingly unstable ICT applications;
- Higher support costs associated with extended support periods;

- Being unable to address strategic imperatives and architectural weaknesses;
- An increased rate of failure in older ICT applications, resulting in unplanned production outages; and
- Unable to adequately meet the required levels of quality, reliability and security of standard control services.

Ausgrid's portfolio of innovation programs has been included in this category. These investments are intended to build upon the innovative projects and trials conducted by Ausgrid and others in the industry in recent years, and meet our customers articulated expectation that we invest to facilitate the delivery of improved customer outcomes as we continue the transition to a lower carbon economy.

The innovation programs have been shaped by the Energy Networks Australia (ENA) and CSIRO Electricity Network Transformation Roadmap (ENTR). The ENTR represents a robust plan that aligns to Ausgrid's principles of taking a customer centric view to the transformation of the industry.

This program was expanded following consultation with stakeholders in March 2018. The innovation program includes around 58 million on OTI projects. Further information about the innovation portfolio can be found in:

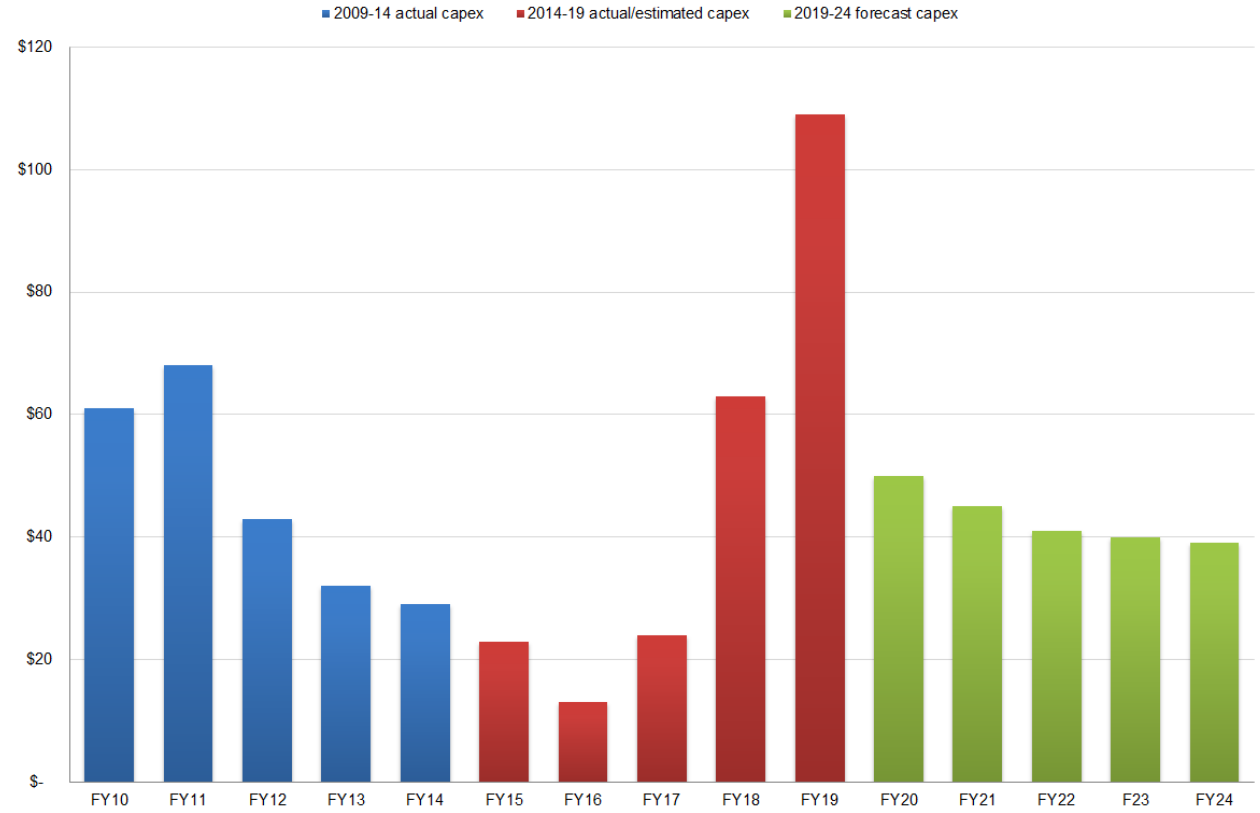
- Attachment 3.01 Ausgrid's innovation program
- Attachment 5.13.L. Program justification for operational technology and innovation programs.

Current period expenditure

Ausgrid's capex on ICT during the 2014-19 period is estimated to be $197 million (real FY2019). Expenditure between FY2015 and FY2017 tracked well below average but has increased during FY2018 as new projects come online and will increase again in FY2019.

Error! Reference source not found. Figure 15 below presents total 15-year trends in actual and forecast ICT and innovation capex for the periods FY2010 - FY2024.

Figure 15: ICT and Innovation capex ($m, real FY2019)



Program achievements

An ICT program of work across Ausgrid was launched during the 2015-19 regulatory period to deliver a set of outcomes which will enable Ausgrid to deliver its vision of continuous improvement. These outcomes will continue to be delivered and improved on in the next regulatory period.

Focus has been on establishing the right platforms and commercial models to enable Ausgrid to drive efficiencies for our customers whilst maintaining a safe and reliable set of technology services. We have also driven efficiencies through legacy application consolidation and decommissioning.

This approach has resulted in a mature and stable application portfolio including:

- Enterprise processes are supported largely by the integrated Enterprise Resource Planning (ERP) software suite from SAP
- Asset Lifecycle Management and Works Management processes supported by specific modules in SAP, and specialist applications like Geospatial Information System (GIS) to identify asset locations accurately
- Asset Operations supported by specialist applications designed for process control including an OMS (Outage Management System) to identify potential outages from calls received from customers
- Metering, a major component of Market Management, supported by a suite of third-party (Itron, TIBCO) and internally developed applications (Metering Business System) to collect meter readings and distribute them to market participants
- For Customer Management, there is a set of specialist applications (Avalanche, Genesys) used in the contact centres to route and record phone calls, and communicate network status information to customers in the event of an outage

Ausgrid has implemented Security Incident Event Monitoring (SIEM) system to assist with the analysis of security incidents and the correlation of such events. These capabilities have been further strengthened by the cyber security assurance and governance initiatives that have been deployed.

To address increasing demands on cyber security Ausgrid has put in place new service and delivery models, where external vendors with deep expertise in cyber security deliver operations and provide independent advice. Ausgrid shifted to this model for cyber security in order to obtain an efficient outcome, leverage wider industry capabilities and also demonstrate prudency.

Proposed non-network OTI program

The non-network Operational Technology & Innovation program encompasses Ausgrid's core operational technology requirements for the regulatory period. It comprises three sub-programs, which are outlined below. The total budget is forecast to be $58.5m for the FY20-24 regulatory period.

- Network Innovation Program

  This program covers a range of innovative network technology pilots including expansion of previous trials in order to develop advanced solutions to resolve network needs more efficiently than traditional network investment approaches.

- Planning and Technology Data Usage

  This program covers data system enhancements and the acquisition of detailed asset data to enable a higher level of service delivery and improve delivery efficiency over time.

- Control System Core Refresh

  This program covers periodic critical upgrades and refresh of Ausgrid's existing core control system servers, operator work stations and network equipment such as routers, switches, firewalls and operator work stations.

Further information about these programs can be found in Attachment 5.13.L. Program justification for operational technology and innovation programs.

Proposed ICT program

The program is made up of licence purchases and renewals, system updates, system replacements and associated costs. The update and replacement of existing systems is required to keep applications and systems on current supported versions, which protects against failure of ICT systems and security intrusions. Newer systems also provide enhanced features that were not available or too costly when the current systems were installed.

Ausgrid will continue to move some systems and applications to cloud based solutions during the 2019-24 regulatory period. Cloud solutions typically increase operating expenses whilst resulting in significant capital expenditure reductions. Based on an independent assessment performed by Ernst & Young the opex increases are expected to be minimal (approximately $1 million) after transition is complete. Our proposal assumes the cloud implementation will be complete by FY2021 resulting in a capex reduction of approximately $8 million in total from the infrastructure and network investments in the current period.

The proposed ICT program has been separated into six separate areas:

- Regulatory and Compliance,
- Cyber Security,
- Application Maintenance,
- Infrastructure and Telecommunications,

- Workplace Technology, and
- Data and Digital Enablement.

Each of these is described in the sections below.

Regulatory and Compliance

In the 2019-24 period our regulatory obligations with respect to the maintenance and licensing of critical infrastructure systems are expected to remain steady. The forecast value of this program during the next regulatory period is $6 million (real FY2019).

The Regulatory and Compliance Systems Program consists of two major streams.

1. Market enterprise systems

Ausgrid requires ICT capital expenditure to expand the capabilities of our existing market enterprise systems to meet requirements. The enterprise systems requiring capital investment during the next period are:

- Customer data systems must be expanded to meet our obligations under the AEMC's *Distribution Network Pricing Arrangements*.
- Data collection and storage systems must be continuously upgraded to align with industry practice
- In-service accuracy testing of our meters needs to adapt to the Australian Energy Market Commission's *Expansion of Contestability in Metering Related Services* rule change. This will increase the complexity in how we handle data relating to the accuracy of the meters we have installed and creates a need to invest in better systems, as issues arise in the 2019-24 regulatory period.
- Annual updates to the CHRIS21 software used for managing our regulatory obligations with respect to employee leave and remuneration entitlements must be maintained to ensure compliance with ATO tax rate changes.

