Revised Proposal Attachment 5.01 - Ausgrid's proposed capital expenditure

January 2019

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1 Introduction

The purpose of this document is to provide additional information to support our revised network capital expenditure (capex) forecast for the 2019-24 Regulatory Period. In particular, the information provided demonstrates that:

1. We have understood and responded to the matters raised by the Australian Energy Regulator (AER) in its draft decision and by our customers through our engagement process; and

2. Our revised total network capex forecasts comply with the National Electricity Rules (NER) and therefore should be approved by the AER.

For the reasons presented in this document, we are confident that our revised total network capex reflects the efficient and prudent costs of achieving the capex objectives, and provides safe and reliable distribution services to our customers, in accordance with the requirements of the NER.

This document forms part of our revised Regulatory Proposal to the AER. It should be read in conjunction with Chapter 5 of the Revised Regulatory Proposal and other supporting documentation that are referenced where appropriate. Separate supporting documents have been prepared in relation to our non-network capex forecast (See Attachments 5.19, 5.20 and 5.24.1).

2 Our revised total capex forecast

2.1 Revised total capex forecast

Our revised total network and non-network capex forecast for 2019-24 is $2.69 billion or $538 million per year[1].

The revised total capex forecast is $394 million (13%) lower than our initial capex proposal of $3,084 million. The lower revised capex forecast reflects our careful consideration and response to feedback from customers and the AER's Draft Decision. We have worked hard to carefully balance the need to address the affordability concerns raised by our customers while also meeting our regulatory obligations.

The revised capex program and forecast meets our corporate objective of providing affordable, reliable and sustainable services to our customers. The revised capex forecast meets the capex objectives and criteria.

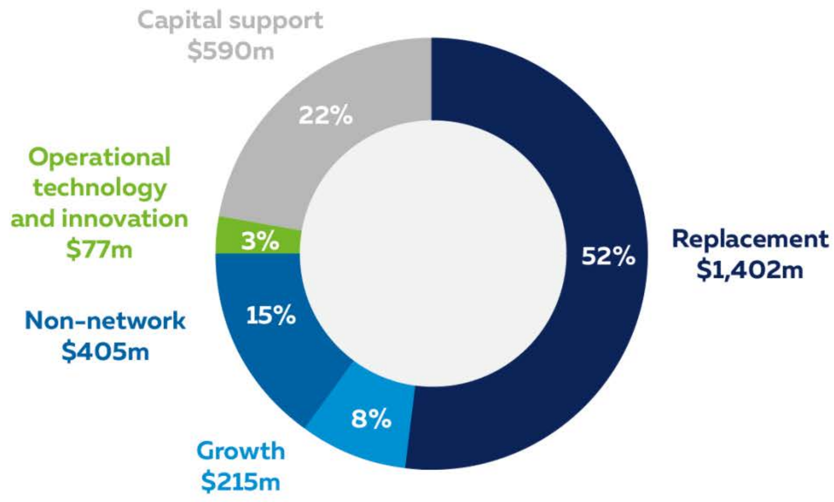
2.2 Components of capex proposal

The key components of our capex forecasts are:

- replacement capex (repex)
- growth capex (augmentation (augex) and connection)
- non-network including information, communications and technology (ICT), property, fleet and minor assets and operational technology and innovation (OTI), and
- capital program support.

Figure 1

Components of our total capex forecast



Source: Ausgrid

[1] All dollar numbers discussed in Attachment 5.01 are in real FY2019 dollars, unless specified otherwise.

The composition of our total capex forecast is largely unchanged from our initial forecasts. Repex represents the largest component of the total capex program at 52% of the total program.

We have revisited each of the components of our capex program in developing our revised forecast. Our revised forecasts reflect the most recent information, including 2017/18 actual capex. A brief description of the main capex components and changes is summarised below.

Capex component	Description
Replacement capex (repex)	Refers to investment that replaces or renews network assets in major projects or planned, conditional and reactive programs. It represents the largest component of our capex plans. We propose to invest $1,402 million replacing network assets that potentially pose a risk to safety and reliability. To address customer and AER concerns, we prepared further detailed analysis using updated information and reprioritising programs. In doing so, we have reduced the total repex forecast by $271 million or 16% from $1,673 million in our Initial Proposal.
Growth (augmentation and connection) capex	Refers to projects and programs to connect new customers and augment the network to meet peak demand forecasts, while maintaining appropriate utilisation of the network. We propose to invest a total of $215 million in growth related expenditure. This is $26 million (11%) lower than our initial growth forecast. The lower forecast is mostly in response to up to date information such as lower peak demand forecasts and updated information on customers connecting to our network.
Non-network capex	Refers to programs for non-network assets including investing in ICT, OTI, property, fleet and minor assets. The revised non-network programs total $482 million, which makes up 18% of the total capex program. This is a reduction of $66 million (12%) compared to our Initial Proposal of $548 million. We have provided detailed options analysis and/or cost-benefit assessment to justify the prudency and efficiency of these programs. OTI, shown separately in the Figure 1 above, relates to our core system operational technology requirements as well as our innovation program, which includes a change in the way we use technology to capture our network characteristics, as well as, a number of network technology projects and pilots. We are proposing $77 million in OTI capex in our Revised Proposal. This is approximately $20 million more than our Initial Proposal as we are proposing additional expenditure for cyber security.
Capital program support (also known as capitalised overheads)	Capital program support captures indirect costs we incur in the delivery of our repex, growth and non-network capital programs. The category includes planning, managing and supervising capital projects and programs, scheduling jobs, administrative support and safety. We propose to invest a total of $590 million in capital program support over the period, which is $31 million lower than our Initial Proposal. This component represents 22% of our total capital program.

In relation to repex and growth capex, we have reviewed our demand management projects for the 2019-24 period. The review included updated information and better testing of the options available. As a result, the number of viable demand management initiatives has reduced from seven in the Initial Proposal to three in the Revised Proposal. This is discussed further in section 7 of this document.

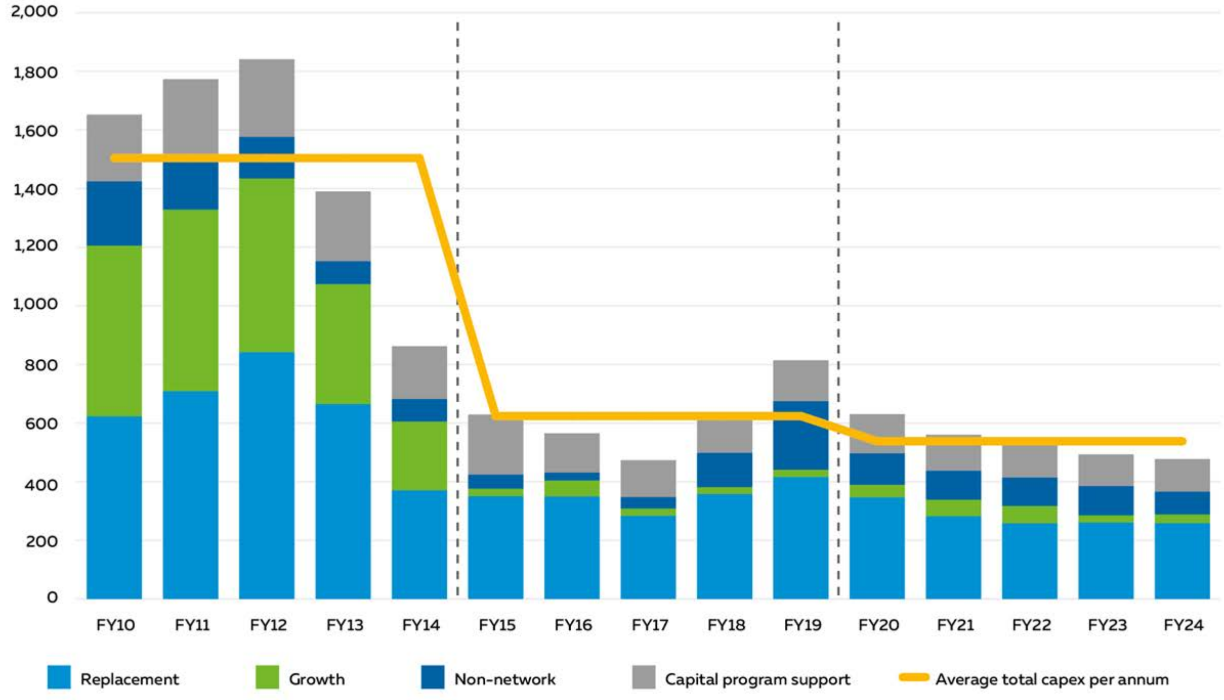
2.3 Trend in capex over time

The NER requires an explanation of any significant variations in forecast capex from historical capex (S6.1.1(7)). The combination of the NSW Government's mandated licence conditions, which enhanced the reliability standards and rising peak demand, led to a rapid increase in capex from 2007 to 2012. A subsequent relaxation of the reliability licence conditions together with a slow-down in the peak demand growth has reduced our future capex requirements. In addition to these external drivers, the downward trend in our capex forecast for 2019-24 reflects a concerted effort to address the affordability concerns raised by customers.

Figure 2 below shows our historical and forecast capex by category.

Figure 2

Forecast by capex driver for 2019-24 compared to previous years ($million, real FY19)



Source: Ausgrid

The actual and forecast capex expenditure over 15 years is presented in Table 1 and Table 2 below.

Table 1

Forecast by capex driver for 2019-24 compared to previous years ($million, real FY19)

Capex driver	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24
$million, real FY19															
Replacement	622	708	841	664	370	350	349	283	357	415	346	281	257	260	258
Growth	583	620	593	410	235	26	55	25	24	25	43	57	60	25	30
Non-network	219	179	142	78	77	48	27	39	117	234	107	99	97	100	78
Capital program support	228	266	265	238	180	205	134	126	139	140	134	123	115	108	111
Total	**1,652**	**1,773**	**1,840**	**1,391**	**863**	**629**	**565**	**473**	**637**	**814**	**631**	**560**	**529**	**493**	**477**

Source: Ausgrid

Table 2

Forecast by capex driver for 2019-24 by regulatory period ($million, real FY19)

$million, real FY19	FY10-14	FY15-19	FY20-24
Total capex for each regulatory period	**7,519**	**3,118**	**2,690**
Average total capex per annum	**1,504**	**624**	**538**
% change from previous period		**-41%**	**-14%**

Source: Ausgrid

The lower level of capex forecasts for the 2019-24 period reflects a number of changes to the way we have prepared the revised capex plans and forecasts. These include:

- Enhancing capex decision-making and review and challenge processes
- Updated analysis of our replacement programs
- Better utilisation of capacity available on the network.

The detailed evidence to support our revised forecasts is presented in later sections of this document.

2.1 How our revised proposal compares to the AER Draft Decision

Table 3 and Figure 3 show our revised capex forecast compared to the AER's Draft Decision and our Initial Proposal.

Table 3

Our total capex forecast compared to AER draft decision 2019-24 ($million, real FY19)

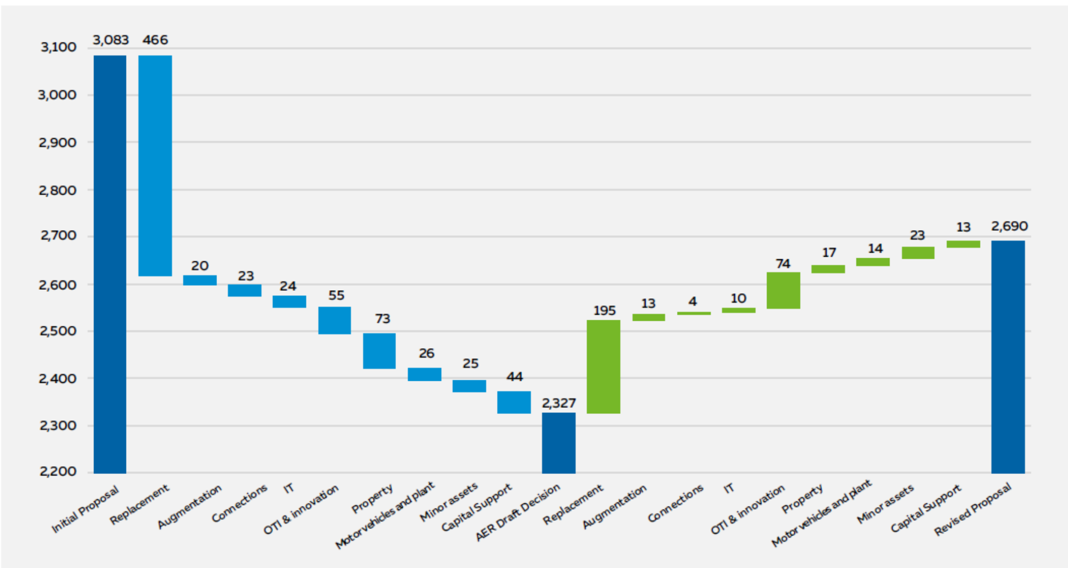
Capex category	Ausgrid Initial Proposal	AER Draft Decision	Ausgrid Revised Proposal
Repex	1,673	1,207	1,402
Augex	189	169	182
Connection	52	29	33
Information, Communications & Technology	158	134	144
Operational Technology & Innovation	58	3	77
Property	208	135	152
Motor vehicles & plant	99	73	87
Minor assets	25	0	23
Capital program support	621	577	590
Total	**3,084**	**2,327**	**2,690**

Source: Ausgrid analysis

Figure 3 below provides a further detailed breakdown of how our Revised Proposal (right hand bar) compares with our Initial Proposal (far left bar) and the AER's Draft Decision (middle bar). It shows that our Revised Proposal moderates the reductions imposed by the AER, while accepting that some savings from our Initial Proposal can be achieved.

Figure 3

Ausgrid total capex forecasts compared to AER draft decision 2019-24 ($million, real FY19)



Source: Ausgrid analysis

We explain how we have responded to the AER's Draft Decision and customer feedback in relation to our revised forecast in the Revise Proposal main document and supporting material.

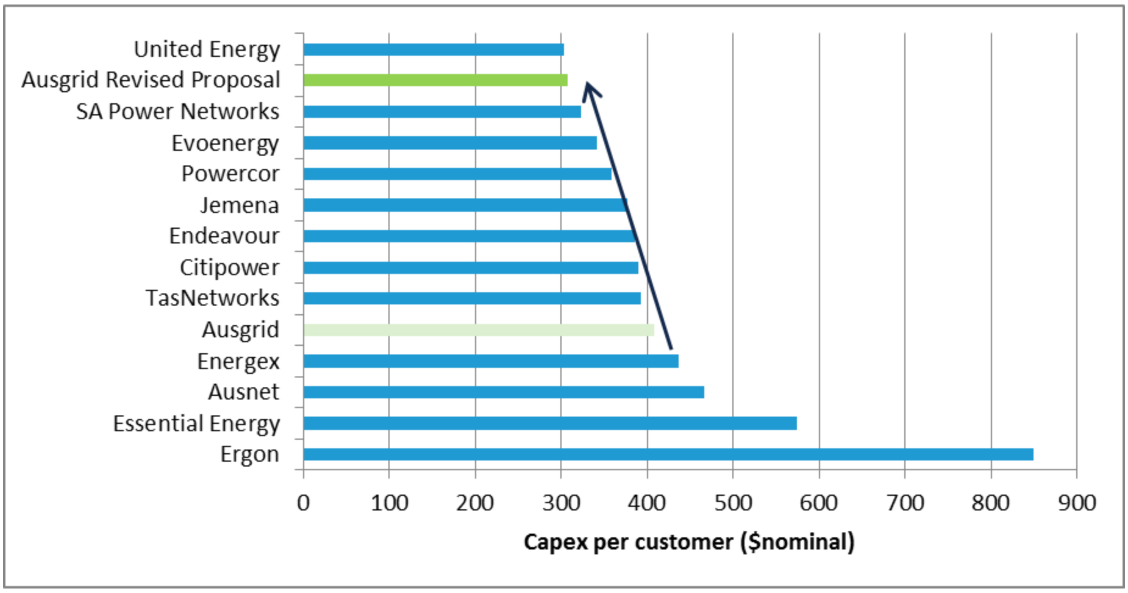
2.2 Our revised capex forecast per customer

Our revised capex proposal compared to other distribution network service providers is shown in Figure 4 below. The revised capex forecast will result in average capex of $300 per customer. This is a significant reduction compared to results for the 2012-17 five-year period.

Benchmarked against other DNSPs, our revised capex forecast will be the second lowest against 12 other DNSPs.

Figure 4

Ausgrid capex per customer compared to other DNSPs FY12-17 ($, nominal)



Source: Ausgrid analysis

2.3 What we've done differently for the revised capex forecast

Following the feedback received from customers and the AER about our Initial Proposal, we carefully reconsidered the way we prepared the capex forecasts. The key changes to the way our capex forecasts are prepared include:

- Improved internal governance and challenge processes, including enhanced roles for the Reset Regulatory Executive Committee and the Investment Governance Committee
- Update of our Risk Management Framework in May 2018
- Certification of our Network Asset Management System to ISO 55001:2014 Asset Management System – Requirements
- Enhanced application of cost-benefit analysis and risk quantification to assess our replacement programs
- Review of demand management projects to ensure that our forecasts reflect an optimal mix of network and non-network solutions
- Revised our real cost escalation factors to reflect the latest available information.

In addition to making these important changes to the way we prepare our forecasts, we have addressed the specific issues raised by the AER and our customers in relation to particular capital programs and projects, in addition to addressing feedback on our input assumptions and projected productivity improvements. We have retained the 2% annual compounding labour productivity improvement included in our Initial Proposal.

Further details on how we have responded to the feedback we have received is discussed in the next section.

2.4 What we heard and how we responded on our initial proposal

Table 4 below summarises the high level matters raised by customers and the AER in its Draft Decision and how we have responded in this Revised Proposal.

Table 4

Responding to feedback on our initial capex forecast

	WHAT WE HEARD	HOW WE'VE RESPONDED
1. Total capex forecast	The AER concluded that we had not demonstrated that our capex forecasts reflected the capex objectives and criteria. As such, the AER substituted its own estimate for total capex in its Draft Decision.	We have addressed the AER's reasons for not accepting our total capex forecast and reduced our proposed expenditure. In particular, we have updated and enhanced the supporting business cases for our capex projects and programs and provided further evidence that our revised forecast meets the capex objectives and criteria.
2. Capex decision making processes	The AER considered that based on the information provided with our Initial Proposal it was not apparent that we had applied a sufficient top-down assessment to reduce our total capex forecast. Customers communicated a similar view.	Our top-down review processes are integral to our capex forecasting approach. At the start of the regulatory proposal process, our total capex program was substantially higher and has gradually been refined through internal review and challenge to reach the revised forecasts of $2.69 billion. However, to address the issues raised in AER and customer feedback, we enhanced our internal capex review and challenge framework for the Revised Proposal, which now includes a detailed review by the Investment Governance Committee. This change has strengthened the role of internal review and challenge processes.
3. Justification for projects and programs	The AER sought more evidence of the need for some capex projects and programs, including risk-based cost-benefit analysis. In relation to our major projects, the AER commended our cost-benefit analysis but suggested refinements to some inputs.	We have taken on board the AER's suggestion and developed more comprehensive cost-benefit analysis for our repex programs, IT and property. The cost-benefit analysis provides clear economic justification for our projects and programs, in accordance with the efficiency and prudency tests in the NER. Looking forward, we will continue to develop our options analysis tools. We will also involve customers to a greater extent in the future development of analytical tools.
4. Affordability	Customers told us that affordability was their number one concern and that they wanted to see clear evidence that significant efforts have been made to reduce capex. Customers had concerns that we had not developed the capex program and forecast with affordability as a key consideration. Customers thought that further productivity improvements could be made to our capex program	To address the issue of affordability, we have worked hard to ensure that we have the balance right. Our revised expenditure incorporates enhanced productivity improvements and innovative delivery plans. Where possible we have revised our timeframes for projects and programs to reduce our expenditure requirements.

5. Demand management	The AER supported three of our six proposed demand management projects. The AER's analysis suggested that the other three projects provided a lower cost-benefit than the capex alternative. The AER also sought more information on our 11kV network augmentation program.	As part of our review of the capex program, a detailed review of our demand management options was completed to verify proposed and identify new opportunities for demand management to defer investment. However, due to low levels of augmentation investment and reduced replacement expenditure, no further non-network projects were identified. We therefore accept the AER's findings that our original number of demand management projects should be reduced. Section 7 sets out our revised demand management proposal in more detail.
6. Non-network solutions	Customers asked us to look at ways of adopting new technology to provide the services that customers want.	Our OTI capex program will allow us to implement new technologies with a view to improving the way we monitor and operate our network. These projects have the goal of reducing capital and maintenance expenditure into the future and enabling us to respond to our customers' changing requirements. We have provided supporting material to justify the prudency and efficiency of these projects, in accordance with the requirements of the NER. Further information about the OTI program is presented in Attachment 5.13.L
7. Benefits from past investment	Customers referred to past levels of investment and wanted to know what the benefits were, especially in terms of reliability and capacity.	Historical expenditure has enabled us to deliver a more reliable, safe and resilient network at the same time as our customer base has grown. We have engaged with our customers to demonstrate where we have leveraged past investments to meet future needs, including plans to make increased use of existing network capacity.

2.5 Key assumptions in this Revised Proposal

The total capex forecast is underpinned by several key assumptions, which have been updated since our Initial Proposal to reflect newer information and the AER's Draft Decision. The NER requires us to provide details of the key assumptions and a directors' certification as to their reasonableness. For completeness the following Table 5 presents the key assumptions for both our revised capex and opex forecasts.

Table 5

Summary of key assumptions for capex and opex forecasts

Key assumption	Description	Applicability
Key assumption 1 – Regulatory obligations	Apart from our regulatory obligations in relation to cyber security: It is assumed that forecast capital and operating expenditure for the 2019-24 regulatory period are based on current legislative and regulatory obligations. It is also assumed that there are no new substantive regulatory obligations and/or major change in scope of current regulatory obligations (anticipated or taken into account). As noted above, this is with the exception of our regulatory obligations in	Capex and Opex

	relation to cyber security, where the forecast capital expenditure for the 2019-24 regulatory period is based on an anticipated change to the regulatory obligations which will increase our required maturity levels.	
Key assumption 2 **demand and customer connections**	Growth forecasts are based on a set of assumptions regarding spatial peak demand and customer connections over the 2019-24 period, as set out in Attachment 5.07 of the Regulatory Proposal.	Capex and Opex
Key assumption 3 – TransGrid's Powering Sydney's Future Project	It is assumed that TransGrid will proceed with the "Powering Sydney's Future" project as outlined in the AER's Final Decision TransGrid transmission determination 2018 to 2023 (May 2018). Based on this assumption, we have not included $239.8 million ($, real FY19) of capex to replace 132kV cables on our network. This is based on the premise that the scope of TransGrid's project addresses our network requirements, meaning we can retire rather than replace these assets.	Capex
Key assumption 4 – Base year opex	Ausgrid's forecasting approach assumes that the amount of opex required to meet the opex objectives over the 2019-24 period will broadly reflect current opex requirements, with adjustments to reflect changes in input costs, outputs delivered, productivity and step changes. It is assumed that the AER's opex allowance for Ausgrid for 2017/18 (as approved in the AER's original distribution determination for the 2014-19 period) can be adopted as the base for deriving a forecast of efficient recurrent opex over the 2019-24 period although actual expenditure for 2017/18 exceeded the allowance.	Opex
Key assumption 5 – Trend adjustments	It is assumed that it is reasonable to escalate our estimated underlying opex for 2017/18 to reflect changes in input costs, outputs delivered and productivity over the 2019-24 period. The trend adjustments that have been assumed are set out in a table in section 3 to Attachment 5.11.	Opex
Key assumption 6 – Forecast capex and opex	The reliability and customer outcomes set out in our Regulatory Proposal assume that all components of Ausgrid's 2019-24 Revised Regulatory Proposal, including the capital and operating expenditure forecasts, will be approved by the AER, and that the approach for setting the regulatory tax allowance and the rate of return will not be materially lower than that documented in Ausgrid's Revised Proposal to enable the necessary funding for the capital program.	Capex and opex

Attachment 5.11 provides details of our key assumptions, the rationale for these assumptions and the directors' certification.

2.6 Real cost escalation factors

Our capex forecasts must include a reasonable estimate of our future input costs, which may increase by more or less than CPI. In this section, we discuss each of the following input costs in turn:

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

2.6.1 Labour

In its Draft Decision, the AER substituted our real labour escalators with an average of our forecasts, which were provided by BIS Oxford Economics (BIS), and forecasts provided to the AER by Deloitte Access Economics.

In our revised forecasts, we have adopted this methodology and have updated the numbers used in the Draft Decision with revised forecasts provided by BIS. Table 6 below presents our revised labour cost escalators.

Table 6

Forecast real increases in labour costs

Category	FY19	FY20	FY21	FY22	FY23	FY24
BIS Oxford Economics	0.71%	0.66%	1.22%	1.53%	1.74%	1.44%
Deloitte	-0.08%	-0.00%	0.06%	0.57%	0.83%	0.84%
Average	**0.31%**	**0.33%**	**0.64%**	**1.05%**	**1.28%**	**1.14%**

2.6.2 Contracted services

Construction

The AER did not comment on our proposed cost escalation for the contracted services category. We have retained the methodology explained in our Initial Proposal, and updated the indices with revised forecasts provided by BIS. Tables 7 to 9 below present revised cost escalators for contracted services which includes construction, general labour and professional services.

Table 7

Forecast real increases in construction costs

Category	FY19	FY20	FY21	FY22	FY23	FY24
Construction	0.85%	-1.24%	-0.80%	-0.10%	-0.37%	-1.29%

Table 8

Forecast real increases in general labour costs

Category	FY19	FY20	FY21	FY22	FY23	FY24
General labour	0.59%	0.21%	0.74%	1.16%	1.15%	0.98%

Table 9

Forecast real increases in professional services costs

Category	FY19	FY20	FY21	FY22	FY23	FY24
Professional services	0.78%	0.51%	1.24%	1.99%	2.11%	1.56%

2.6.3 Materials and land

We did not propose real materials escalation except where it applied to land. The AER did not accept our proposal for land price escalation. We accept this decision and therefore do not propose any real materials escalation in our Revised Proposal.

3 Network planning

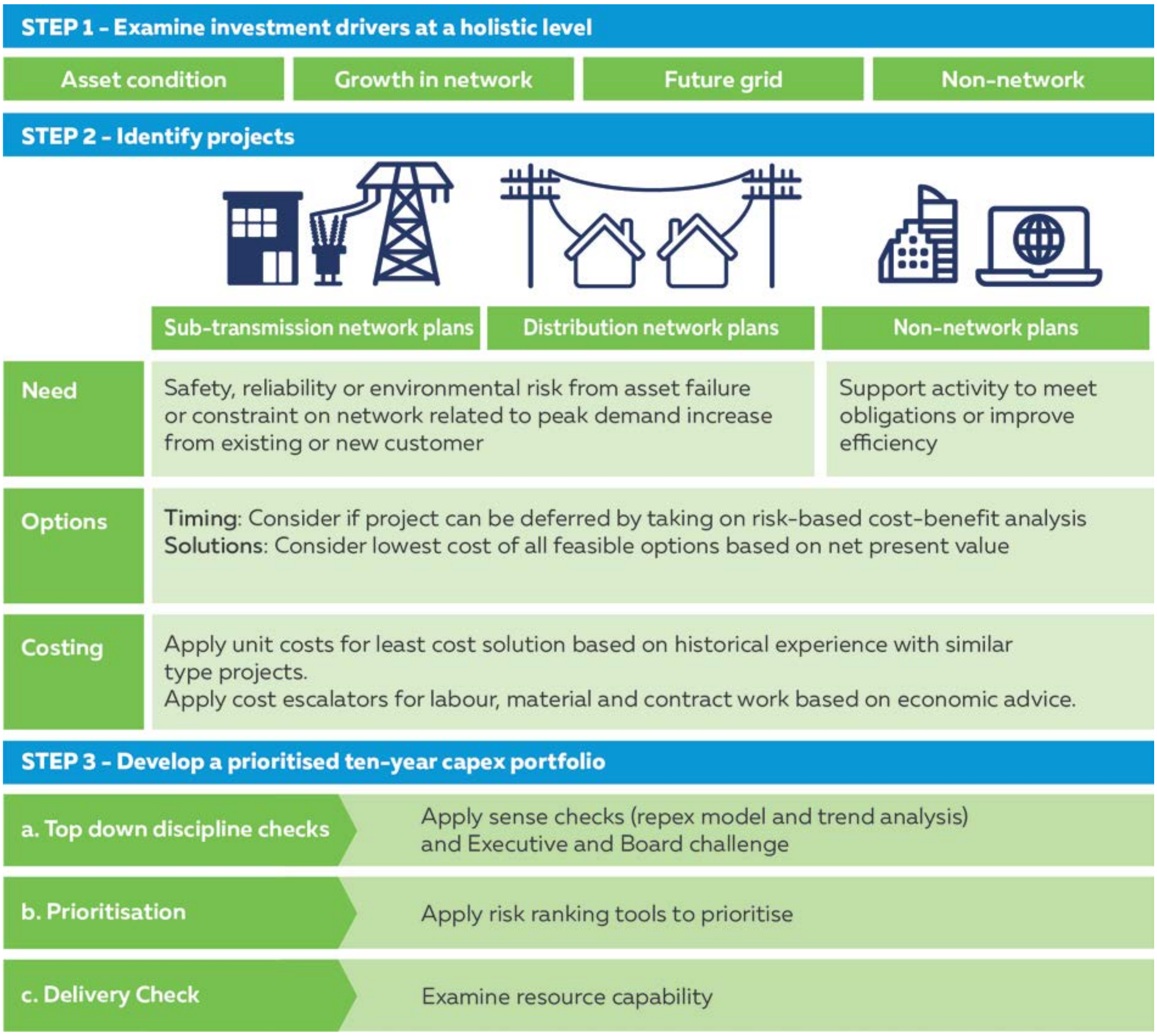
Ausgrid prepares a 10-year forecast of the capital program on an annual basis. This annual review process has informed the revised network capital program and forecasts.