2. Technology licence growth

Ausgrid utilises a number of commercial software applications from third party vendors. Licensing for these applications is typically based on either the number of:

- connections (or associated meters); or
- measurement points on the Ausgrid network.

To ensure continued access to network information and compliance with contractual software licensing agreements, it will be necessary to invest in additional licences to keep pace with predicted growth in the number of network connections and measurement points on our network during the 2019-24 regulatory period.

The software licences used by Ausgrid are:

- SAP IS-U/CCS
- Oracle Outage Management
- GE Smallworld
- Iron Enterprise Edition
- PI Historian.

Cyber Security

Ausgrid operates critical infrastructure that supports 20 per cent of the nation's Gross Domestic Product and 40 per cent of the NSW population. The threat of cyber attack and the possibility of network outages is a potential risk which we are required to address. Our licence conditions (critical infrastructure licence conditions) require us to utilise best industry practice and to develop and implement strategies to manage cyber security and other threats affecting the operation and control of the distribution system, including all associated ICT infrastructure.

Given the nature of Ausgrid's business and supply area, Ausgrid is a potential target for adversaries. Based on our external review, Ausgrid's top three threat actors are: nation states, organised crime, and trusted and semi-trusted insiders.

An attack by a nation state could involve similar methods as seen with recent globally events such as the Ukaraine, and recent advisories from the US and UK governments related to State-Sponsored Cyber Actors Targeting Network Infrastructure Devices.

Financially motivated organised crime and errors by trusted insiders also featured in the threat analysis. The most likely point of compromise is through malware.

We have a planned program to sustain the capabilities of our existing ICT infrastructure to reduce the risk of our critical systems being impacted by cyber-attacks, virtual or physical, in response to recent global security events and continued compliance with licence conditions. In the 2019-24 regulatory period, we forecast that the cost of this ICT expansion program will be $19.9 million (real FY2019).

We have also conducted a cyber security maturity assessment. This identified that we are displaying a low maturity on this measure compared to our industry peers. Historically, Ausgrid has invested approximately 1 per cent of our technology budget on cyber security. This is relatively low, with most other companies responsible for critical infrastructure spending at least 4 to 6 per cent. The proposed capital expenditure will raise our spend on cyber security to 9 per cent of our ICT budget.

The program also includes rectification of historical under-investment in our cyber security protections to bring Ausgrid up to comparative industry maturity and ensure that we can continue to sustainably meet our regulatory obligations. The cyber security program will expand our existing ICT capabilities to be in line with the increasing sophistication of cyber security threats.

Application Maintenance

Application maintenance is the process of updating to current supported versions of an ICT application. Ausgrid's business processes are supported by 104 critical systems, of which thirty are mission critical and seventy-four are business critical. ICT applications have an expected useful life of between four and seven years, which generally coincides with when the vendor reduces or withdraws support.

If we do not make this investment business operations will be significantly disrupted. This includes increased risk of non-compliance with licence conditions, laws and regulatory obligations; our systems will be misaligned with normal ICT industry changes; and there would be an increased risk of a significant cyber security breach.

If systems are not maintained, some of the immediate impacts would be:

- Maintenance schedules may not be undertaken correctly causing impact to Ausgrid assets (SAP)
- Market obligations for retail billing and settlements would not be met (metering)
- Councils would not be billed, Retailer NUOS billing impacted (SAP Billing)
- Outage information not available real time, exposure of customer and life support information and data may be breached (Privacy breach, increased risk of NECF Type 1)

- Increased risk of resource intensive manual processing of documents within Ausgrid.

In the 2019-24 period, we forecast application maintenance to cost $80.9 million (real FY2019). This is a 'business as usual' program in line with our ICT application policy and standards.

The Application Maintenance program consists of three major streams:

1. End of Life Application Upgrades

This program manages end of life applications to ensure critical rated ICT applications continue to be vendor supported and their technical currency is maintained. Our goal is to use the extended technical support offered by vendors for as long as possible before replacing or updating an ICT application. This minimises our costs by deferring the investment in a new or updated version of an ICT application until all technical support is about to end.

We have identified a suite of ICT applications which are likely to have their technical support being withdrawn in the 2019-24 regulatory period. To mitigate the risk of running software platforms without appropriate technical support, we plan to update these ICT applications. This will lead to continued stability in our software platforms over the forthcoming period. The affected applications are:

- SAS Enterprise
- GE Smallworld GIS and PNI
- AutoDesk/Vault
- MicroStation

2. Mandatory patch and release management

As patches are released for software programs, Ausgrid is faced with a need to assess and develop the deployment strategy to manage them. This is undertaken by acquiring, installing and testing new patches that correct errors in our software and remediate vulnerabilities that have been identified.

In the 2019-24 period, our patch management needs are likely to expand in volume and complexity as recently experienced with Spectra and Meltdown vulnerabilities. Cyber security threats are increasing in sophistication and complexity to remediate, in response to this, software developers are continually increasing the frequency and volume of the patches they release.

This is a 'business as usual' program which is required to respond to our evolving cyber-security threats and the expected uplift in the volume and complexity of patches being released by vendors.

3. SAP core maintenance

SAP is a suite of business software and includes SAP Enterprise Resource Planning (ERP) and SAP Business Warehouse (BW), along with other associated products. SAP ERP is comprised of various modules developed for specific areas of a business. The role of SAP ERP is to connect these modules so that data can be shared across all areas of a business. The role of SAP BW is to capture, store and consolidate that data. Each SAP product therefore works together to manage the information requirements of Ausgrid.

We plan to migrate our SAP data management systems to a next generation platform. This is in response to an announcement that the version of SAP we presently operate will have its mainstream maintenance withdrawn. The withdrawal of mainstream maintenance would put Ausgrid at risk. The stability of the current SAP ECC6 platform is likely to suffer as regular system fixes would no longer be offered. Our ability to comply with our regulatory and legal compliance obligations could also be put at risk, as we would no longer receive updates to SAP ECC6 in line with changes to those obligations.

The latest version of SAP (SAP HANA) is different to the version of SAP we currently operate in two main respects. It is cloud based and procured via a 'Software-as-a-Service' (SaaS) contract. The proposed adoption of SAP HANA will reduce ICT capex and total cost of operation over the long run through the SaaS delivery model. However, capex will be required in the implementation phase. After our SAP transformation program, our data management systems will be managed by the cloud under a software subscription contract.

Infrastructure and Telecommunications Maintenance

The program seeks to migrate Ausgrid's core ICT infrastructure services to cloud based offerings and maintain or refresh elements of Ausgrid's telecommunications infrastructure that are reaching the end of their technical life.

This is an ongoing program which commenced in the 2014-19 period. The forecast value of the program in 2019-24 is $24.1 million (real FY2019), a reduction of $11.9 million from the previous period.

The Infrastructure and Telecommunications maintenance program consists of two major streams:

1. Infrastructure maintenance

Our core ICT infrastructure is currently made up of Ausgrid owned and operated servers and storage architecture located "on-premises" at leased data centre facilities. The proposed works will complete an ongoing program targeted at transitioning to a fully outsourced model of ICT infrastructure by FY2024. This will involve the migration of on-premises servers and applications to cloud based technologies.

By migrating to cloud-based technologies we will be able to manage our rising ICT operating costs, and stabilise them at their current levels. Continuing this program as planned will realise the full benefits of capex already incurred and will also result in lower on-going operating costs than if a reduced program was pursued.

2. Telecommunications maintenance and capacity upgrades

Ausgrid has invested in deploying and maintaining its own telecommunications infrastructure. In the 2014-19 period, we invested in higher capacity communications and data centre infrastructure.

Our proposed capex in the 2019-24 period is required to refresh existing infrastructure that has reached the end of its life, or no longer has support from the vendor. For each asset, we have examined the most efficient feasible option to refresh the asset including options of a replacement, migrating to a cloud platform, or continuing to maintain the asset if the consequence of failure can be effectively managed. When refreshing an asset, we will consider whether a cloud based offering would be more cost effective and within the obligations of our licence conditions.

Workplace Technology

The program will maintain and refresh workplace technology programs that Ausgrid introduced in the 2014-19 period. This includes email systems, desktop standard operating environments (SOE), and mobile devices.

The scope of the proposed projects in the 2019-24 period include:

- Complete the transition to and maintain support for Office 365, Enterprise Content Management (ECM), and other collaboration tools such as SharePoint.
- Finalise Ausgrid's migration to a Windows 10 Desktop SOE and maintain functionality through a regular rollout of changes and updates to the platform.

- Conduct on-going regular maintenance and refreshes of the fleet of mobile devices to ensure field workers are able to work effectively.

The forecast value of this program during the next regulatory period is $4.7 million (real FY2019).

Data and Digital Enablement

The Data and Digital Enablement program provides better intelligence from data to meet customer expectations of faster response times and real time information. This ongoing program will support efficiencies already built into the proposal and meet changing customer expectations. The total value in the 2019-24 regulatory period is $23.5 million (real FY2019).

The data and digital enablement program consists of three major streams:

1. Digital transformation

This stream will involve taking advantage of developments in digital technology that provide for greater automation of our internal processes and which leverage and expand the capabilities of our existing ICT systems. We have four areas of work planned for the next period, as illustrated in Figure 16 below.