We consider the traditional drivers for network assets including the condition of assets, growth in peak demand by location (spatial load) and the number of new customers seeking connection to the network. We also consider the impact of the growth in the number of customers adopting technologies such as rooftop solar PV and battery storage.

Our planning process assesses how our investments should cater for the changing energy sector. This approach ensures that the business considers broader factors including, environmental sustainability as well as customer experience and expectations, and that these are incorporated in the development of our forecasts.

Figure 5

Our capital planning process



Source: Ausgrid

4 Decision-making framework for capex forecasts

4.1 Decision-making framework

The overarching objective of our planning approach is to identify investments that provide the most benefit to customers in terms of affordability, reliability and safety, consistent with the NER requirements. Our planning approach is supported by an enhanced decision-making process, which is described in the next section.

4.2 Ausgrid Board

The Board provided oversight and guidance on the strategic direction, risk management, review and challenge and final approval for the Revised Proposal. The role of the Ausgrid Board was specifically set out as follows:

Ausgrid's Board set a strategic direction that drove the business to ensure the Revised Proposals delivered against the current energy industry challenges and addressed feedback provided by stakeholders. Ausgrid's stated purpose is to 'connect communities and empower lives with a focus on providing services that are reliable, affordable and sustainable'.

In May 2018, the Board approved, the Risk Management Framework (RMF). The RMF has been developed to support management in embedding risk management into all critical processes and systems for making decisions including day to day decision making at Ausgrid. The revised forecast capex was developed within this new risk management framework.

4.3 Regulatory Reset Executive Committee

The Regulatory Reset Executive Committee (RREC) was established to support the delivery of a compliant, credible and reasonable regulatory proposal that aligned with the strategic direction set by the Board and Ausgrid's corporate objectives. RREC consisted of Board members, company secretary, executive and senior management. The importance of the regulatory proposal to all of our stakeholders warranted the establishment of the RREC. The RREC performed an important key role in ensuring interdependencies were considered with a consistent strategy across Ausgrid. The RREC reports to the Ausgrid Board.

The role of the RREC was reinforced for the Revised Proposal. The RREC charter was amended to specifically take into consideration feedback from the AER and stakeholders. The changes to the RREC charter formalised its review and challenge role; strengthened requirements to consider feedback from stakeholder consultation; and specified that it was to take into account the long-term interests of consumers into its deliberations.

4.4 Investment Governance Committee

The revised capex forecasts were subject to review and challenge by the Investment Governance Committee (IGC) before being submitted for consideration by the RREC and the Board.

We first submitted our revised capex forecasts to IGC for review and challenge on 7 November 2018. The IGC performed an important role in ensuring that the revised capex requirements addressed the issues raised by the AER and our customers. The IGC also ensured that our revised capex forecasts:

- Align with Ausgrid's Investment Governance Framework and ensure that consistent investment evaluation principles have been applied.
- Reflect a portfolio-wide project and program approach so that synergies are identified and captured
- Comply with investment governance policies and that the proposed projects and programs are in line with our long-term plans.

The IGC did not accept our first submission of our revised capex forecasts. In addition to raising specific issues for Ausgrid's subject matter experts to address, the IGC also sought feedback from the Customer Consultative Committee on each capex category. A further round of reviews was conducted by the IGC on 5 December 2018, and the revised capex forecasts were refined again prior to being submitted to the RREC for approval.

In summary, the IGC imposed a significant discipline on the capex forecasting process to ensure that the resulting forecasts comply with the NER requirements and address the matters raised by the AER and customers.

The papers and minutes from the IGC meetings are available to the AER upon request.

4.5 Network Asset Management System

In September 2018, Ausgrid's Asset Management System was certified to ISO 55001 Asset Management System – Requirements. The ISO55001 certification is internationally recognised and meets a licence requirement under Ausgrid's NSW Distribution Licence Conditions. Achieving the ISO55001 certification demonstrates that Ausgrid's asset management processes are in line with best practice asset management. It provides assurance that the asset management processes and data analytics used to develop network capex forecasts are appropriate.

Our Asset Management System is underpinned by clear asset management objectives that are aligned and contribute to achieving Ausgrid's corporate objectives, the National Electricity Objective and capex objective and criteria set out in the NER. Our asset management objectives align with our core objectives of providing network services that are safe, secure and reliable, as well, as affordable and sustainable.

Our asset management objectives are shown in Table 10 below.

Table 10

Asset management objectives

Asset Management Objective	What Does This Mean?
Keep the network safe for the public, customers, and workers	In practice this means minimising the likelihood of safety incidents associated with network assets or activities by eliminating safety hazards so far as reasonably practicable and where this is not possible reducing risks to 'as low as reasonably practicable' (ALARP). This will be measured through safety incident performance, risk assessments, and asset failure trends.
Maintain current levels of network reliability and security	In practice this means managing the risk of customer interruption while maximising Ausgrid's ability to restore supply as quickly and safely as possible after an interruption has occurred. This involves identifying constraints or asset issues and taking appropriate proactive action before asset failure occurs or adverse consequences arise. This will be measured through SAIDI and SAIFI, performance against guaranteed service levels, asset failure trends, and value of unserved energy.
Maintain affordability for customers	Maximising cost efficiency and competitiveness of assets through the use of market tested unit costs and cost benefit analysis to select efficient treatment options. This will be measured through peer benchmarking of capex and opex costs.
Sustainable expenditure	Optimising the balance between total expenditure and risk through targeted investment and risk prioritisation. This will be measured by analysing system level performance and trends over time.

Source: Ausgrid

Further information about our decision-making approach for network capex forecasts is presented in Attachment 5.05.

5 Replacement capex

5.1 Our revised repex forecast

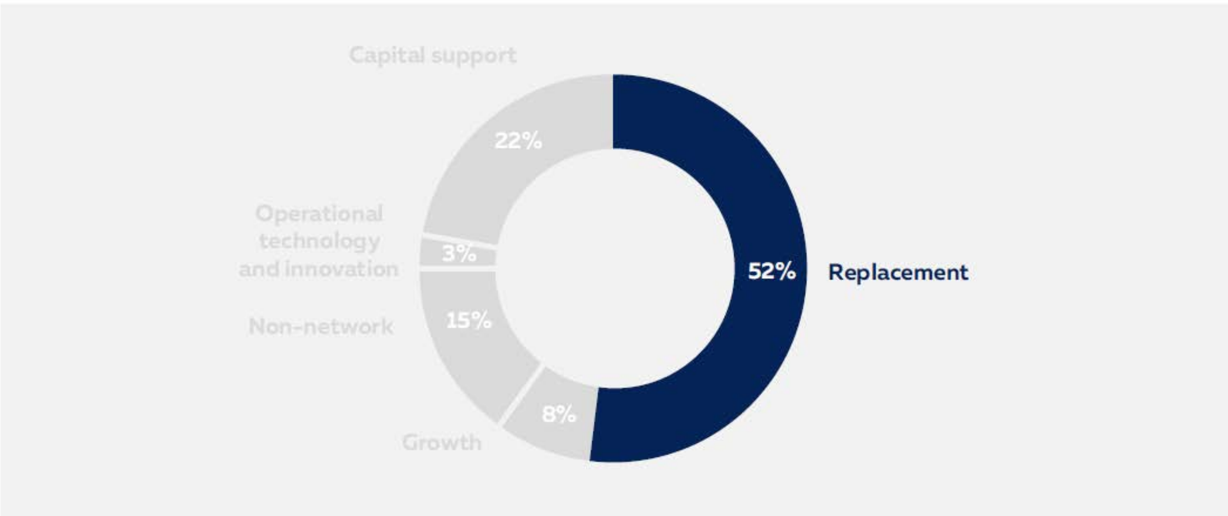
Our revised repex forecast is $1,402 million. As shown in Figure 6 below, this represents 52% of our total capex program. Repex is our largest capex category. Repex includes capital investment to replace assets at the end of their life. It also includes expenditure to renew assets in order to extend their life. The key drivers for replacement capex are:

- Ensuring the safety of our customers, our staff and the general public
- Meeting our compliance obligations
- Maintaining the current level of performance of the network
- Recognising that prudent deferral creates future options for more efficient development of the network through innovation.

Revised replacement capex in 2019-24 is shown in Table 11 below.

Figure 6

Replacement capex as a proportion of total capex forecast in 2019-24



Source: Ausgrid

Table 11

Revised replacement capex in 2019-24 ($million, real FY19)

	FY20	FY21	FY22	FY23	FY24	Total
Replacement	346	281	257	260	258	**1,402**

Source: Ausgrid

We have reviewed our replacement capex projects and programs using a condition-based assessment of our assets and applying an improved risk based cost-benefit analysis approach.

As discussed in more detail below, our revised repex forecast is below what our cost-benefit analysis indicates as economic expenditure in the 2019-24 period. This approach provides Ausgrid with greater flexibility and optionality to meet customer needs in the future and pushes us to leverage our existing assets even more.

We believe the revised repex forecast is prudent and efficient and reflects the capex objectives and criteria.

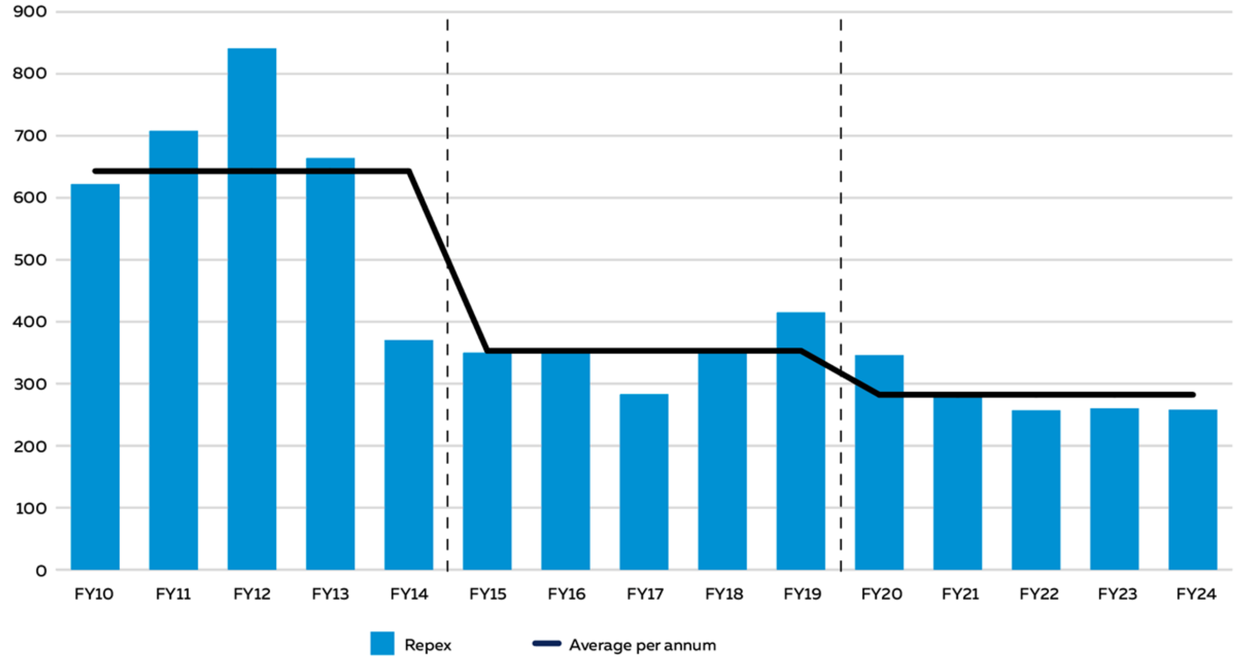
5.2 Repex over time

The revised repex forecast for 2019-24 is $352 million (20%) lower than our expected expenditure of $1,754 million in the current period. The revised repex forecast is also substantially lower than the actual expenditure in the 2009-14 period.

The downward trend in repex forecast for 2019-24 reflects a concerted effort to address the affordability concerns raised by customers.

Figure 7

Repex forecast for 2019-24 compared to previous years ($million, real FY19)



Source: Ausgrid

We show a comparison of the actual and forecast repex by regulatory period in table 12 below.

Table 12

Actual and forecast repex by regulatory period ($million, real FY19)

$million, real FY19	FY10-14	FY15-19	FY20-24
Total capex for each regulatory period	3,204	1,754	1,402
Change from previous period		1,451	352
Average total capex per annum	641	351	280
% change from previous period		-45%	-20%

Source: Ausgrid

The increase in actual FY18 expenditure reflects improvements in our approach to delivering assets, resulting in more efficient and timely construction of assets. The transformation of Ausgrid's delivery approach was discussed in our Initial Proposal (refer to Attachment 5.12 Resourcing and Delivery Strategy for 2019-24).

5.3 What we heard and how we've responded on our initial repex forecast

Our proposed repex program and forecast was not accepted by the AER. Customers expressed concern about the qualitative nature of our justifications and wanted to see more quantitative analysis. We have summarised the high level matters raised by customers and the AER about our repex forecast and how we have responded. This is shown in the Table 13 below.

Table 13

Responding to feedback on our initial repex forecast

	WHAT WE HEARD	HOW WE'VE RESPONDED
1. Repex forecast	The AER sought further information and justification for our revised repex program. Similarly, our customers also expected more quantitative analysis to support our planned expenditure.	In response, we have developed more comprehensive cost-benefit analysis for our repex projects and programs. This further information forms part of this Revised Proposal.
2. Reliability levels	Customers said that the current levels of reliability are adequate and there should not be more investment to improve them.	There are no projects or programs specifically targeted to materially change overall reliability.
3. Top-down assessment	The AER concluded that we had not applied a sufficient top-down assessment to the repex forecasting approach. The AER wanted to see more evidence that we had captured synergies between programs, projects and work areas in determining our expenditure requirements.	We undertake a top-down assessment of our expenditure requirements in developing our Area Plans, which combine augmentation, connection and asset replacement work. As such, our Area Plans capture synergies by developing an integrated work program. In response to the Draft Decision, however, we have adopted a further 'top down' challenge through the application of the AER's repex model and our enhanced review and challenge process.
4. Cost-benefit analysis	The AER expressed concern that we had provided limited justification for key programs and projects. The AER therefore encouraged us to provide additional supporting justification in our Revised Proposal.	In response to the AER's comments, we have applied cost-benefit analysis to a greater proportion of our programs. We also engaged an external expert to provide assurance that our analysis is robust.