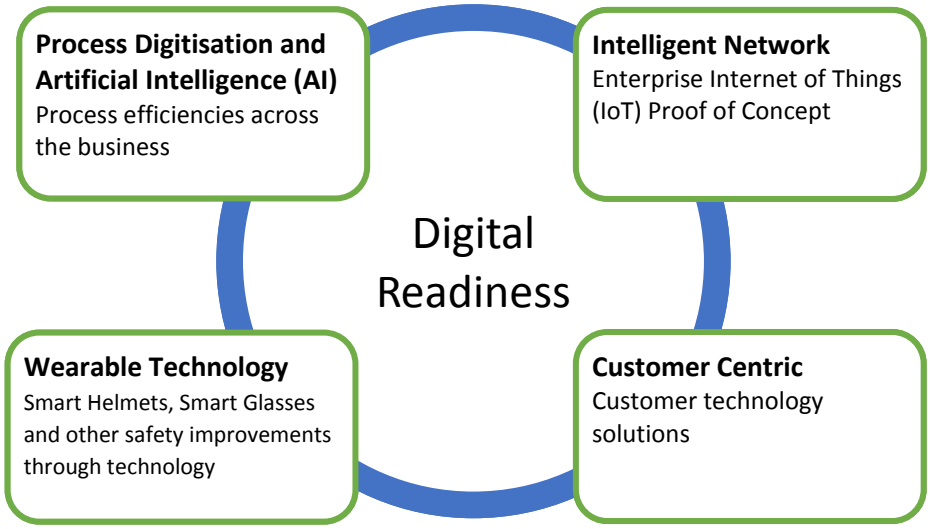


Figure 16. Digital transformation areas of work

This ongoing need is corroborated by the ENTR developed by Energy Networks Australia and the CSIRO. It supported Digital Readiness so far as it:

- improves trust with customers through better engagement and customised services
- facilitates an 'intelligent grid' which defers or negates the need for capital expenditure by better managing peak demand
- leverages flexible, efficient and agile ways of delivering electricity network services to customers.

2. Information management

Our information management needs are guided by our compliance obligations and an internal audit of our current capabilities. To gauge our needs in the 2019-24 regulatory period, we also had regard to the ENTR.

3. Field services enablement

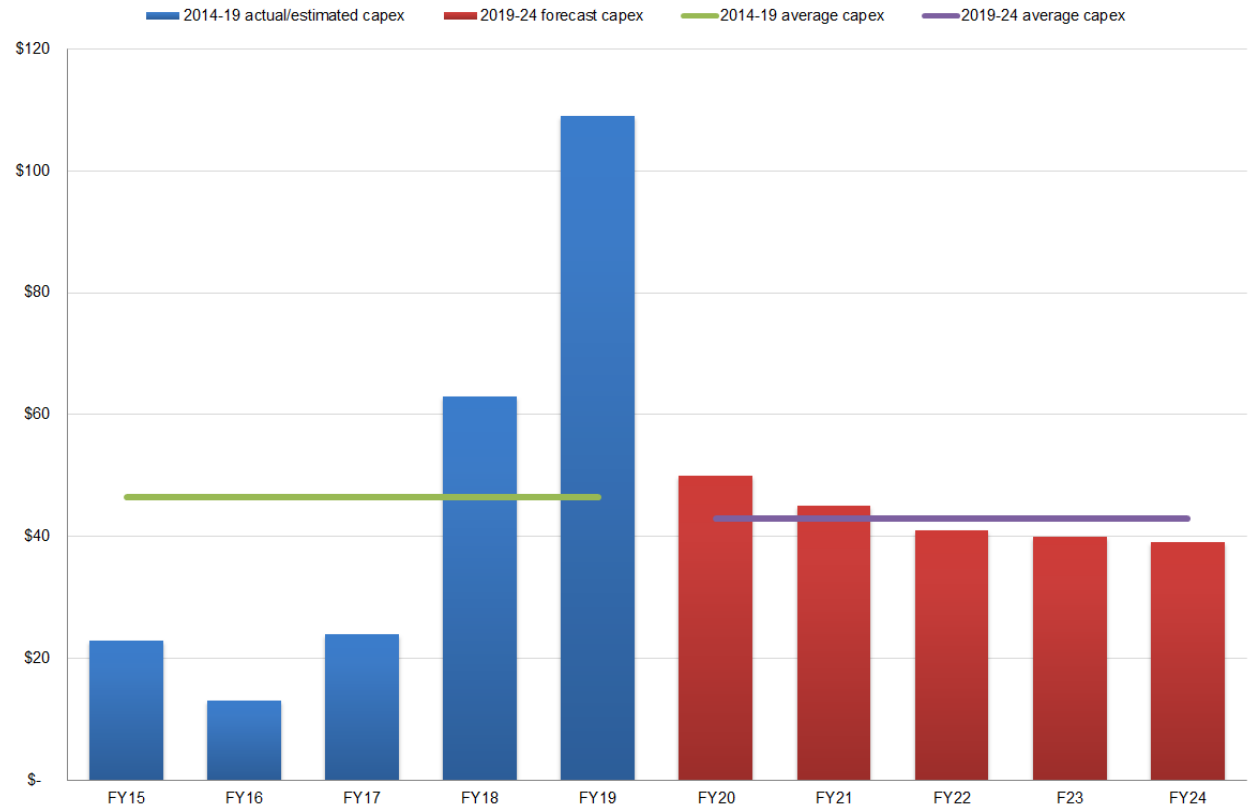
The existing systems in place for managing field services activities are in continued need of modernisation. At present, scheduling and resource allocation is managed through a mix of paper based 'job packs' and a recently introduced mobile platform. This leads to delays in the provision of information to and from the field. The paper-based system also either requires significant data entry resources or workers to periodically return from the field to input data in our SAP asset management systems about the status of a job.

The continued implementation of the Field Services program will continue to improve these processes by enhancing the mobile ICT platform for our field workforce. This will enable real, or near real, time project updates both to and from the field without the need to reissue paperwork. Integration with SAP will also automate updates about work performed on our assets—removing the need for data entry resources or for workers to leave the field to manually update the status of a job, into our asset management systems.

Proposed Forecast

Our proposed ICT and OTI capital expenditure program for the 2019-24 period is $215.6 million over five years (real FY2019). This is 7 per cent lower than actual/forecast capex in the 2014-19 period ($232 million). Figure 17 illustrates the non-network ICT and OTI capex spend in the 2014-19 and 2019-24 regulatory periods.

Figure 17.–ICT and OTI capex ($m, real FY2019)



Forecasting method

The capex program for ICT is based on a needs assessment with feasible options generated to address future requirements. Ausgrid conducts reviews to assess the state of ICT systems and to determine maintenance, upgrades and patching of each system.

Ausgrid assesses its portfolio of applications based on the application classification:

- Mission Critical (0-4 hours) – Business Applications vital to the safe supply and restoration of energy.
- Business Critical (4-24 hours) – Business Applications which support the day to day viability of Ausgrid
- Business Important (1-3 days) – Business Important Applications used by multiple business areas within or across a division
- Non-Critical (>3 days) Applications supporting key functions of a working group

The forecast cost of ICT capex has been estimated using bottom-up individual estimates for each project that has been identified as necessary to undertake during the next period. Further information about the ICT program can be found at:

- Attachment 5.18 ICT Technology Plan for 2019-24 period
- Attachment 5.19 ICT Project Justifications (excluding ADMS).

The forecast cost of the OTI program is a mixture of business cases, developed for large projects, and bottom-up individual estimates smaller project based on similar historical projects where available, Due to the new and innovative nature of many of the projects included in the Network Innovation Program, it was not possible to develop detailed estimates based on similar projects. In these cases indicative costs have been included based on market insight and estimated levels of internal resource effort.

Benchmarking

Benchmarking ICT capital expenditure is challenging because expenditure is often highly cyclical, as the needs of businesses change over time and legacy systems are replaced periodically. The better approach, therefore, is to seek external validation of the ICT strategy and expenditure plans by a suitably qualified expert, who is able to draw on experience across the sector and other industries.[3]

In relation to cyber security, Ausgrid believes benchmarking is appropriate and an important way of identifying and implementing best or better practices in cyber security. It should be noted that as part of the long-term partial lease of Ausgrid there is a new set of NSW Distributor's Critical Infrastructure Licence Conditions. These obligations slightly differ from other Transmission and Distribution businesses in NSW with implications of these being different between Transmission and Distribution businesses depending on their individual technology landscape and existing maturity. It is important to note that these specific Licence Conditions do not apply outside NSW which should be factored into any benchmarking undertaken.

In relation to cyber security, we undertook additional validation to ensure that our proposed expenditure was appropriate, both in the context of the AER's review and in relation to the potential risks. We therefore engaged a number of parties to:

- assess Ausgrid's cyber control maturity using the US Department of Energy developed, Cybersecurity Capability

[3] KMPG undertook an external validation of our ICT strategy.

- review Ausgrid's cyber security risk landscape to evaluate our cyber security and resilience controls, and existing mitigation strategies. The review produced a costed and executable roadmap of cyber improvement activities we need to undertake, including ongoing continuous improvement. Our forecast of ICT capex includes the efficient cost of executing these improvements over the next regulatory period.
- assist Ausgrid with a strategic review of its cyber security strategy and program. The by industry expert (Hakluyt) found the Ausgrid cyber security strategy and program to be 'sound' and identified a number of recommendations to be incorporated in Ausgrid's cyber security strategy and program.