5. Repex model	The AER highlighted that in applying the repex model to conduct top-down assessment, we had not applied its refined repex modelling approach.	We have engaged further with the AER and our revised repex forecasts have been assessed against the AER's updated approach. We will continue to work with the AER to refine the repex model.
6. Modelled repex	The AER applied the repex model in deriving an alternative forecast for 'modelled repex' categories. The AER relied on trend analysis, repex modelling, bottom-up assessment, and a technical and engineering review to form its position.	A small number of our asset categories are not suited to repex modelling, for example, new programs where there is insufficient benchmark information. Therefore, we propose that the AER should not rely on the results from the repex model for these specific categories. We have prepared cost-benefit analysis that supports the timing, volume and costs of repex programs for these categories.
7. Unmodelled repex	The AER extrapolated our actual spend in the first four years of the current period to a five-year period (on a pro-rata basis). The AER commented that we had not provided sufficient cost-benefit analysis to justify our initial forecast.	We reviewed our programs in light of feedback from the AER with consideration of refined needs and historical performance. Our review led us to reprioritise our programs, including staging some programs over two future regulatory periods. As a result, our revised forecasts for these capex components are aligned to the amount allowed in the AER's Draft Decision.
8. 132kV cable replacement	AER supported capex of $93 million for our 132kV fluid filled cable program, compared to our forecast of $165 million. The reduced allowance reflected the AER's conclusion that we had not provided a specific compliance obligation that requires the removal of a number of underground cables.	In light of feedback from the AER and in the interests of affordability, we have decided to manage the risk of the 132kV cable replacement projects within the allowance provided by the AER.
9. Powering Sydney's Future	Customers sought a better explanation for the interaction between the 132kV cable replacement program and Powering Sydney's Future.	There are a number of subtransmission cables supplying the Inner Sydney area that are approaching the end of their serviceable lives. The Powering Sydney's Future program addresses the most economically viable solution to ensure a reliable supply. Our proposed capex only includes costs for cables which are not addressed by TransGrid through Powering Sydney's Future. The Powering Sydney's Future project means that Ausgrid avoids significant expenditure in cable replacement and therefore delivers a lower cost outcome for our customers.

5.4 How our revised repex proposal compares to AER Draft Decision

Our Initial Proposal forecast for repex was $1,673 million. The AER did not consider that we had provided sufficient justification to meet the capex objectives and criteria and did not accept our proposal. The AER's Draft Decision provided a substitute repex allowance of $1,207 million, which is $466 million (29%) lower than our Initial Proposal.

We do not accept the AER's substitute estimate for repex as it would affect our ability to meet our regulatory obligations in relation to safety, security and reliability. We have revised our repex forecast to $1,402 million which is $195 million (16%) higher than the AER's Draft Decision.

Our repex projects and programs are driven by the need to prevent assets failing while in service with unacceptable consequences. The consequences of critical assets failing while in service include:

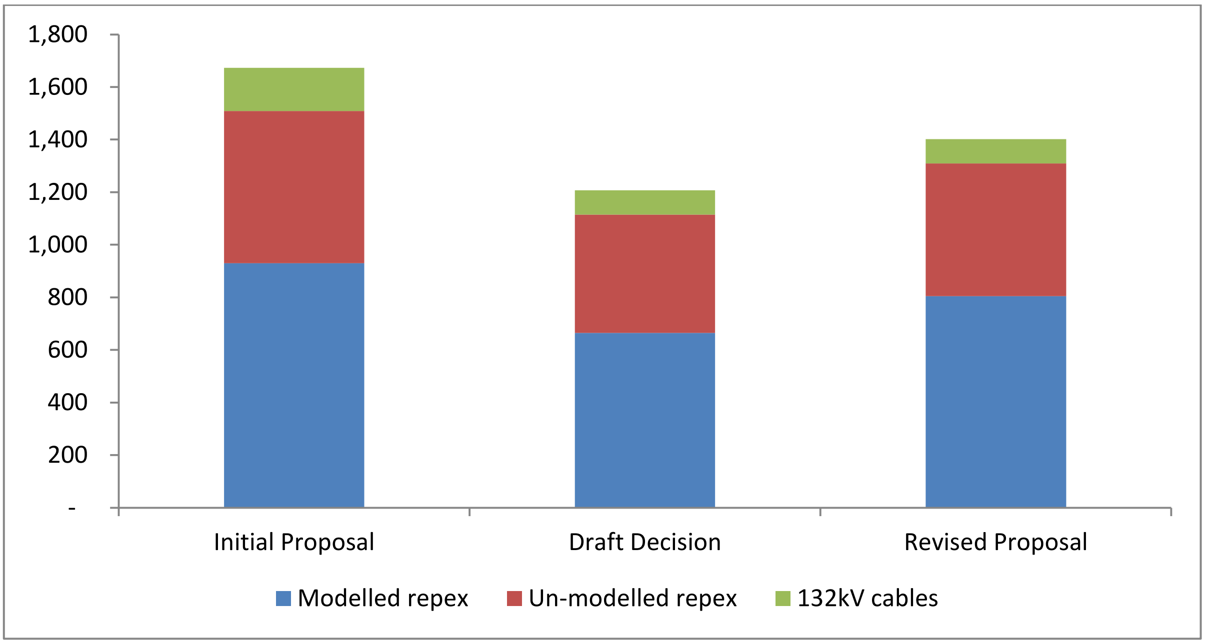
- Deteriorating safety performance, putting at risk the health and wellbeing of the general public, our contractors and our staff
- Increased risk of damage to other assets in the event of catastrophic asset failure
- Increased risk of environmental harm including bushfires and oil leaks from network assets
- Loss of supply to potentially large numbers of customers, depending on the criticality of the asset.

Our repex forecast has been developed to best mitigate the risk of assets failing while balancing the responsibility to make sure network prices remain affordable for customers.

The figure below compares our revised repex forecast with the AER's Draft Decision and our Initial Proposal.

Figure 8

Ausgrid repex proposals compared to AER Draft Decision ($million, FY19)



Source: Ausgrid analysis

As shown above, our repex forecast is broken down into modelled repex, unmodelled repex and 132kV cables. The unmodelled component includes $60 million for the Advanced Distribution Management System (ADMS).

The modelled and unmodelled categories align to the AERs Regulatory Information Notice (RIN) mapping used by the AER to undertake repex modelling.

Modelled repex is investment related to specific asset types by particular RIN asset categories with reasonable commonality across industry and having historical benchmark information.

The repex data is also shown in Table 14 below. For the modelled and unmodelled repex, our revised forecasts sit between our Initial Proposal and the AER's Draft Decision. For the 132kV cables, as already noted, we have accepted the AER's Draft Decision.

Table 14

Comparison of Ausgrid repex proposals and AER Draft Decision ($million, real FY19)

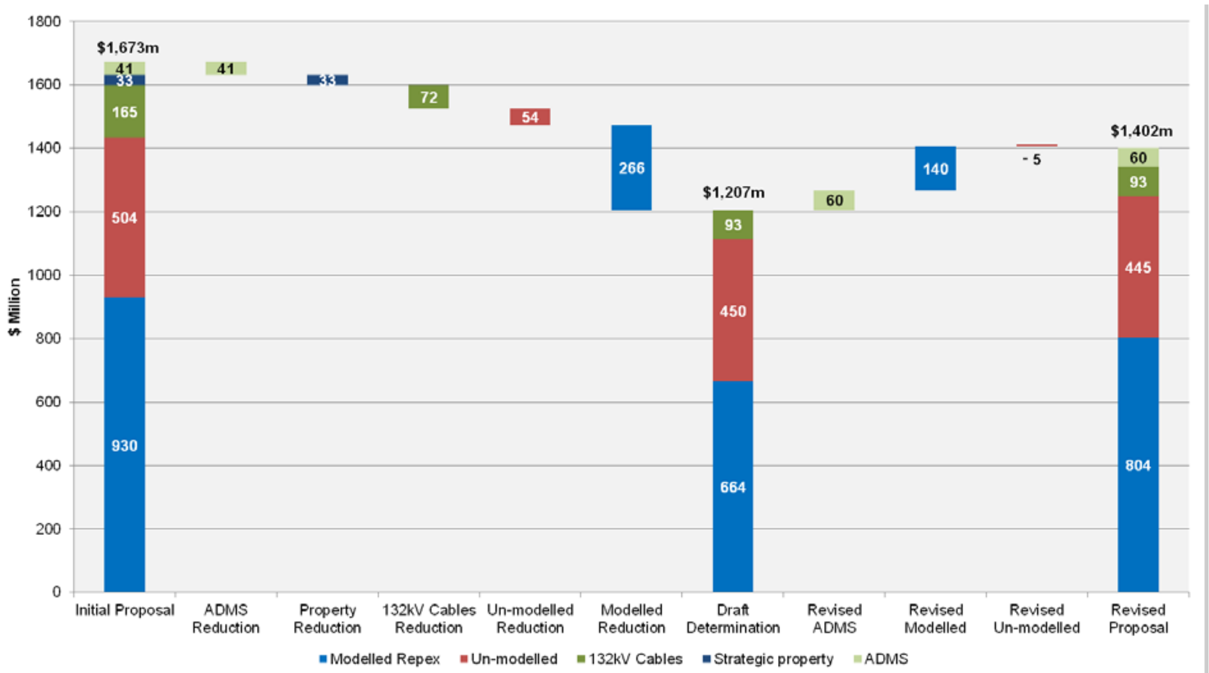
FY19, $millions	Initial Proposal	Draft Decision	Revised Proposal
Modelled repex	930	664	804
Unmodelled repex	578	450	445
General unmodelled	504	450	445
Strategic property	33	0	0
ADMS	41	0	60
132kV cables	165	93	93
Total	**1,673**	**1,207**	**1,402**

Source: Ausgrid analysis

A more detailed breakdown of the changes in the repex forecasts from the Initial Proposal, to the AER Draft Decision and our Revised Proposal is presented in Figure 9 below.

Figure 9

Ausgrid repex forecasts compared to AER draft decision 2019-24 ($million, real FY19)



Source: Ausgrid analysis

The largest difference in our revised repex forecast compared to the AER Draft Decision is for overhead conductors ($71 million), ADMS ($60 million) and switchgear ($47 million). A number of programs within our repex proposal have unique characteristics that are not currently suitable for the AER's repex modelling and we have demonstrated their prudency and efficiency through detailed quantified cost benefit analysis in our Revised Proposal.

5.5 Putting together the revised repex forecast

5.5.1 Key changes

Where the AER has not accepted our initial capex proposal we have updated our supporting information and analysis to address the matters raised by the AER. We have revised the way we have prepared key aspects of our repex forecasts. In particular, we have:

- Subjected more of our repex forecast to cost-benefit analysis using risk quantification (as discussed in the next section).
- Obtained an external peer review of the methodology and analysis.
- Tested our repex forecasts against the AER's refined repex model
- Refined the forecast for major replacement projects based on updated information.

Our revised capex forecasts also reflect the latest available data and enhanced analysis, using the most recent asset failure and condition data

In preparing our revised repex forecasts, we have given further consideration to whether expenditure can be deferred or staged without exposing customers to unacceptable service levels. We have also examined whether there are opportunities to undertake non-network solutions in preference to replacing assets.

5.5.2 Cost-benefit methodology for replacement programs

Determining when to replace network assets is a complex task. Replacing assets too early results in customers bearing costs earlier than necessary. Waiting too long to replace assets results in increased asset failures. This can result in economic costs such as loss of supply, potential safety impacts and damage to property and the environment. Ausgrid has developed methods to inform when to replace assets such as poles, cables and substation equipment.

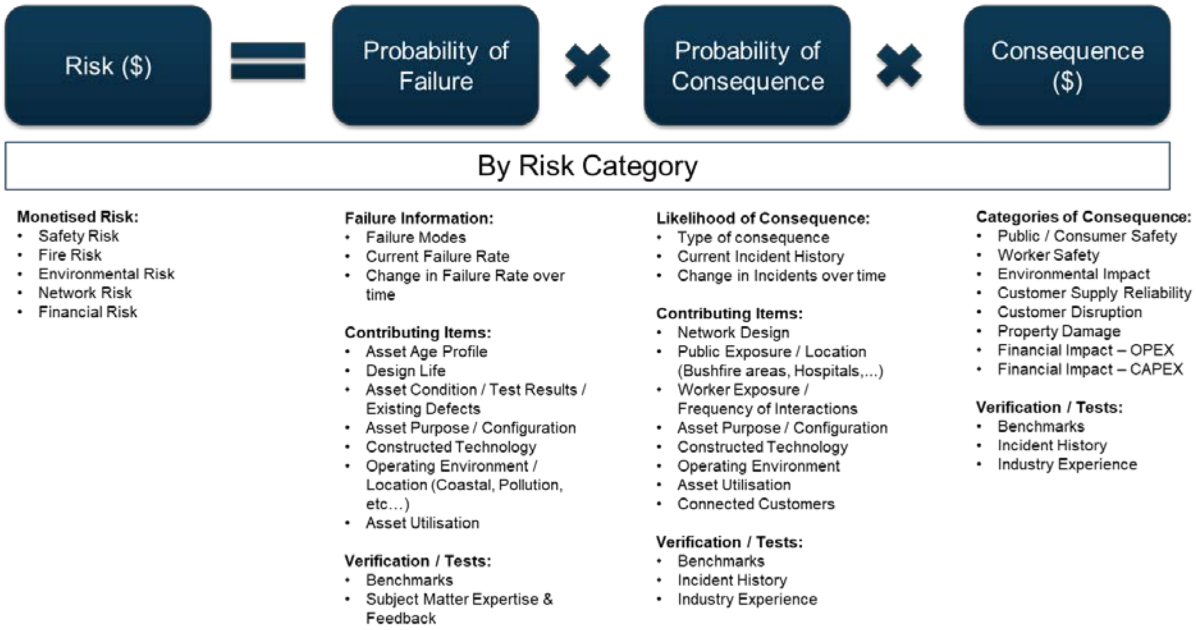
In addition to cost-benefit analysis for major projects we have expanded our economic analysis to help inform investment in our replacement programs. We have developed a robust cost-benefit methodology for high volume, low value replacement programs which uses a series of models to assess the appropriate timing of replacement investment decisions. The methodology is based on the principles of ISO31000: Risk Management and considers risk in terms of likelihood and consequence. The replacement program cost-benefit methodology sits within a broader framework for the justification of replacement expenditure.

The justification for our replacement programs is detailed in Attachment 5.13.0. The cost-benefit analysis methodology used in our models for our replacement programs is explained in Attachment 5.13.M.0 to this Revised Proposal.

The monetised value of risk is the key input in the cost-benefit methodology. The risk management inputs and factors that affect those quantified risk value is shown in Figure 10 below.

Figure 10

Cost-benefit analysis modelling inputs



Source: Ausgrid

While a single approach to the determination of risk is applied, there are variations in the modelling method based on the available information and the appropriateness of the approach for the asset class being reviewed. We have developed models for around 20 asset classes.

Once the asset risk has been assessed, it is possible to undertake a cost-benefit assessment. The cost-benefit modelling compares the change in asset risk against replacement cost to determine the appropriate timing and volume for replacement.