In addition, the Ausgrid cyber security strategy and program has been reviewed and endorsed by the Critical Infrastructure Centre and Australian Signals Directorate (ASD) within Federal Government.

6.3 Property

Non-network property includes offices, depots and specialist sites located throughout Ausgrid's distribution area. Investment in non-network property and buildings allows Ausgrid to maintain our level of service and emergency response times to customers. Property related to network substation investments is included as part of the respective growth or replacement programs.

Capital expenditure is required for the consolidation and renewal of depots, development of offices and specialist supply sites in the right locations that assist in reducing response times in an event of an outage or emergency. The portfolio is ageing with a number of properties not meeting mandatory compliance or environmental requirements.

The property program drives benefits for Ausgrid through savings on the operation and maintenance costs of buildings. The majority of these savings are from efficiencies gained through the implementation of modern energy efficient systems above those currently installed, which although regularly upgraded and maintained are of a significant age and accordingly less efficient. All new elements within the building will be under warranty for periods of between 12 months for minor items such as fittings and furniture and up to 10 years for glazed curtain walls and similar furnishings.

There are also savings in time and other efficiencies that the building and property program achieves through the consolidation of properties. In addition, unquantifiable savings in respect of staff wellbeing and a more efficient use of space lead to productivity increases.

Current period expenditure

In the current period, we expect to invest $173 million on non-network property which is $28 million more than the regulatory allowance of $145 million. The additional expenditure has been necessary to support changing business requirements in relation to the upgrading of properties. Expenditure between FY2015 and FY2017 tracked well below the final determination for the 2014-19 period as Ausgrid realigned its program of works over the period in response to impending changes in our business ownership. These changes required some adjustments to the original investment plan, including:

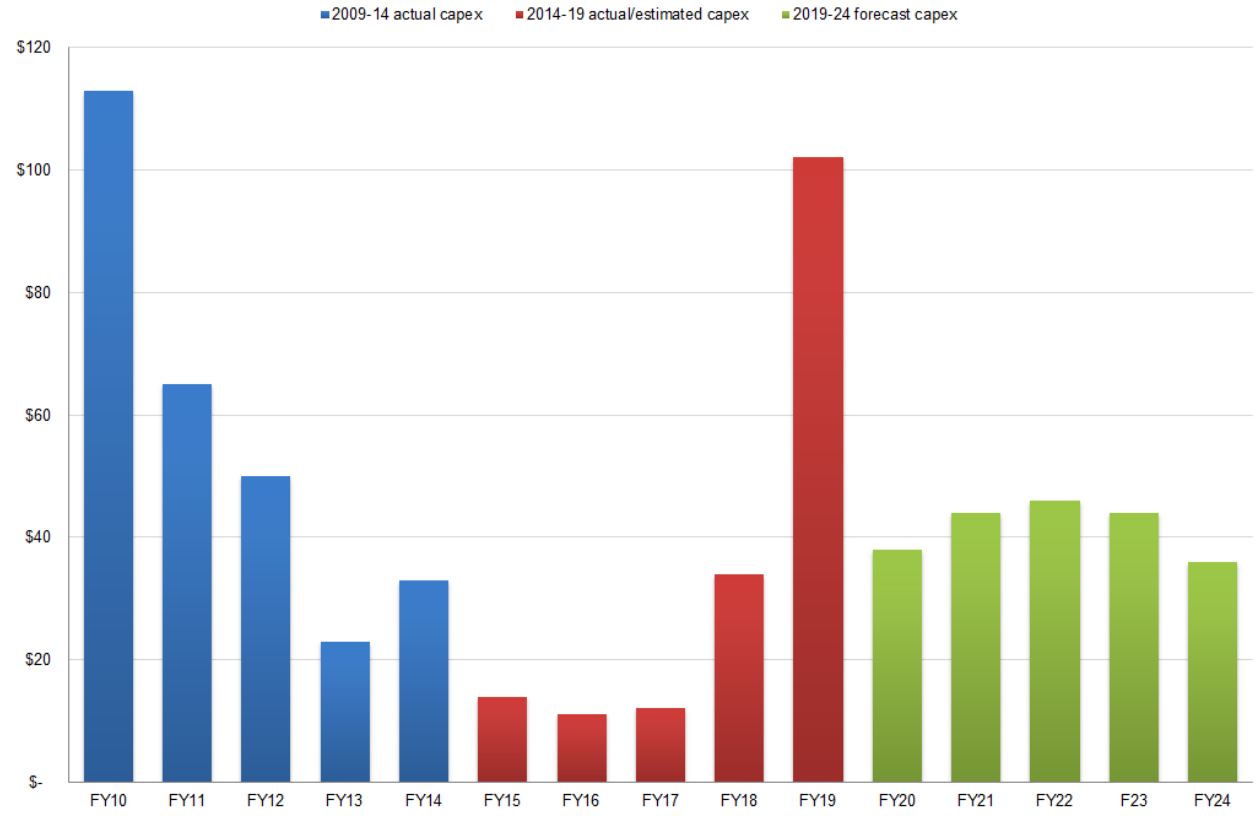
- Deferral of projects - Some projects programmed for the last period have been completed in the current period such as Ourimbah Depot and Roden Cutler House minor works;
- Decrease in staff numbers – Over the period staff numbers decreased from 5,500 to approximately 4,000 which led to a re-prioritisation of the depot investment program. In some instances, additional space was re-let to accommodate the decrease, which enabled deferral of certain projects;
- Opex/capex substitution – More detailed planning revealed safety issues with keeping some facilities operational, which required a change in the programmed delivery; and

- End of short-term leases - In some instances, additional temporary leased space was not able to be re-let, which required the acceleration of certain refurbishment and fitout projects.

Capital expenditure is forecast to increase during FY2018 and FY2019 to catch up on the program from the preceding years and complete deferred projects.

Figure 18 below presents total 15-year trends in actual and forecast building and property capex for the periods FY2010 - FY2024.

Figure 18: Building and Property capex ($m, real FY2019)



Program achievements

The 2014-19 period continued the renewal journey commenced in the 2009-14 period, with the renewal of aged facilities and the consolidation of depots.

The renewal process has been impacted on by statutory planning constraints, latent land conditions and compulsory acquisitions that have affected the planned delivery timetable. By way of example the Sydney East depot renewal project for the relocation of Zetland Depot to Alexandria was delayed by the statutory acquisition by Sydney Water of access rights and easements associated with trunk drainage on the Alexandria property; the Lower Hunter depot renewal project from Rutherford to Beresfield was delayed by the identification of unrecorded abandoned mining leases requiring extensive re-evaluation of the land and a re-design of proposed structures. Both projects, whilst now on track, will be completed later than forecast in our 2014-19 proposal.

During the current period our depot consolidation strategy has managed the significant decrease in staff numbers – from a base of 5,500 to approximately 4,000. Much of this decrease impacted the depot facilities with lower levels of field and support staff required to deliver the system capital program and maintain the network.

These changes required some adjustments to the original investment plan and saw some leasehold solutions extended to meet the immediate need and avoid capital expenditure pending the

stabilisation of the workforce which has contributed to the capital underspend between FY2015 and FY2017.

Property investment faces risks and challenges, with numerous internal and external factors that can lead to delays and overspend. Although some risks, such as those that impeded our Zetland Depot and Rutherford to Beresford projects, are difficult to foresee and plan for, Ausgrid has risk management processes in place to minimise disruption and avoid cost over-runs. Risks are mitigated as follows:

- Risk identification and mitigation strategies are prepared for every project before commencement;
- Formal project delivery strategies are adopted for each project;
- Regular internal reporting on status both financial and progress;
- Project review meetings are regularly carried out with internal and external stakeholders i.e. builder and relevant contractors and consultants; and
- Appropriate project governance is applied.

Proposed program

Our proposed program for the 2019-24 period includes two office projects and six depot projects. Each project is briefly described below.

Wallsend office replacement

- New green-field development at a nearby appropriately sited Newcastle depot to replace the ageing Wallsend Administration Building

Future workplace program

- Program of works at various sites to support the cultural transformation by providing a collaborative work environment that sponsors productivity, growth and creativity

Zetland depot replacement (Alexandria)

- New green-field development to enable replacement of the existing Zetland depot due to ageing assets, encroachment by residential development and local council infrastructure development. This project has already commenced and is expected to be completed early in the next regulatory period.

General depot refurbishment program

- Program of works at various minor sites to address ageing assets and compliance requirements

Homebush depot upgrade

- Staged rebuild of the depot facilities at the existing Homebush site to provide fit for purpose facilities and replace ageing assets

Hornsby depot replacement

- New green-field development to enable replacement of the existing Hornsby depot due to ageing assets

Oatley depot replacement

- New green-field development to enable replacement of the existing Oatley depot due to ageing assets

Wallsend depot upgrade

- Staged rebuild of the depot facilities at the existing Wallsend site to provide fit for purpose facilities and replace ageing assets.

A summary of forecast capex for each project is presented in Table 20.