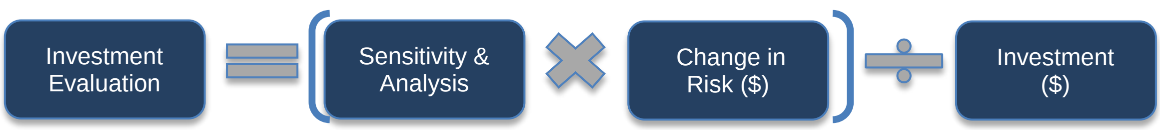
In order for an investment to proceed, the risk mitigated (the benefit) must exceed the cost of the proposed investment. That is, the benefit of the risk mitigated and any other benefits must exceed the annualised cost of investment. Sensitivity analysis is undertaken on the results.

Given the cost-benefit analysis has valued risks and benefits for each asset within an asset class, all assets in a given year with a risk value greater than the annualised replacement cost are considered for replacement.

This cost-benefit analysis and investment evaluation process is outlined in Figure 11 below.

Figure 11

Cost-benefit evaluation method



Source: Ausgrid

Our approach is consistent with the AER's draft best practice application note for asset replacement planning.[2]

We engaged experts to review and challenge our cost-benefit analysis methodology and its application. CutlerMerz supported the development of the models and provided independent validation of our modelling inputs. The independent validation by CutlerMerz is provided at Attachment 5.13.M.20.

We engaged Frontier Economics to provide an independent review of the appropriateness of the methodology and recommendations for modelling improvements. We incorporated these improvements in the final methodology and modelling, Frontier Economics provided a report setting out its findings.

It found that the methodology we have applied to assess the appropriate timing of replacement investment across asset categories conforms to sound principles of cost-benefit analysis:[3]

> *Frontier Economics considers that the methodology used by Ausgrid to assess the appropriate timing of replacement investment across the four asset classes outlined above conforms to sound principles of cost-benefit analysis.*

In terms of affordability, which customers have told us they want Ausgrid to prioritise in the 2019-24 period, it is significant that Frontier Economics noted: [4]

> *If anything, Ausgrid's methodology appears to understate the benefits of replacement by not adjusting the probabilities of consequence of various severity failures upon the replacement of an aging assets by a new asset.*

We have provided the Frontier Economics report at attachment 5.13.M.21 as well as the financial models and their summaries which contain our cost-benefit analysis at attachments 5.13.M.1A-19A and 5.13.M.1-19 respectively.

5.5.3 Repex model

Ausgrid's view is that the AER's repex model is a useful tool for benchmarking replacement capital requirements. Issues, however, arise where the standard asset categorisation under the repex model does not capture unique or special circumstances of programs or characteristics of the assets being replaced.

Given the significance of repex modelling results as an external reference point for the determination process, Ausgrid has been engaging with the AER to reach a common understanding of how the repex model would be applied and to understand any implications or anomalies. To assist with this work, we engaged Nuttall Consulting to assess our repex forecast using the AER refined repex model. In particular, we sought advice regarding the amenability to repex modelling of a number of our replacement programs. The Nuttall Consulting advice is contained in Attachment 5.15.1.

We have identified seven repex programs that are either not suited to assessment under the repex model or should have a different unit rate due to the specific characteristics of the proposed program in Ausgrid's circumstances. The programs and our reasons for excluding them from the repex modelling are summarised in Table 15 below.

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[2] AER (2018), Draft Industry practice application note: Asset replacement planning, September 2018

[3] Frontier Economics (2018), Review of capex CBA methodology. Report for Ausgrid, December 2028, p.5 (Refer to Attachment 5.13.M.21)

[4] Frontier Economics (2018), Review of capex CBA methodology. Report for Ausgrid, December 2028, p.5 (Refer to Attachment 5.13.M.21)

Table 15

Repex programs proposed for specific consideration in or exclusion from repex modelling

RIN category	Program description	Reason for excluding from repex modelling
Low voltage overhead conductor	Reconfiguring low voltage network and decommissioning redundant dedicated low voltage network used to supply public lighting. This program is safety driven. Our forecast for this RIN asset category is $54 million and 3,127km of which $43M (2,900 km) relates to the reconfiguration and decommissioning of the dedicated low voltage network.	The unit cost for this program ($24k per km) is much lower than historical unit costs for the overall repex low voltage overhead mains category ($85.6k per km) because the scope reflects network reconfiguration which is a lower cost solution than like for like replacement and is therefore not representative for the category. It is also much lower than the median unit costs of $67k per km. Application of the repex model also reduces quantities significantly as this program has a step change which is not reflected in historic activity levels. The combined effect of the above factors is that the repex model understates both the unit rate and the volume of this category if dedicated low voltage mains reconfiguration is included. We consider that dedicated low voltage mains reconfiguration should be removed from the overhead mains repex category and assessed separately using Ausgrid's cost-benefit analysis.
Low voltage underground cable	This program primarily relates to replacement of Consac and HDPE cables. These cables fail at an earlier age (45 years) than the average cable population (73 years). The replacement of these cables involves significant trenching and re-instatement costs (supplied through competitively tendered service providers); and temporary supply arrangements for commercial premises and customers with special circumstances. Ausgrid's forecast for this asset category is $122.6 million.	The comparative median unit cost for this scenario is $304k per km. This is considerably lower than Ausgrid's historical unit cost of $595k per km and the forecast unit cost of $898k per km. The higher forecast unit cost is the result of significant increases in complexity due to the nature and location of assets to be replaced this period, compared to those replaced previously. The unit rates for some other DNSPs do not reflect the same scope of work as Ausgrid's program (such as trenching and significant re-instatement costs) and therefore unsuitable for inclusion in repex model. We consider that this program should be assessed using Ausgrid's cost-benefit analysis. This program could be further verified by repex modelling using an appropriate unit rate for Ausgrid's circumstances, as reflected in the cost-benefit analysis.
<= 11kV switches	This asset category captures a broad range of asset types, covering lower cost air break switches ($11k) and higher cost ring main Isolators and fuse switches ($45k) contained within underground and chamber substations. Ausgrid's forecast for this asset category is $53.7 million and 2,427 units.	There is a broad range of unit costs for the other DNSPs, and these variations are probably more reflective of the predominant types, rather than relative efficiencies. The median unit rate set by other DNSPs reflects predominantly overhead, lower cost asset types as opposed to more expensive underground and chamber substations on Ausgrid's network. We consider that this program should be assessed using Ausgrid's cost-benefit analysis
<=11kV fuses	This asset category captures a broad range of asset types, covering lower cost overhead fuses ($3.0k) and higher cost indoor units ($5.0k). Ausgrid's forecast for this asset category is $17.1 million and 5,075 units.	As with 11kV switches, a key concern is that variations between distribution network service providers is potentially more reflective of the predominant types, rather than relative efficiencies and therefore consideration should be given to different fuse types in setting the comparative unit costs.

		We consider that this program should be assessed using Ausgrid's cost-benefit analysis. This program could be further verified by repex modelling using an appropriate unit rate in Ausgrid's circumstances, as reflected in the cost-benefit analysis.
<= 11kV circuit breakers	This asset category captures a range of asset types and replacement types, including circuit breakers within distribution substations, outdoor zone substations and indoor zone substations. Ausgrid's forecast for this asset category is $70.4 million and 865 units of which $33.6 million (281 units) relate to brownfield switchboard replacements.	Replacements in this category involve a larger volume of higher cost brownfield and in-situ replacement circuit breakers (and associated switchboard) in indoor zone substations, at a cost of on average $141k per breaker. The median replacement cost set by other DNSPs is likely to be reflective of switchgear replacement in distribution substations (typically 1-2 breakers per location) or outdoor circuit breakers only. This is relatively consistent with our costs for replacement of this type of circuit breaker but not for the more complex circuit breakers. We consider that projects and program within this asset category should be assessed using Ausgrid's cost-benefit analysis.
Ground-mounted transformers<22kV>600kVA	These assets were primarily replaced as part of a distribution substation replacement program which has now been completed. Future replacements are focused on CBD underground substation transformers The unit cost of these replacements is $110K per unit. Ausgrid's forecast for this asset category is $6.8 million and 101 units.	The comparator unit cost is defined by our historical unit cost of $34k which is materially lower than our forecast unit cost. The increase in Ausgrid's unit cost reflects the need to replace CBD Conservator type transformers in underground substations, compared to predominantly above ground substation in the past. Replacement of these assets is significantly more complex as involves underground substations with confined spaces, after hours work and CBD road closures. Our historical unit rate was also impacted by an allocation issue with a distribution substation replacement program. We consider that this program should be assessed using Ausgrid's cost-benefit analysis. This program could be further verified by repex modelling using an appropriate unit rate in Ausgrid's circumstances, as reflected in the cost-benefit analysis.
Service lines	The service wire replacement program was substantially increased and moved towards a more targeted approach following a report which identified the risks associated with bare and PVC service wires.	The increased level of activity in this category initially enabled Ausgrid to achieve a significantly lower unit cost ($300/unit) than other DNSP's ($800-$1,040). A recent IPART review of this program identified the need for additional modelling to target replacements on a site-specific basis, resulting in a less 'production line' approach but addressing a greater quantum of risk. This explains the increase in the forecast unit rate ($400-430/unit). We consider that this program should be assessed using Ausgrid's cost-benefit analysis.

The total value of the repex programs proposed to be excluded from the repex modelling is $316 million.

We request that the AER consider the merits of these specific asset replacement categories on the basis of the cost-benefit analysis provided in Attachment 5.13. To achieve a comparable AER repex modelling outcome for testing we suggest excluding those categories above and substituting with the cost-benefit analysis to a value of $316 million.

A number of these asset categories could be further verified by repex modelling, if required, using the unit rates reflected in the cost-benefit analysis as noted above. Further information about Ausgrid's repex modelling can be found in Attachment 5.15.

5.6 Revised forecast for repex projects and programs

In preparing our revised repex proposal we have carefully considered the AER's Draft Decision and feedback from engagement with customer advocates. We have also engaged in constructive consultation with the AER following the submission of our Initial Proposal on matters such as repex modelling and cost-benefit analysis of the replacement programs. The engagement with the AER and customer advocates has been incorporated into our revised repex forecast. A summary of our repex proposals compared to the AER Draft Decision is shown in Table 16 below.

Table 16

Comparison of Ausgrid repex proposals and AER Draft Decision ($million, real FY19)

FY19, $millions	Programs/ major projects	Initial Proposal	Draft Decision	Revised Proposal
Modelled	Programs	754		662
	Major projects	176		142
Modelled sub-total		**930**	**664**	**804**
Unmodelled	Programs	382		342
	Major projects	122		103
Strategic property		33	0	0
ADMS		41	0	60
Unmodelled sub-total		**578**	**450**	**505**
132kV fluid-filled cables		165	93	93
Total		**1,673**	**1,207**	**1,402**

Source: Ausgrid analysis

As shown in the above table, our revised repex forecast of $1,402 million is $195 million (16%) higher than the AER's Draft Decision of $1,207 million.

A summary of our position on the AER's Draft Decision on repex is presented in Table 17 below.

Table 17

Summary of our position on the AER's Draft Decision on repex

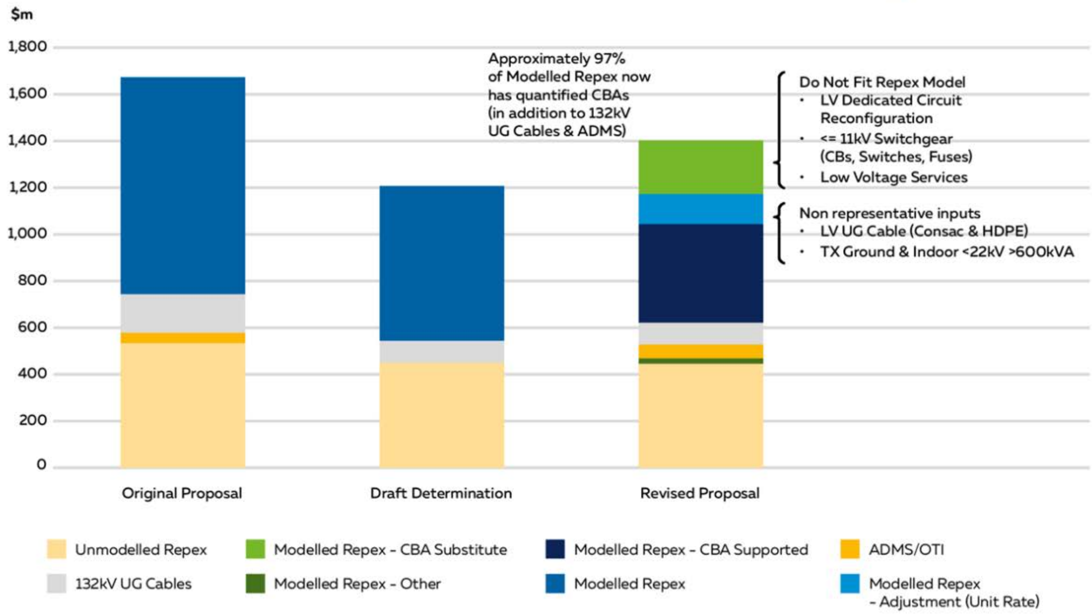
Where our revised repex forecast aligns with AER Draft Decision		
✓	**Unmodelled repex**	Marginally below AER Draft Decision
✓	**132kV fluid-filled cables**	We have aligned our revised forecast with the AER decision
✓	**Strategic property**	We have aligned our revised forecast with the AER decision.
Where our revised repex forecast does not align with the AER Draft Decision		
o	**Modelled repex**	We have provided enhanced economic analysis of the replacement programs component of the repex forecast
o	**ADMS**	We have provided an enhanced project justification for this program. This program has been approved by the Board.
o	**Major projects**	We reviewed and tested our cost benefit analysis considering AER feedback on inputs, as well updates via our annual planning process. This has substantiated additional major projects repex compared to the draft decision, although it is lower than our original proposal.

5.7 Justifying our repex program

Our Initial Proposal included cost-benefit analysis of major projects. The AER considered this analysis but concluded that additional information and quantitative justification was needed to support our replacement program. Customer advocates sought similar information. Figure 12 shows a comparison of the proportion of our repex forecast subject to cost-benefit analysis.

Figure 12

Proportion of our repex forecast subject to cost-benefit analysis ($million, real FY19)



Source: Ausgrid analysis

This expansion in the coverage of our cost-benefit analysis addresses the AER's request that we provide additional justification for our modelled repex forecast. The modelling approach we have applied and why we consider it to be robust, is discussed in the next section.

We have presented the revised repex information in various configurations to reflect the analytical methods applied by the AER and the areas that were of most interest to customer advocates.

This section provides a detailed explanation of our revised forecasts for each of the following repex categories:

- Replacement programs
- Unmodelled repex
- Major replacement projects
- 132kV fluid-filled cables
- ADMS.

5.7.1 Replacement programs

Initial Proposal

In our Initial Proposal the replacement program component including the modelled and unmodelled repex was $1,136 million. The initial modelled component included $754 million for replacement programs repex. This is shown in Table 18 below.

In preparing our repex forecast for the Initial Proposal we engaged with the AER in early 2018 on the repex model. As these discussions progressed, the AER indicated that it was refining its repex modelling approach. Both prior to and following the release of the AER Draft Decision in November 2018, we have worked with the AER on jointly enhancing the repex modelling approach and we are committed to continuing to do so in the future.

Table 18

Modelled and unmodelled replacement programs ($million, real FY19)

FY19, $millions	Programs	Initial Proposal	Revised Proposal
Modelled	Programs	754	662
Unmodelled	Programs	382	342
Total		**1,136**	**1,004**

Source: Ausgrid analysis

AER response

The AER did not accept our initial proposal for replacement programs. The AER considered that Ausgrid had not provided sufficient justification for our repex program and sought further information from Ausgrid.

The AER applied its refined repex model to assess our initial repex proposal for the modelled component. The AER applied trend analysis for the unmodelled component. The AER also used bottom-up assessment, and a technical and engineering review to form its position on repex.

Justifying our revised modelled repex component

We have reviewed our replacement programs using a condition-based assessment of our assets and by applying an improved risk-based cost-benefit analysis approach to our high volume low value replacement programs.

Our revised forecast for modelled replacement programs by (excluding major projects, 132kV cables and ADMS with cost-benefit analysis provided), is set out in Table 19 below.

Table 19

Cost-benefit modelling summary for replacement programs ($million, real FY19)

Cost-benefit model	Initial Proposal	Cost-benefit model outcomes	Revised Proposal (Change from model outcomes}	
Poles	156	144	138	↓
Low Voltage CONSAC / HDPE	116	104	95	↓
High Voltage Overhead Lines	47	59	51	↓
Low Voltage Overhead Service Lines	55	60	49	↓
High Voltage Underground Cable Reactive	34	46	43	↓
Low Voltage Dedicated Mains	45	72	43	↓
Circuit Breakers (excludes switchboards)	51	43	43	↔
High Voltage Fuse Switches	50	46	36	↓
Distribution Substations	32	27	24	↓
Low Voltage Underground Cable Reactive	26	25	26	↔
Pole Top Substations	20	23	22	↔
High Voltage Air Break Switches	16	19	15	↓
Major Transformers	13	21	17	↓
Sub-transmission Isolator and Earth Switches	7	10	9	↔
High Voltage Underground to Overhead Connection	8	15	6	↓
High Voltage Drop-out Fuses	8	26	7	↓
Sub-transmission Towers	5	8	8	↔
CBD Distribution Transformers	18	7	4	↓
High Voltage CBD Isolator and Earth Switches	16	2	2	↔
Sub-total	**723**	**756**	**639**	↓
Not Modelled for the Revised Proposal	31	-	23	↓
Modelled Total	**754**	**756**	**662**	↓
Un-modelled	$382	-	$342	↓
Total	**$1,136**	**-**	**$1,004**	↓

Source: Ausgrid

Of the $754 million of modelled replacement programs in the in the Initial Proposal:

- $723 million (96%) has been subject to rigorous quantified cost-benefit analysis
- $31 million (4%) has not had cost benefit analysis undertaken.

The latter is predominately made up of pole staking, which is an ongoing requirement to extend and maximise the potential life of our poles with a lower cost solution than replacement, and overhead low voltage mains replacement (not including dedicated LV mains reconfiguration) which we only intend to invest reactively i.e. after failure. Both these programs are reasonably aligned to the AER repex model outcomes. However, we have proposed an increase in pole staking from our Initial Proposal as we seek to increase the use of staking, reducing our pole replacement needs and delivering greater value to customers while still managing the associated risks.

As shown in the table above, all replacement programs in our modelled categories of our Revised Proposal are equal to or below the modelled outcome produced by our risk-based cost-benefit analysis. The outcome of the cost-benefit analysis found that $756 million of investment would be prudent and efficient. We have made to decision to only propose $639 million of justified cost-benefit repex which is $117 million (15 %) less than justified by the revised cost-benefit analysis.

Our decision to adopt a revised forecast below the amount indicated by our cost-benefit analysis reflects the impact of the top-down review we have applied to our Revised Proposal. As already explained, in response to customers' affordability concerns, we introduced an enhanced review and challenges processes led by our IGC. As a result of this process, we have reduced our forecasts below the level that would be justified from a strict cost-benefit assessment.

We also recognise that technological advancement is changing the way networks are operated and creating uncertainty about how to best meet customer needs into the future. Where there is uncertainty regarding future outcomes, investing in long lived assets now may preclude other options in the future. For this reason, we are comfortable with a revised repex forecast that is lower than indicated by our cost benefit analysis. Lower expenditure now provides us with greater flexibility and optionality to meet customer needs into the future.

Technological change, as well as providing us with a more flexible grid, will also provide us with much better information about the risks associated with our network. We expect that new technologies will allow us to better understand and manage those risks. This provides us with additional assurance that spending less repex now won't impact our ability to maintain the reliability, safety and security of the network. The need to undertake this deferred capex, however, will depend on the rate of technological change.

Revised proposal

We are proposing to invest $1,004 million for replacement programs in the 2019-24 period. This is $132 million lower than our Initial Proposal. Of this, the modelled component of our replacement programs, has fallen by $92 million (12%).

The adjustments we have made to our modelled replacement programs are supported by robust quantitative analysis and together with the top-down review and challenge lead to a revised forecast which meets the requirements of the capex criteria and objectives in the NER.

We believe that the strengthened approach to forecasting will provide customers with the confidence that our Revised Proposal is prioritising affordability in the 2019-24 period.

Further information on the revised analysis for repex is presented in Attachment 5.13.0 and repex modelling in Attachment 5.15.

5.7.2 Unmodelled repex

Initial proposal

The unmodelled repex component in our Initial Proposal was $578 million, which included elements of replacement programs, major projects, strategic (network) property purchases and the ADMS. During consideration of our submission the AER transferred strategic property ($33m) to augex and ADMS ($41m) to non-network leaving $504 million in unmodelled repex. The draft decision reflects this categorisation. This is shown in Table 20 below.

Table 20

Comparison of Ausgrid unmodelled repex proposals and AER Draft Decision ($million, real FY19)

FY19, $millions	Programs/ major projects	Initial Proposal	Draft Decision	Revised Proposal
Unmodelled	Programs	382		342
	Major projects	122		103
Sub-total		**504**	**450**	**445**
	Strategic property	33	0	0
	ADMS	41	0	60

Source: Ausgrid analysis

AER response

The AER did not accept the unmodelled component of our Initial Proposal. The AER analysis extrapolated Ausgrid's actual spend in the first four years of the current period to a five-year period (on a pro-rata basis). This trend analysis approach resulted in $450 million for unmodelled repex. This is 11% below our proposed forecast of $504 million.

Justifying our revised modelled repex component

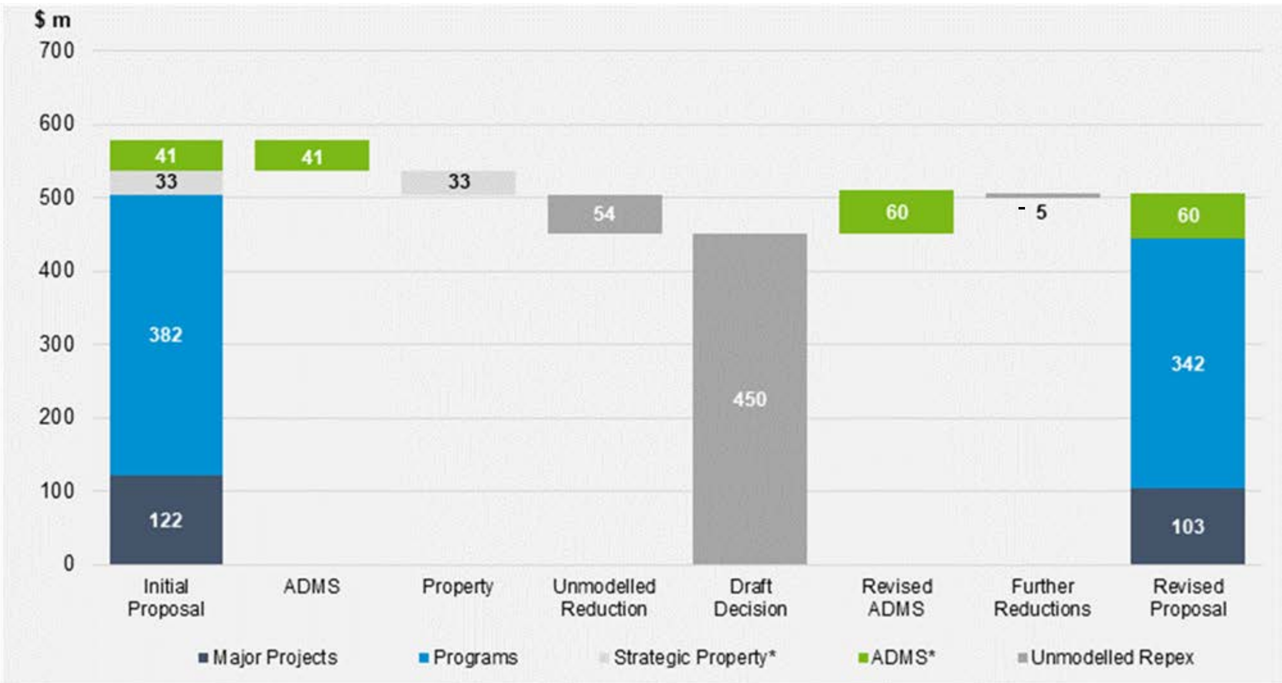
We considered the feedback provided by the AER and customer advocates on our unmodelled replacement program forecast and have revised our forecast. . The key changes in our forecasts are:

- A reduction in SCADA, Control and Protection of $13 million due to a revised forecast in modem upgrades to align to a revised timeline for the 3G roll-off
- A reduction in Oil Containment upgrades by $20 million considering potential future alternative solutions
- A reduction in Tower Refurbishments by $5 million through deferral into the next regulatory period
- A reduction in Distribution Substation Civil upgrades by $5 million considering the potential for further synergies to be identified with adjacent works
- The removal of two programs valued at $4 million for relay replacement, and
- A reduction of approximately $10 million in major project costs due to refined project needs in the revised forecast.

The changes in the unmodelled component are shown in the below waterfall chart.

Figure 13

Changes in unmodelled repex ($million, real FY19)



Source: Ausgrid analysis

Our revised repex proposal (excluding strategic property and ADMS) is $445 million which represents a reduction of $59 million (12%) from our Initial Proposal of $504 million. The revised unmodelled repex forecast is $5 million lower than the AER Draft Decision of $450 million.

5.7.3 Major replacement projects

The total modelled and unmodelled components of major replacement projects in our Initial Proposal was $298 million. Our revised forecast for this component is $245 million which is $53 million (18%) lower than our Initial Proposal. The lower revised forecast is largely the result of incorporating updated information from our annual network planning process into our capex plans.

Table 21 shows our initial and revised forecasts for major replacement projects.

Table 21

Major replacement projects ($million, real FY19)

FY19, $millions	Programs/ major projects	Initial Proposal	Revised Proposal
Modelled	Major projects	176	142
Unmodelled	Major projects	122	103
Total		**298**	**245**

Source: Ausgrid

By their nature, renewal major projects address multiple asset types and therefore contribute to both modelled and unmodelled repex categories. For simplicity, this section discusses this capex at the project level, as this is the level at which needs and cost benefit analysis are considered.

11kV switchgear replacement

In our Initial Proposal we included projects to replace 11kV switchgear. The repex forecast for the 11kV switchgear is linked to our proposed demand management initiatives for Lidcombe and Mascot 11kV switchgear replacement projects. In the Draft Decision the AER commended our modelling approach to assess 11kV switchgear replacement projects, but considered that a number of our input assumptions were conservative. These included 'mean time to repair' that the AER believed resulted in overstated unserved energy and quantified benefit calculations.

We have revised our cost-benefit analysis to address the AER's concerns about input parameters for the 11kV switchgear projects and updated them to reflect newer information. Key revisions include:

- Updated load forecast based on winter 2017 and summer 2017/18 actuals
- Adjusted grossly disproportionate factor (as applied to the value of a statistical life saved) of 6 for rather than the original 10 for safety risks
- Conducted sensitivity analysis of the mean time to repair (MTTR)
- Adjustment of the allocation of indirect cost to the project cost to reflect only the variable component of capital support costs (25%), consistent with the approved Cost Allocation Model (CAM).

Our revised proposal is to invest $115 million to replace 11kV switchgear. This incorporates deferral in capex which we can achieve by undertaking two demand management projects and is a reduction of approximately $15.5 million from our Initial Proposal.

Our revised justification for 11kV switchgear replacement program is presented in Attachment 5.14.1.

33kV switchgear replacement

In our revised forecast for 33kV switchgear replacement program, we propose to include an additional project. The additional Willoughby STS 33kV switchgear replacement is forecast to cost $9.2 million in 2019-24. The total cost of the project is forecast to be $24.9 million and will be completed in 2027. Willoughby132/33kV subtransmission substation was commissioned in 1968 and is nearing the end of its life with forecast declining performance and related risks for the 33kV switchgear and related buildings. The proposed project will replace the existing 33kV switchgear and switchroom building.

The justification for this additional program is presented in Attachment 5.14.3.1.

5.7.4 132kV fluid--filled cable replacement program

Initial Proposal

Ausgrid proposed a 132kV fluid-filled cable capex replacement program of $165 million in the Initial Proposal. The basis of the program was to address the risk of fluid leakage from these cables into the environment. The proposed program was consistent with undertakings made to the NSW Environment Protection Authority (EPA). It was also intended to mitigate against expected unserved energy (EUE) due to the increasing failures rate and long repair times for these cables.

Cost-benefit analysis for individual projects assessed the cost of the projects against the monetised benefits of reducing environmental impact, EUE using the Value of Customer Reliability (VCR) and avoided maintenance and incident response costs. The cost-benefit analysis was submitted as part of the Initial Proposal in Attachment 5.14.

A number of projects were included in Ausgrid's forecast which did not have positive CBAs but were included to meet our commitments to the EPA reduce leakage risk by 50% over each successive regulatory period.

AER response

The AER's substitute forecast for the 132kV cable replacement program was $93 million for the 2019-2024 period.

The AER commended our approach to cost-benefit analysis and accepted a number of our 132kV cable projects that:

- have positive cost-benefit outcomes within the FY20-24 period
- were committed and already under way, or
- which were Ausgrid's component of work related to Powering Sydney's Future.

In its Draft Decision the AER did not support a number of projects that did not have positive cost-benefit analysis. The AER expressed the view that Ausgrid did not have a specific obligation to carry out these works if we could not also demonstrate that they were economically justified.

Following extensive discussion and consultation, customers also expressed a view that, given price pressures, they had a strong preference for Ausgrid and its shareholders to share some of the risk related to the cables which did not have positive cost-benefit analysis, rather than making a capex investment, the cost of which would be wholly borne by customers if accepted by the AER.

Our revised proposal

Following discussions with the AER and customer advocates, we have agreed not to pursue funding for the remaining 132kV replacement projects in our Revised Proposal.

In parallel with completion of the works approved by the AER, we will instead continue to monitor performance of the remaining cables, liaise with the EPA and if action becomes necessary, draw any required funding from across our approved capex allowance, based on priorities. This will allow us to manage the risk without an additional cost impact on customers.