Table 20. Forecast property capex by project (m, real FY19)

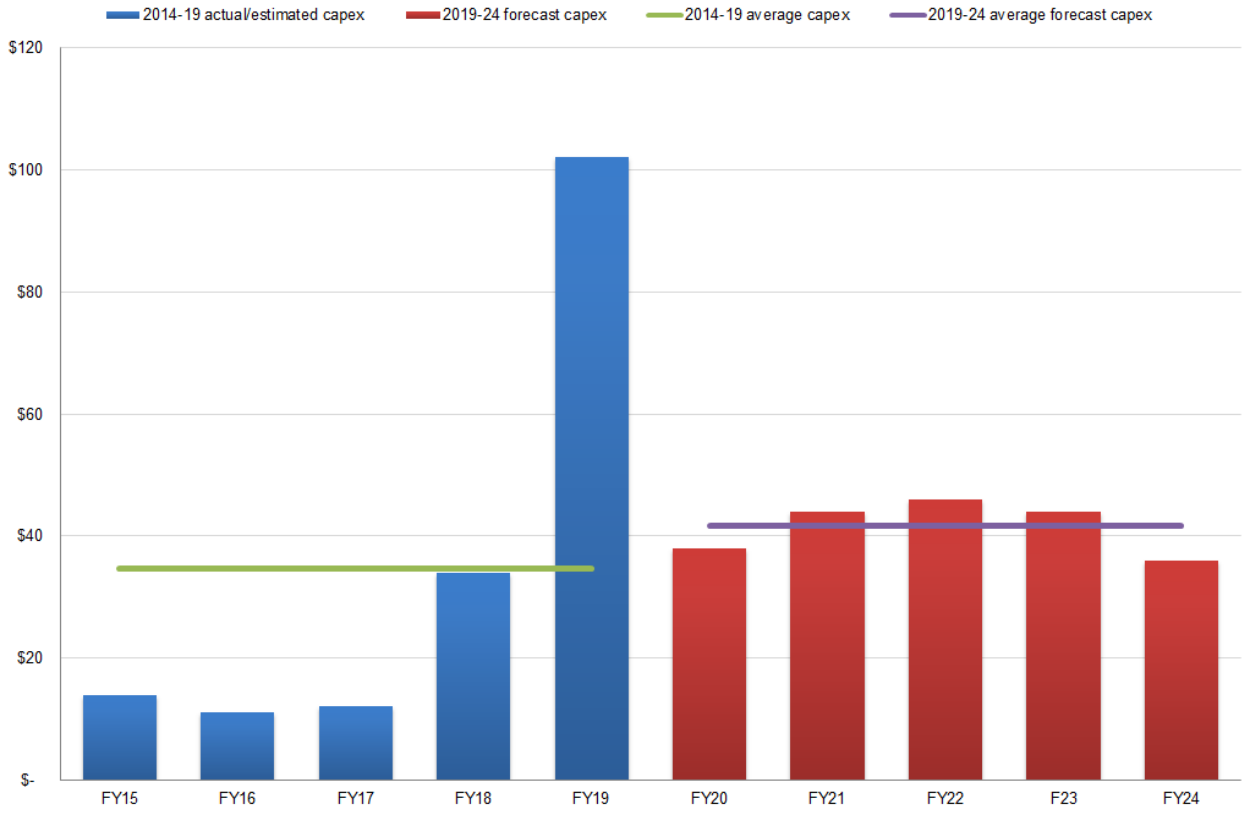
Project	FY20	FY21	FY22	FY23	FY24	Total
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						
[redacted]						

Proposed forecast

Our proposed property capex program for the 2019-24 regulatory control period is for $208 million over five years (real FY2019). This is $36 million (or 21 per cent) higher than actual/forecast capex of $173 million in the 2014-19 period.

Figure 19 illustrates the non-network property capex spend in the 2014-19 and 2019-24 regulatory periods.

Figure 19. Actual and forecast property capex (m, real FY19)



Our capex on buildings and property in the 2014–19 period is estimated to exceed the final determination allowance in the current regulatory period by $28 million (real FY19). We forecast a single disposal of non-network property during the next period for the sale of the Zetland depot once Alexandria is built. Disposals of property and buildings are treated in accordance with the AER roll forward model, where the value of the regulated asset base is reduced by the disposal value of any asset. This will result in lower costs to customers over the longer term.

Forecasting method

The capex program for property is based on a needs assessment with feasible options generated to address future requirements. Ausgrid conducts annual reviews to assess the state of the property portfolio and how changes in the underlying business environment or external circumstances are likely to drive requirements of the portfolio. Options assessment criteria include:

- Geographic and strategic location
- Town planning
- Depot size / utilisation / consolidation
- Design and condition
- Co-location
- Business requirements

The forecast cost of property capex has been estimated using bottom-up individual estimates for each project that has been identified as necessary to undertake during the next period.

The Non-Network Property Plan, and business cases for each of these projects can be found in:

- Attachment 5.20 Non-network Property Plan
- Attachment 5.21 Non-network Property Business

6.4 Fleet and plant

Ausgrid is committed to setting industry best practice in fleet management. A safe, reliable and efficient fleet is essential for supporting Ausgrid's delivery of network services.

Ausgrid's fleet is made up of vehicles (cars, light vehicles, trucks, elevated work platform vehicles, trailers, etc.) and plant (air compressors, vehicle mounted and self-propelled elevated work platforms, forklifts, generators).

Current period expenditure

Ausgrid's capex on fleet and plant is estimated to be $65 million (real FY2019) during the 2014-19 regulatory period. Of this, $54 million is for fleet and $11 million is for plant.

At the beginning of the period the fleet was larger than required following the reduction in the capex program. From FY2015 we have reduced the size of the fleet to improve utilisation rates, resulting in lower capital expenditure requirements. This downsizing also coincided with a reduction in staff numbers, reducing the need for some vehicles.

Ausgrid has a mix of leased and owned vehicles and determines the appropriate vehicle procurement method in line with our fleet strategy. Our fleet strategy is focused on reducing opex (maintenance, leasing costs) and optimising life cycle costs of capex through timely replacement of aged fleet. Often, lease units are more expensive than owned fleet and if business needs change before lease term ends, these vehicles require additional funds to retire the lease.

Figure 20 and Figure 21 below present total 15-year trends in actual and forecast fleet and plant capex for the periods FY2010 - FY2024.

Figure 20. Fleet capex ($m, real FY19)

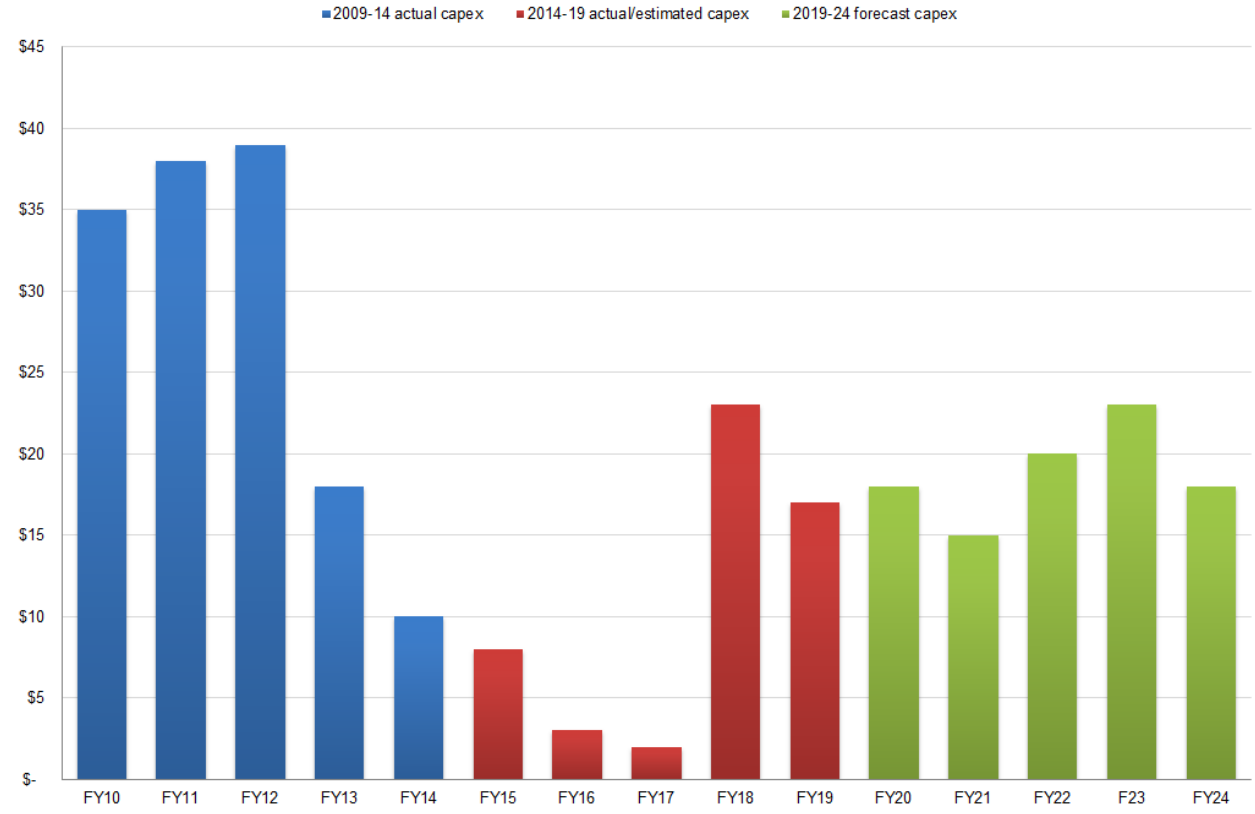
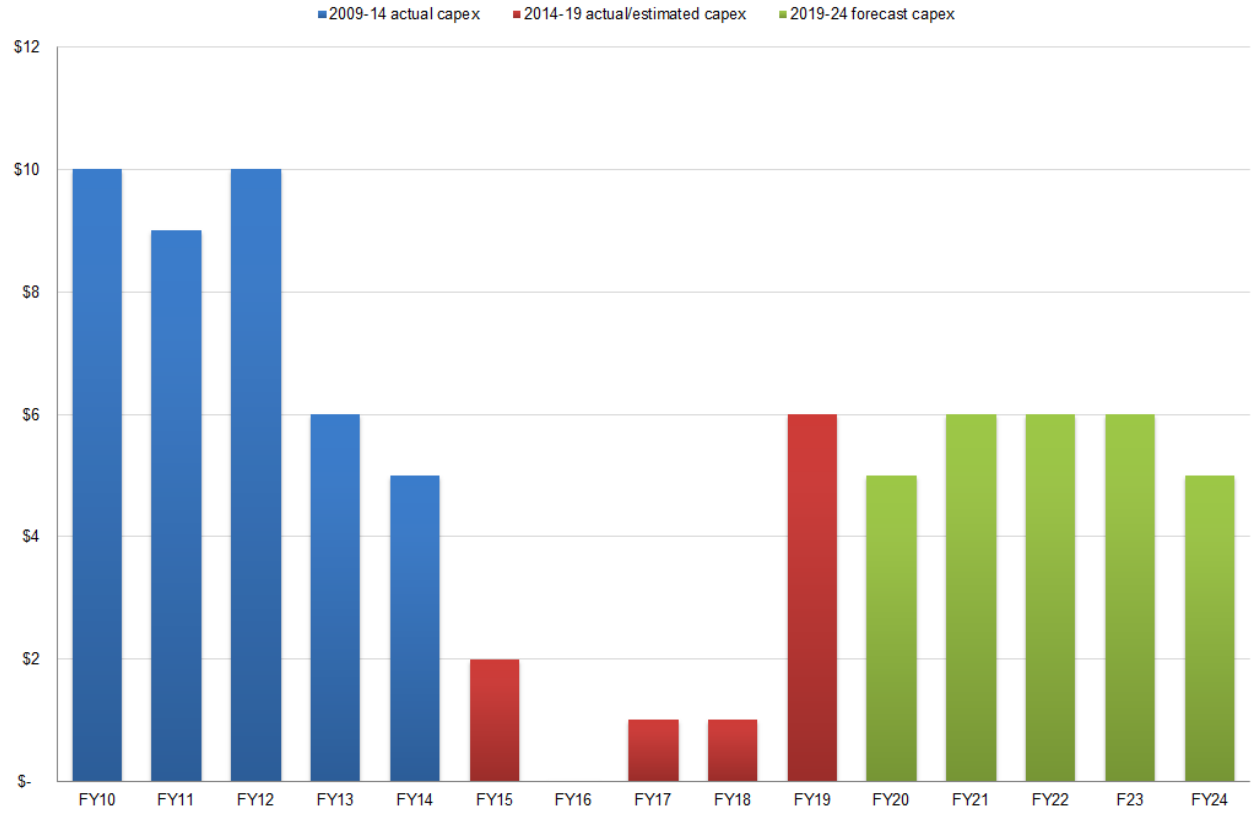


Figure 21. Plant capex ($m, real FY19)



Program achievements

During the current regulatory period Ausgrid has developed and implemented a wide variety of fleet initiatives to reduce current and future costs associated with the fleet, including:

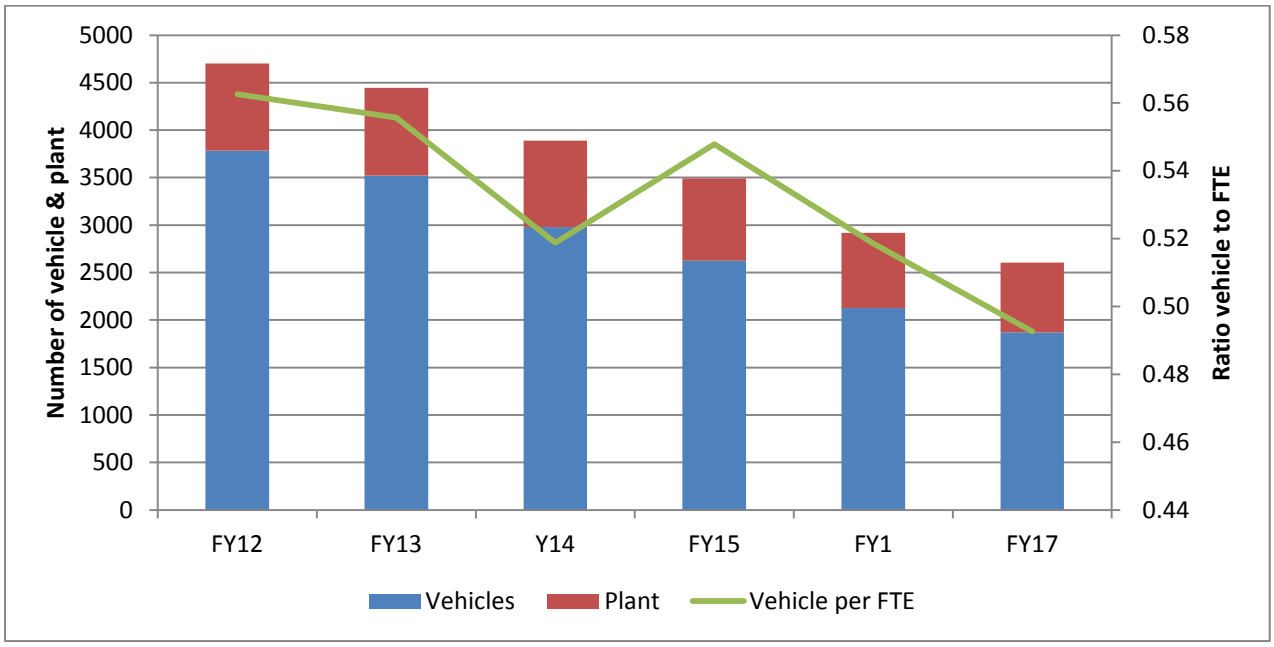
- Revision of fleet retention or replacement life cycles
- Reduction in requirement of additional fleet
- Potential reduction in requirement of light commercial fleet unit numbers
- Reduction in private use travel of fleet
- Opportunity to standardise fleet and equipment across all network providers
- Increase in refurbishment of heavy fleet in lieu of replacement following life cycle revision.

Reduction in fleet size

We have reduced the number of vehicles in our fleet from 3,783 in FY2012 to 1,871 in FY2017 (or 50 per cent) and reduced the number of units of plant from 920 to 733. This reduction was focused on increasing the utilisation of our fleet, which is measured by a reduction in vehicles per FTE (shown in Figure 23). We have improved the utilisation of our fleet from 0.56 to 0.49 vehicles per employee over the period from FY2012 to FY2017. We now believe this is a sustainable fleet for the future and will allow us to be prepared for major network events while maintaining a high utilisation rate at other times.

To meet our needs during major network events, we are able to use vehicles and plant from our various depots and redirect them to areas facing emergencies and are also are able to borrow equipment from adjacent distribution network service providers as required.

Figure 22. Utilisation of fleet



Revision of fleet retention or replacement lifecycles and opportunity to standardise fleet

During the current period we revised our fleet retention or replacement lifecycles and sought to standardise our fleet to reduce our capital costs over the longer term. The standard age and mileage for owned vehicles we have adopted ranges from:

- 5 years / 100,000 km life for cars and station wagons
- 7 years /150,000 km for light commercial cab/chassis, panel vans and utilities. Our light commercial vehicle fleet is being standardised with suitable fit out that can be reused on new vehicles, reducing capital outlay.
- 15 years / 250,000 km for trucks
- 15 for elevated work platforms and cranes this includes a major inspection to Australian Standards requirements at 10 years. This is a cost effective extension to the life of the unit reducing required capital for early replacement whilst maintaining reliability.

Ausgrid has also invested in telematics for the vehicle fleet. Telematics allow Ausgrid to manage driver behaviours and improve fleet utilisation, providing benefits in operator safety and operational efficiency.

Proposed program

Initially in the 2014-19 period, the focus was on reducing the fleet. This was undertaken to improve fleet utilisation following reduction in the capex program. The business operating plan is now sufficiently progressed via transformation to support network service delivery with replacement fleet.

The focus of fleet capex over the 2019-24 period is on fleet replacement. The objective is to reduce opex (maintenance, leasing costs) and optimising life cycle costs of capex through timely replacement of aged fleet.

Decisions to replace fleet are primarily driven by age of the vehicle. Vehicles are generally replaced when they reach the standard age. Reasons for aged based replacement include:

- As vehicles increase in age, wear and tear increases, which results in assets that are less safe, are more prone to breakdowns and require more servicing.

- Fleet vehicles are permanently loaded increasing maintenance and wear on mechanical components. The vehicles are tools required for our staff to do their work and these need to be reliable to provide an efficient service to our customers.
- Most of Ausgrid's fleet is parked externally with rust and general wear and tear on the unit being an issue from aged fleet. Major mechanical, rust and trim repairs are costly and introduce major downtime. Updating at reasonable intervals to reduce repair cost and downtime is necessary.

From FY2022-FY24 there will be an additional focus on specialised crane-based plant to keep unit ages below 15 years. Major inspections will be carried out at 10 years of age to extend service life to 15 years on crane-based fleet units including elevated work platforms for extended service life and reduced capital requirements.