Our revised forecast for 132kV fluid-filled cable replacement of $93 million aligns with the AER's Draft Decision.

5.7.5 Advanced Distribution Management System

Initial Proposal

In our Initial Proposal we proposed to invest $41.3 million in an Advanced Distribution Management System (ADMS) in 2019-24 which is at the centre of transforming our network management environment to take advantage of technological changes and better serve the needs of our customers.

The ADMS is proposed to replace the legacy distribution management system. The ADMS will also permit the rationalisation and integration of several legacy ancillary systems which support operations, planning and design.

The full ADMS solution addresses existing and future system needs and risks as well as providing a platform that will support Ausgrid's ability to meet changing customer needs into the future. An ADMS is a necessary first step to deliver the services expected by customers and stakeholders in a rapidly changing industry, with increasing levels of distributed generation, customer engagement and network and customer concerns for energy prices. The need to integrate greater quantities of new and innovative technology is driving the need to have a modern and adaptive control system.

AER Draft Decision

In its Draft Decision, the AER considered that, while there may be a need for the ADMS program, we had not provided sufficient information to justify the proposed capex replacement program. The AER did not include capex for ADMS in its substitute estimate.

Customers indicated that they supported the ADMS in principle and wanted to understand the benefits of the investment for customers.

Revised justification

In response to the AER's and customers' concerns, we have prepared cost-benefit analysis that compares a number of options to address the need to replace the legacy distribution management system. The options are compared against a base case of continuing with the current distribution management system. The cost-benefit analysis and qualitative assessment supports implementing the full ADMS options against the base case and all other options.

Need

The new ADMS system was proposed in response to critical risks that have emerged with the existing network management system, including:

- Inadequate cyber security capabilities to manage current and emerging threats to continue to meet compliance with State and Federal legislative requirements
- High costs to maintain and difficulty in achieving necessary contemporary cyber security protections
- Significant risks for legacy software and hardware at end of life and without on-going vendor support
- Inefficient connection of new types of network equipment due to the lack of a modern network system providing asset and connection integration capabilities, and
- High development and support costs solely funded by Ausgrid.

Following the submission of our Initial Proposal, planning workshops were held with vendors and the Commonwealth authorities resulting in a change to the scope of the ADMS requirements. This changed scope included introducing a staged implementation approach to de-risk the implementation and addressing the requirement to onshore all Ausgrid data during implementation.

Cost of ADMS

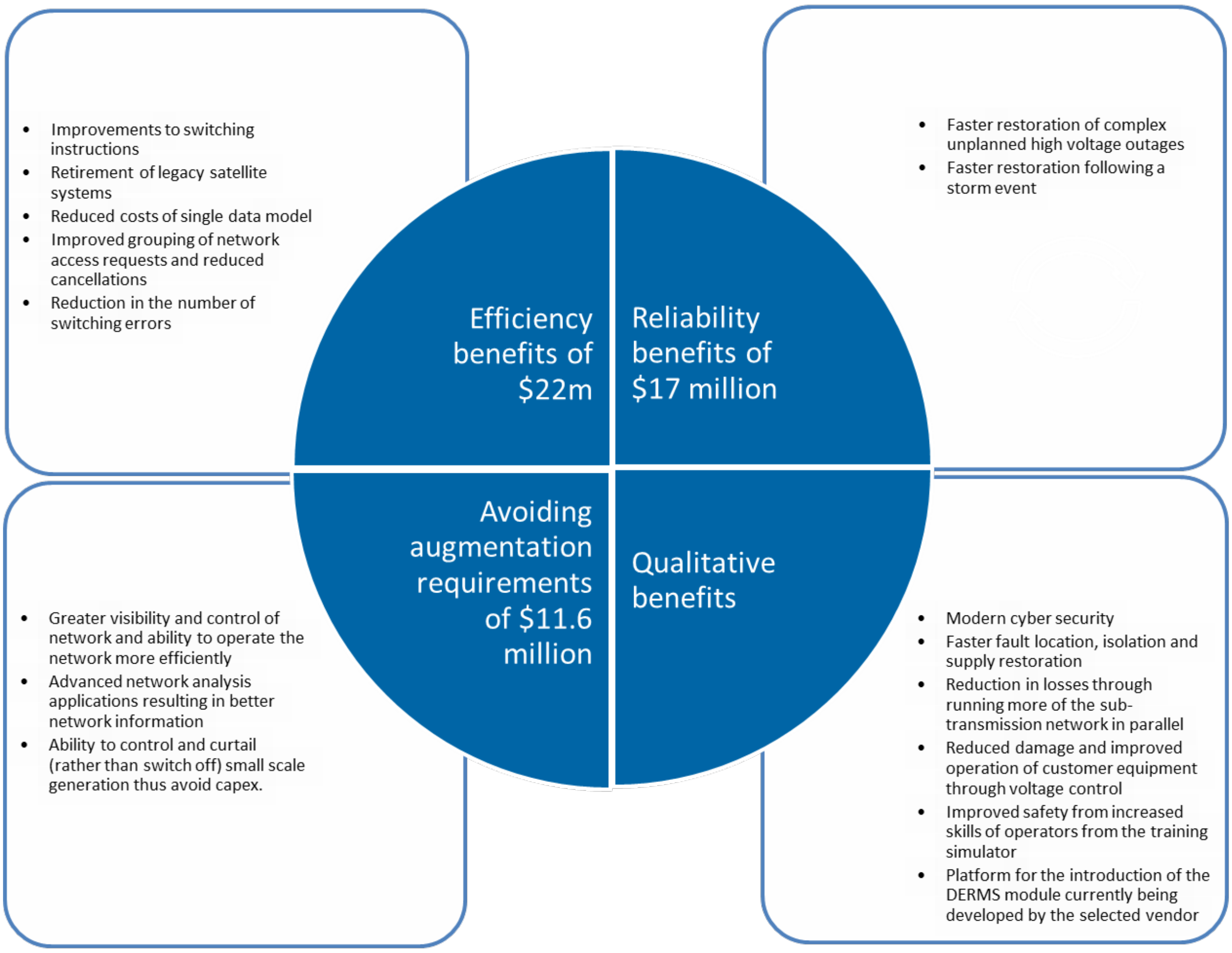
The increased scope of requirements changed the project cost from $41.3m to $59.9m during FY21-24. The full ADMS project will be implemented across two regulatory periods commencing in commencing in FY19.

Benefits of ADMS

The benefits of the proposed ADMS program include efficiency, reliability, avoiding augmentation capex and a range of qualitative benefits. The benefits of the ADMS are shown in Figure 14 below.

Figure 14

Benefits of Advanced Distribution Management System



Source: Ausgrid

The qualitative benefits of the full ADMS outperform the benefits of the part ADMS option. This is the key reason why we prefer the full ADMS option. We have described the qualitative benefits of the full ADMS option in in Attachment 5.13.N.

Cost-benefit analysis

The cost-benefit analysis compares each of the options to the ‘do nothing’ base case over a 15-year period.

The outcomes of the quantitative cost-benefit analysis shows that the full ADMS option has the second highest net present value against the base case and the part ADMS option has the highest. However as discussed above, the full ADMS option will deliver better qualitative benefits compared to the part ADMS option.

A summary of the cost and quantifiable benefits is presented in Table 22 below.

Table 22

Summary of cost-benefit analysis of replacement options for ADMS (Present value, $million)

Costs/Benefits	Base case - Do nothing (Option 1)	DNMS update (Option 2)	Like-for-like replace (Option 3)	DMS + switching (Option 4)	Part ADMS (Option 5)	Full ADMS (Option 6)
Costs	77.9	102.9	83.9	89.7	96.1	105.8
Benefits	-	$-	6.1	24.8	44.3	50.6
Net of cost and benefits	77.9	102.9	77.8	64.9	51.8	55.1
NPV against Base case	**-**	**-24.9**	**0.1**	**13.0**	**26.1**	**22.8**

Source: Ausgrid analysis

As shown, the ‘do nothing’ option entails operating the current distribution management system and would cost over $70 million in ongoing management to maintain operability and compliance with our obligations and deliver no incremental benefits.

The ADMS proposal has been approved by the Board.

Our revised proposal

Our revised forecast for the ADMS program is $59.9m in FY20-FY24. This is an increase of $18.6 million (45%) from our Initial Proposal. The reason for the increase is refinement of the delivery schedule following vendor design workshops, updated vendor pricing, and to meet a change in regulatory obligations relating to cyber security.

Our revised proposal is prudent and efficient as it meets our regulatory obligations and facilitates transforming our network to better manage increased levels of distributed energy resources.

Customers will benefit from having a network that can adapt and manage the shift to new technologies.

Further information about the ADMS program is presented in Attachment 5.13.N and associated attachments.

5.8 Further supporting material

Other supporting material includes

- Attachment 5.02 Master List of Ausgrid forecast capex projects (January 2019)
- Attachment 5.05 Capital expenditure decision-making framework (January 2019)
- Attachment 5.11 Key assumptions and Directors’ certification of key assumptions (January 2019)
- Attachment 5.13 Justification for replacement programs (January 2019) and associated attachments
- Attachment 5.14 Project justification for major projects (January 2019)
- Attachment 5.15 Nuttall Consulting supplementary repex review (January 2019) and associated attachments.

6 Growth capex

6.1 Our revised growth capex forecast

Growth capex includes augmentation and customer connection related projects and programs. Augmentation refers to works on our shared network needed to meet increases in demand for energy. Connection refers to new installations to provide reliable supply to customers who want access to the shared network. In our revised forecast we have applied the AER's draft decision to re-categorise some of our proposed network property acquisitions from replacement to growth.

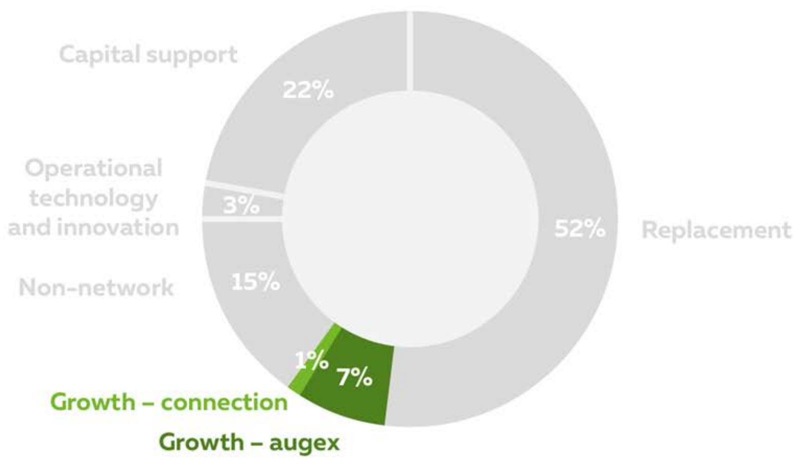
Our revised forecast for growth capex totals $215 million (or an average of $43 million per annum) (real, FY19) in the 2019-24 period, comprising:

- revised total augex of $164 million over the regulatory period, which increases to $182 million when the network property acquisitions that were accepted in the AER's Draft Decision are included, and
- revised total connections capex forecast of $33 million over the regulatory period. This forecast corrects for an error in our initial proposal, and updated forecasts of peak demand and the probability of projects that require connection to our shared network proceeding.

Our growth capex is $26 million or 11% lower than our Initial Proposal and $17 million or 9% above the AER's substitute forecast in its Draft Decision. Our proposed growth capex (augex and connection) as a proportion of total capex program in 2019-24 in shown in Figure 15 below.

Figure 15

Growth capex as a proportion of total capex program in 2019-24



Source: Ausgrid

The revised growth capex forecast is $26 million (11%) lower than our Initial Proposal of $241 million. The lower growth capex forecast addresses anomalies in our original connection forecast that were amended in consultation with the AER, which subsequently considered $29.2 million to be prudent and efficient. The growth capex forecast has been revised further, following our annual network planning process. This annual review process applies revised peak demand forecasts and customer information including the probability of connection projects proceeding and their timing.

Growth capex is largely driven by increases in peak demand and the number and size of customers connecting to our network. While we are seeing moderate peak demand growth at a system level, demand on some parts of our network are growing quickly due to an increase in the number and size of large customer connections. These large new connections can have a significant impact in a localised area.

We are experiencing unprecedented growth for transport infrastructure projects, residential high-rise developments and digital infrastructure projects such as data centres. Most of the new asset investments will be in 'hotspots' on our 11kV network. The hotspots we are experiencing are mostly in the Sydney region. Our proposed high voltage (11kV) network reinforcement program will allow us to take advantage of past investment in zone substations.

The breakdown of the growth capex forecast into augmentation and connection is shown in Table 23 below.

Table 23

Forecast growth capex for 2019-24 ($million, FY19)

	FY20	FY21	FY22	FY23	FY24	TOTAL
Augmentation	33	49	54	20	26	182
Connection	10	7	6	5	4	33
Total growth	**43**	**57**	**60**	**25**	**30**	**215**

Source: Ausgrid analysis

The majority (85%) of the proposed growth capex program is for augex related projects. Connection forecasts are low in comparison because customers organise and fund the cost of direct connection to the network. In NSW, contestability of connection services means that connecting customers engage third party providers to build the connection infrastructure. We do not receive any payment under these arrangements, and the value of customer funded capex is not added to the value of the regulatory asset base.

In response to customer feedback prior to our Initial Proposal, we undertook not to change our connections policy, which means that new customers (such as property developers) fund the costs of assets required to connect their loads to the shared network. The value of this customer funded capex is not added to the regulatory asset base and therefore existing customers do not have to share the costs of these assets.

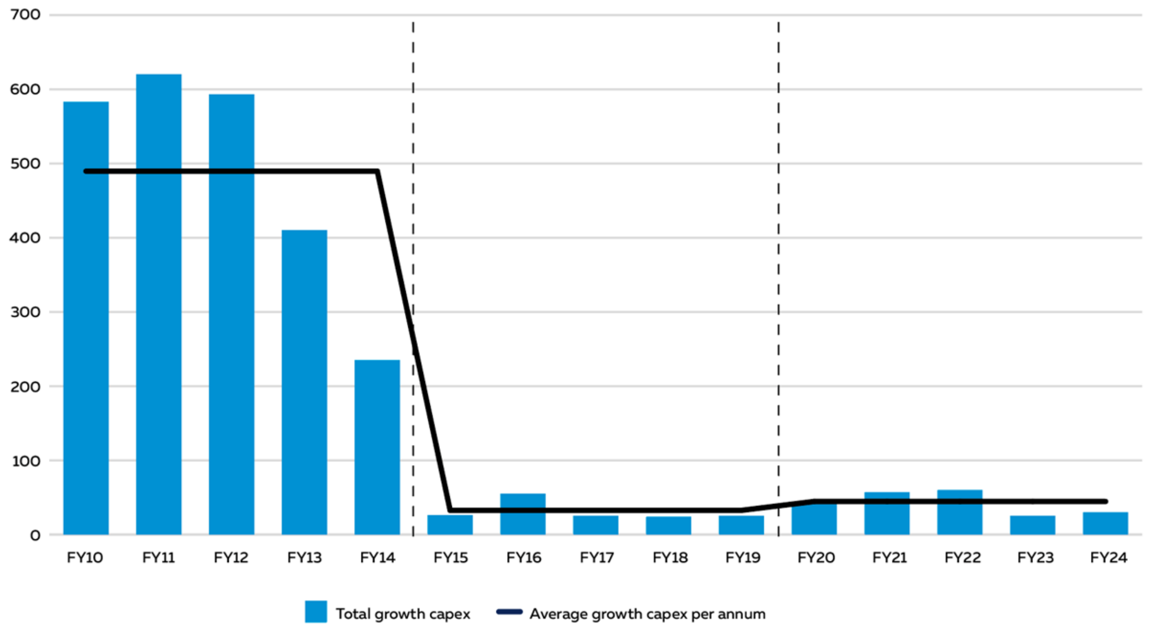
6.2 Growth capex over time

Our revised growth capex forecast is relatively low compared to historical levels. It represents around 9% of the amount we invested in 2009-14.