Ausgrid will also review its fleet of elevated work platforms as they reach replacement age, with a focus on moving to smaller, more agile units and more standardisation of vehicle types across our network regions. Optimising and standardising the fleet of elevated work platforms will improve efficiency for staff and maintenance.

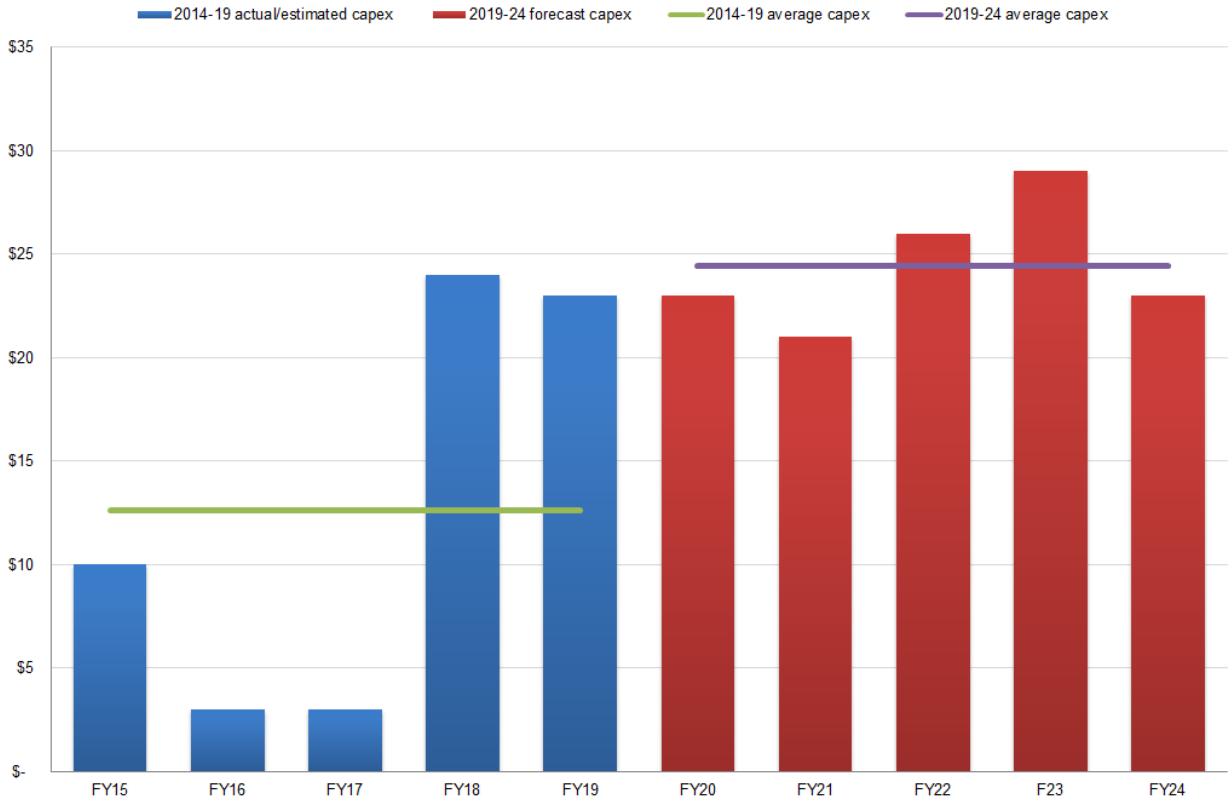
The planned renewal program aims to deliver:

- Safe rotating and elevating plant
- Fit for purpose, low maintenance vehicles and plant
- Sustainable fleet with predictable capex and opex to meet regulatory and business plan objectives.

Proposed forecast

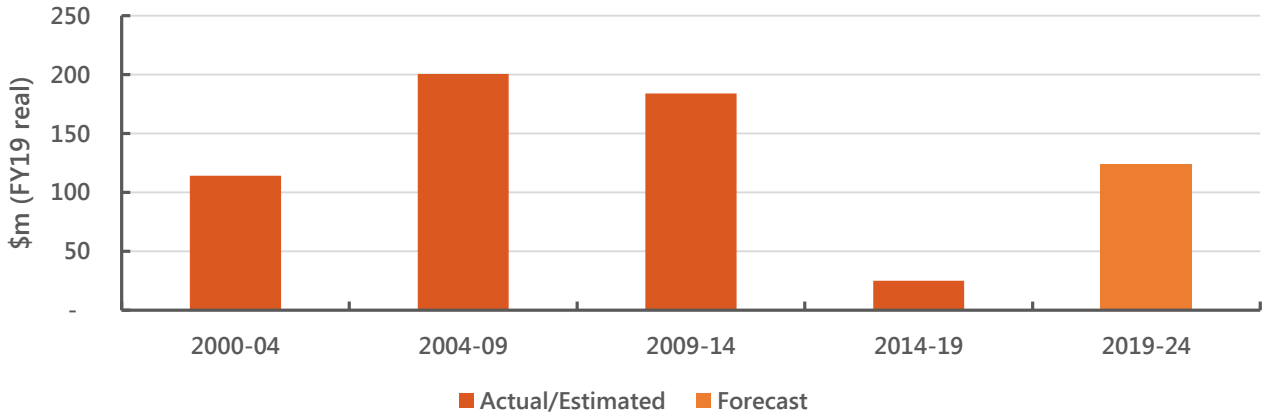
Ausgrid proposes to spend $124 million (real FY2019) on fleet and plant capex during the 2019-24 regulatory period. This is made up of $94 million for vehicles and $30 million for plant. Figure 23 presents actual and estimated fleet and plant capex for 2014-2024.

Figure 23. Fleet and Plant capex ($m, real FY19)



This level of expenditure is higher than during the current period. However, the 2015-19 period is not comparable due to the one-off nature of the fleet downsizing that occurred and further increases in the average age of the fleet would risk increasing maintenance costs. Figure 24 below shows the proposed capex is lower than other historical periods.

Figure 24. Historical and proposed fleet capex($m, real FY19)



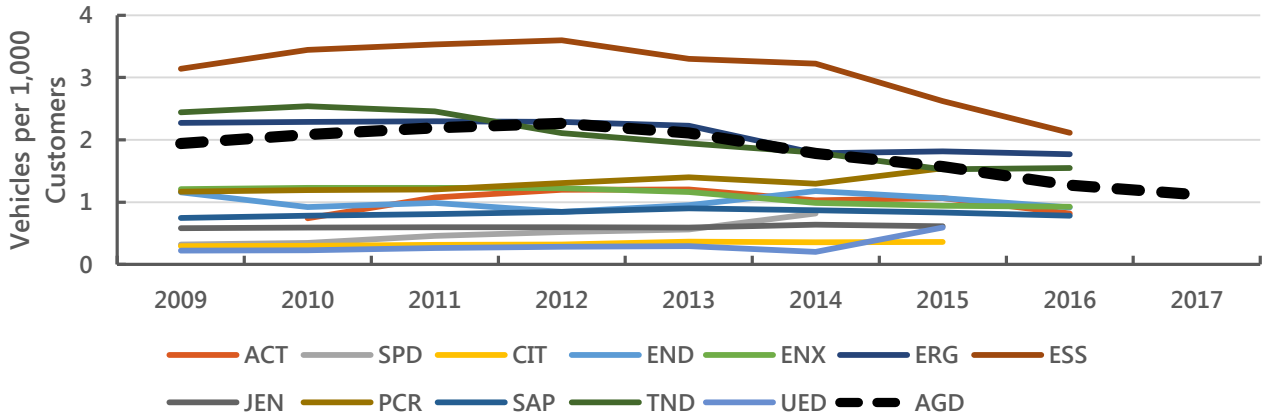
Forecasting method

Capex for fleet and plant was forecast by estimating age-based retirements of existing assets. These forecasts were then adjusted for changes in maximum acceptable asset ages and refurbishment plans and the total requirement for each vehicle/plant type.

Benchmarking

Ausgrid has historically had a relatively high number of vehicles relative to its customer base when compared to other distribution businesses. This has been falling and now Ausgrid is around the middle of the pack on this metric, as shown in Figure 25.

Figure 25. Vehicles per 1,000 Customers



Source: RIN data, Ausgrid

7 CAPITAL PROGRAM SUPPORT

Capital program support (also known as capitalised overheads) includes support costs required to deliver the capital program. These costs cannot be allocated to individual projects so are bundled together as overheads. The value of overheads that are capitalised is calculated in accordance with Australian Accounting Standards and are allocated to standard control services in accordance with Ausgrid's Cost Allocation Method (CAM) which is approved by the AER.

This expenditure is needed to support and deliver the replacement, augmentation and non-network capital programs.

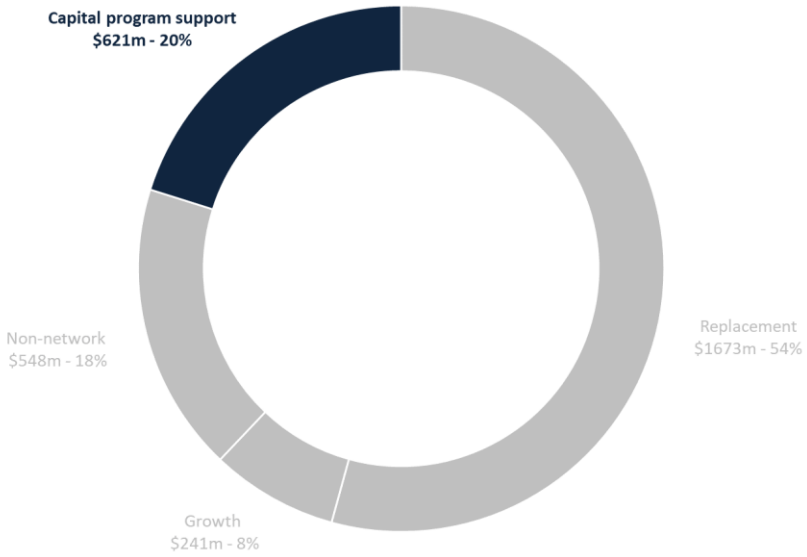
Capital program support costs are made up of direct costs (network planning) and indirect costs (network divisional management and business support functions; fleet; corporate support functions; logistics, warehousing and procurement; and IT). (These costs are separate from the non-network programs)

Indirect overheads are allocated to various project and programs based on direct labour, so they are effectively spread across all asset classes and hence depreciated according the regulatory depreciation rates for the various RAB asset categories.

Capital Support costs for the FY20-24 period have been forecast based on the current level of network planning costs and support costs to direct capex labour, which is 64 per cent of forecast direct capex labour.

We propose to spend $621 million on capitalised support costs for the 2019-24 capital program (real FY19) or $124 million per annum. This makes up 20 per cent of the total capital program as shown in Figure 26 below.

Figure 26.: Capital program support capex as proportion of total capital program in 2019-24



7.1 Current period expenditure

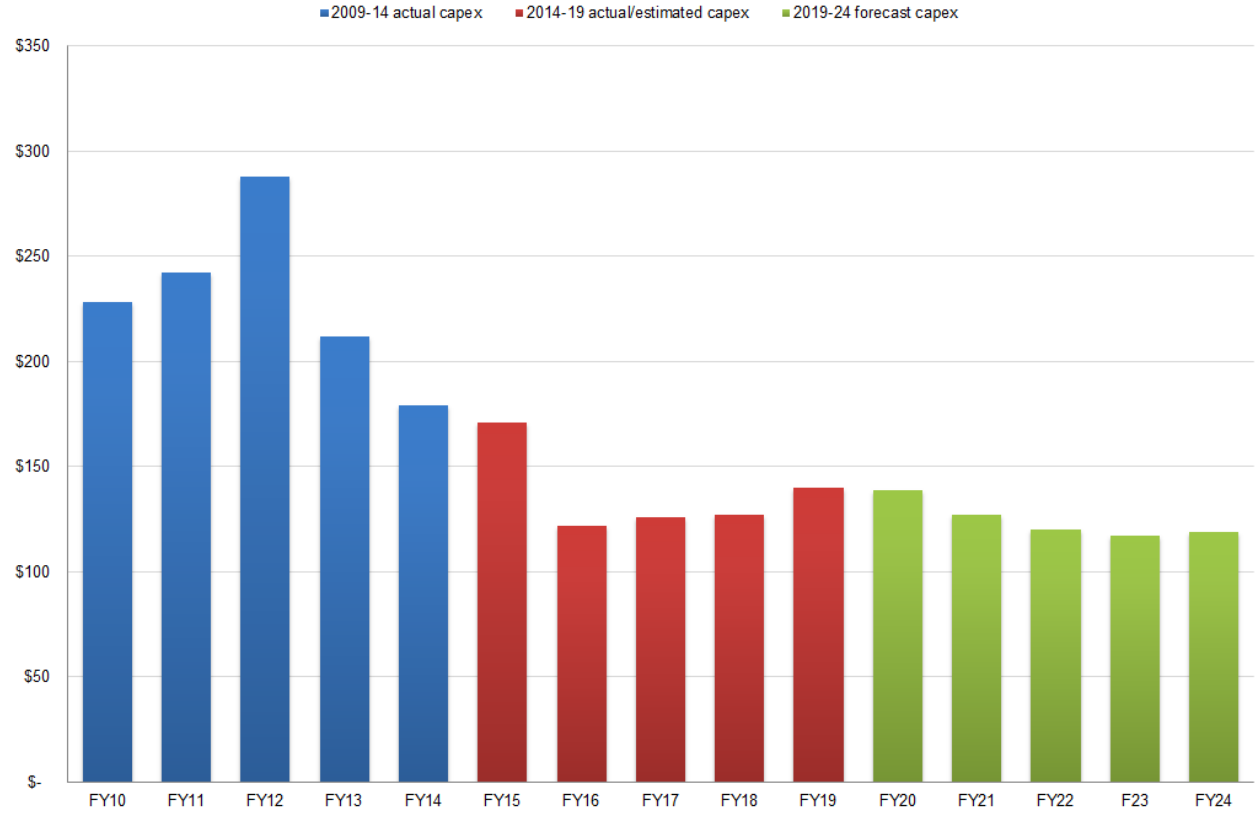
Capital program support costs have decreased significantly in the current regulatory period, from $238 million per annum in the 2009-14 period to $146 million in the current period. In addition,

capitalised overheads have fallen from 74 per cent of direct capex labour in the 2009-14 period, to 64 per cent of direct capex labour in FY2018.

The decrease was driven by sustainable cost reductions arising from Ausgrid's transformation program. Decreases across operating and capital expenditure programs reduced the total cost pool of our network, resulting in lower indirect support costs allocated to capital.

The figure below presents total 15-year trends in actual and forecast capital program support capex for the periods FY2010 - FY2024.

Figure 27. Program Support capex ($m, real FY19)



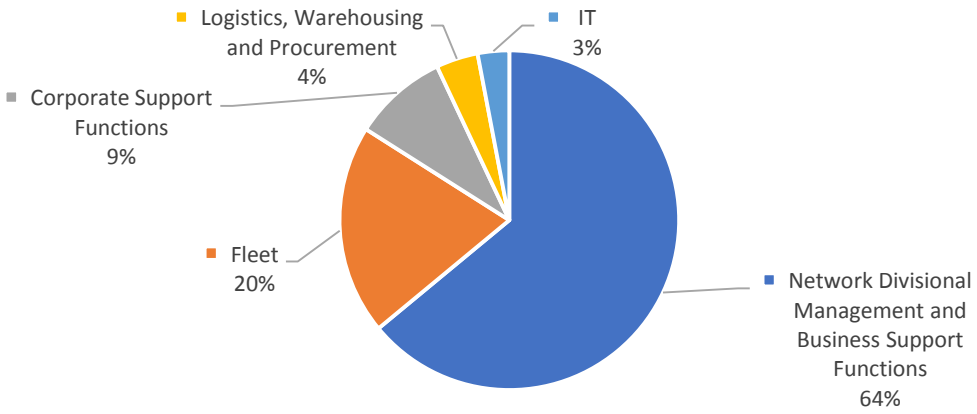
7.2 Program achievements

Capitalised overheads support all aspects of Ausgrid's capital program, including replacement, growth and non-network capital expenditure.

Approximately 40 per cent of total indirect support costs and 46 per cent of total labour costs (including overtime, labour on-costs and labour hire) are currently capitalised. These percentages are broadly in line with the actual annual average since the start of the current regulatory period.

The breakdown of indirect support costs by item for FY2017 is shown in Figure 28 below.

Figure 28. Indirect overheads by item



7.3 Direct costs (network planning)

Direct capitalised overheads are costs related to the network planning function within Ausgrid. In the 2019 – 2024 period it is proposed to spend $76.2m on network planning functions in support of the network capital program.

This includes the teams responsible for network planning activities, developing Ausgrid's capital investment programs and major projects and seeking related approvals.

The majority of Network planning costs are recognised as capital expenditure when incurred.

7.4 Indirect costs

Indirect costs are costs related to other functions and services that support the capital program, but which cannot be directly attributed to a specific capital project. Indirect support costs are allocated to projects and programs via the use of labour and non-labour costing rates.

Indirect costs are made up of network divisional management and business support functions, certain corporate support functions, fleet, logistics and procurement and ICT.

- Network divisional management and business support functions is made up of costs related to the management and supervision of capital projects and programs, scheduling jobs, admin support and safety briefings
- Fleet costs are made up of vehicle running costs (i.e. fuel, registration, insurance and servicing), vehicle lease costs and costs associated with running the fleet function.
- Corporate support costs are made up of certain corporate support functions that support the capital program, including Finance Operations (payroll, accounts payable/receivable and transactional processing), Commercial Finance (financial and decision support), Human Resources (employee relations and recruitment) and Safety Operations (safety support and awareness services).
- Logistics, warehousing and procurement costs are those costs from these functions that are utilised by the capital program.
- Overhead ICT costs include costs such as desktop support, computer and device leasing and telecommunication charges.

The largest segment of indirect costs is network divisional management and business support functions, which represents indirect support costs related to the management and supervision of capital projects and programs, scheduling jobs, admin support and safety briefings. Based on the FY2017 breakdown of indirect costs, this makes up 64 per cent of the cost.

These costs originate from Ausgrid's four network divisions being, Asset Management and Operations (12 per cent), Field Services (78 per cent), Program Delivery (9 per cent) and Customer (1 per cent). This amount comprises of both labour (74 per cent) and non-labour (26 per cent) costs incurred within these divisions and subsequently capitalised based on Australian Accounting Standards.

7.5 Forecast methodology

Capitalised overheads are calculated using Ausgrid's CAM. The CAM defines capitalised overheads as a multiple of direct labour costs.

The CAM has been approved by the AER and meets Australian accounting standards.