The substantial reduction in the forecast level of growth capex compared to the past is driven by moderate peak demand growth compared to the rapid increases during 2009-14 and the relaxation of NSW licence conditions relating to network reliability standards. We are now able to leverage the significant investments made in the past to deliver safe, secure and reliable electricity without imposing significant additional costs on customers. Figure 16 below shows the trends in actual and forecast growth capex over a 15-year period.

Figure 16

Trends in actual and forecast growth capex ($million, real FY19)



Source: Ausgrid

Our forecasts for the 2019-24 period remain well below the levels observed 10 years ago, and remain closely aligned with expenditure levels in the most recent period.

6.3 What we heard and how we responded on our initial growth forecast

The AER's Draft Decision did not accept all of our growth capex forecasts. We have summarised the high level matters raised by customers and the AER in the Table 24 below. The main areas raised related to peak demand forecasts and the level of information we provided to demonstrate the prudency and efficiency of specific projects.

Table 24

Responding to feedback on our initial growth forecast

	WHAT WE HEARD	HOW WE'VE RESPONDED
1. Growth (augmentation and connection) forecast	The AER accepted our (amended) connection forecast but did not accept our augex forecast. For augex the AER stated that we needed better information to demonstrate the need for a number of proposed programs and projects. Customer advocates broadly accepted our original growth (connection and augex) capex forecast with the caveat that it was expected we pursue demand management, load shaping, and distributed energy resource opportunities to reduce costs.	We have reviewed our growth capex in response to new information, through our business-as-usual annual network planning review process. We have substantiated the basis of diversity factors used in our 11kV reinforcement capex forecast. (refer Attachment 5.23). We have re-examined whether there is scope for non-network solutions to reduce the need for network investment. As part of this review, we have provided further substantiation of our demand management proposal to defer 11kV

		reinforcement capex. We have also considered whether we can make better use of existing spare capacity instead of constructing new assets.
2. Peak demand forecasts	The AER concluded that our system peak demand forecasts were reasonable, noting that it will review any revisions we make to forecast demand in our Revised Proposal. Some customers considered that we had taken a conservative approach to the potential impact of energy efficiency, innovative demand management and customer responses to new forms of electricity pricing. As a result they thought our forecast was overstated.	As noted in the AER's Draft Decision, we have revised our peak demand forecasts for the latest economic information and new customer connections. We have sought external advice and updated our modelling to estimate the impact of rooftop PV, battery storage and energy efficiency. Further information on peak demand forecasts can be found in Attachment 5.07.
3. Major projects	The AER and customers sought further information in relation to key growth capex projects at Macquarie Park, Rozelle, Alexandria, White Bay and Pyrmont. The AER and customers sought further explanation of the scope, cost and configuration of several of the proposed major projects.	We have reviewed a number of our major projects as part of our annual planning review process. Updated information about the probability of large customer connections proceeding, peak demand changes and scope of projects have resulted in revisions to our original augex and connection forecasts. Further information on peak demand forecasts can be found in Attachment 5.16.1 to the Revised Proposal
5. Sufficient levels of growth capex	There was support for sufficient growth capex to ensure businesses are able to secure new connections to the grid in a timely manner.	We agree that it is important for investment to be at a level to support economic growth.
6. Strategic property	The AER accepted our strategic property purchases for White Bay but did not accept our strategic property purchases for non-specific zone substation sites in Sydney and Hunter.	We have accepted the AER's Draft Decision. As a consequence, our growth capex forecasts include $17.8 million in strategic property (re-categorised from repex), consistent with the Draft Decision.
7. Demand management	The AER did not accept our proposal for a $5 million opex step change for demand management to mitigate against a further $17 million augmentation of the 11kV network. The AER sought further information on the net benefits of the demand management and network options in this case. Customer groups were strongly supportive of demand management initiatives.	In response to the AER's request for further analysis we improved the cost-benefit analysis underpinning our proposal. As explained in further detail in Section 7 below, the updated analysis better demonstrates how the benefits of the proposed demand management opex exceed those of augmentation capex. Our analysis demonstrates that our proposed demand management opex of $4.1 to defer $17 million of 11kV network augmentation capex, a $0.9 million reduction from our previous proposal of $5 million, is prudent and efficient, and therefore in the long term interests of customers. Further information is contained in Attachment 6.05.

6.4 How our revised forecast differs from the AER

The AER's Draft Decision did not accept our initial growth capex forecast, which comprises connection and augmentation capex. The AER's substitute total growth capex of $198 million was $44 million (18%) lower than our initial growth forecast.

Our revised forecast of $215 million is $17 million (9%) higher than the AER's substitute estimate. The revised forecasts best reflect the network investment required to meet the needs of our existing and new customers.

Our revised forecasts are presented in Table 25 below, alongside the AER's Draft Decision and our Initial Proposal.

Table 25

Our forecasts compared to AER draft decision 2019-24 ($million, real FY19)

$millions FY19	Ausgrid Initial Proposal	AER Draft Decision	Ausgrid Revised Proposal
Augmentation	189	169	182
Connection	52	29[5]	33
Total growth	**241**	**198**	**215**

Source: Ausgrid analysis

6.4.1 Augmentation capex

Our revised augex forecast accepts the AER Draft Decision with the exception of 11kV reinforcement program and updates to information about customer loads. Our revised growth forecast has been revised to incorporate the most up-to-date peak demand forecasts and customer information.

For example, we have more certain information about the likelihood of projects proceeding, such as:

- Macquarie Park updated from 75% to 100% likelihood
- Deferred Alexandria third transformer project
- Deferred Darling Harbour to Camperdown load transfers
- Zone substation proposed at Beresfield to meet requirements of local land releases. We propose a 50% likelihood weighting for this project.

11kV network reinforcement program

The 11kV network reinforcement program addresses capacity shortfalls in Ausgrid's high voltage distribution network. It covers over 2,500 high voltage feeders which consist of 10,038km of overhead conductors and 8,294km of underground cables. The program maintains existing network reliability by addressing the forecast network impacts from load growth. It is needed to reduce the risk of network being overloaded and to allow us to restore interrupted customers using available capacity on neighbouring feeders. The 11kV reinforcement program also allows us to take advantage of past investment in zone substations and contribute to more efficient use of the network.

Our Initial Proposal included $80.7 million in 11kV network reinforcement capex, which was reduced to $63 million as a result of a demand management initiative with opex costs of $5 million. Our revised proposal reiterates and further

[5] In our Initial Proposal we forecast connection capex to be $59.2 million. This figure included anomalies which were addressed in consultation with the AER after we submitted the Initial Proposal.

substantiates the forecast capex of $63 million, although with a smaller opex requirement of $4.1 million to achieve the required capex deferrals.

The AER considered that our methodology was reasonable but did not consider that our use of a diversity factor of 1.1 was sufficiently substantiated. We have provided further information to address the AER's concerns by demonstrating that our diversity factor is based on empirical data. This is discussed further in section 6.6.3 below with further detail in Attachment 5.23.

6.4.2 Connection capex

Our initial connection forecast was amended in consultation with the AER and subsequently $29.2 million was considered to be prudent and efficient by the AER. We accept the AER's findings with adjustments based on updated project timing and information. Specifically, Stage 2 of the WestConnex project was deferred from the current period into the next period adding $3.7 million to our connection forecast in 2019-24 to give a revised forecast of $33 million.

6.5 Putting together the revised growth capex forecast

We have revised our growth capex forecast as follows:

- We have reduced our augmentation capex forecast
- We have updated peak demand forecasts for the latest input data
- We have updated our modelling of the impact of distributed energy resources on peak demand
- The potential for demand management has been reviewed and further analysis undertaken in relation to a particular demand management initiative
- We have reviewed our future network property requirements and reduced strategic property acquisitions, and
- We have updated customer connection forecasts based on latest information available.

6.5.1 Peak demand forecasts

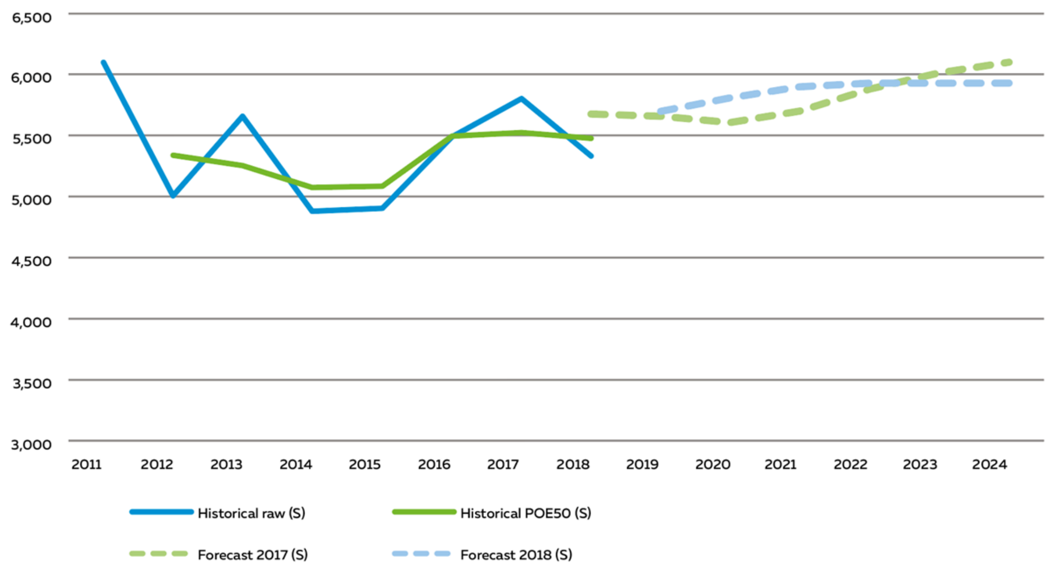
Peak demand is a key driver of growth capex requirements. We have updated our peak demand forecasts to take account of the most recent information available following the submission of our Initial Proposal. Updated information includes economic data and revised customer connection information.

The 2018 spatial demand forecast projects system demand to increase by about 0.8% per annum over the 2019-24 periods. The 2018 revised forecast is lower than our Initial Proposal forecast of 1.5% per annum. The peak demand forecast used for 2019-24 capex planning in our Initial Proposal was based on 2017 data.

The change in the peak demand forecast has reduced our total forecast augmentation requirements over the 2019-24 periods. Our revised system total summer (S) peak demand forecasts is shown in Figure 17 below.

Figure 17

Forecast summer maximum demand for 2019-24 compared to historical changes (MW)



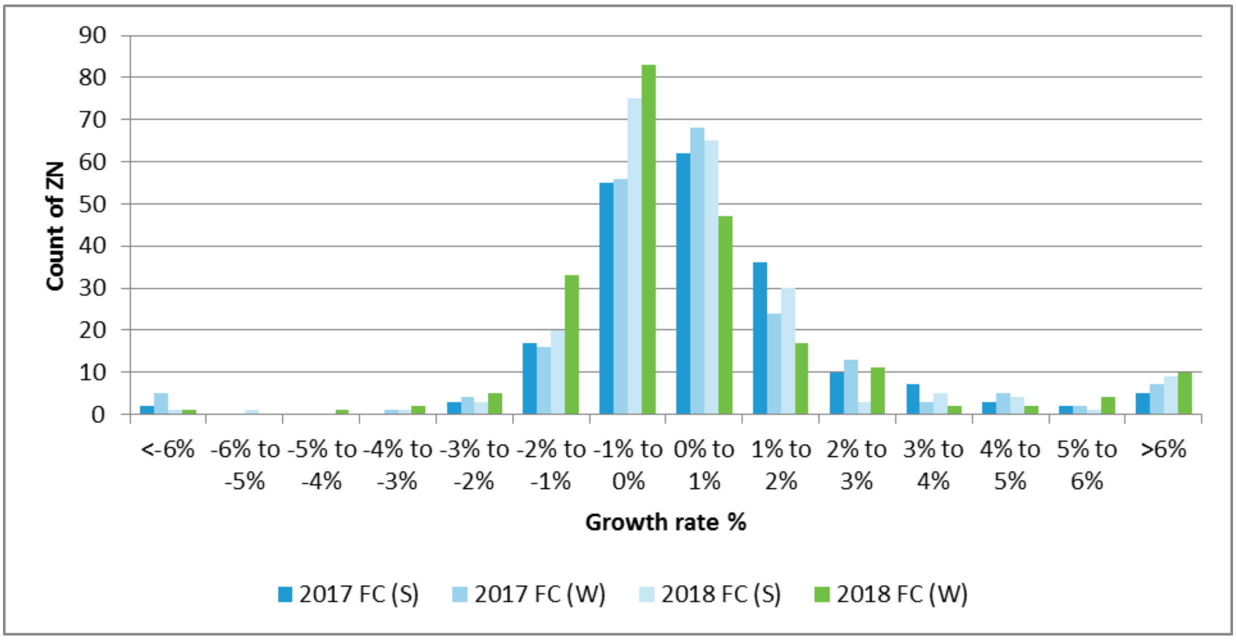
Source: Ausgrid

While the growth in peak demand forecasts is lower, at the spatial level, around 54% of zones in summer and 43% of zones in winter are expected to experience growth in maximum demand over the next seven years (based on compound annual growth).

However, the levels are down from 62% of zones in summer and 60% of zones in winter expected to experience growth over the next 7 years in the 2017 forecast. This is shown in Figure 18 below.

Figure 18

Seven year compound substation growth rates



Source: Ausgrid

As shown in the chart, the 2018 forecast indicates that there is an increase in the number of zones that will experience growth rates greater than 6%. This correlates to the pressure on the network that that spot loads are having on certain parts of our network, driving the need for localised network augmentation.

Further information about the 2018 peak demand forecasts used in the Revised Proposal can be found in Attachment 5.07.

6.5.2 Distributed energy resources

As shown in the figure above, our revised demand forecast at the end of the next regulatory period is slightly lower than our original forecast. In preparing these updated forecasts, we revisited the projected impact of rooftop PV, battery storage and energy efficiency.

This lower growth trajectory is primarily due to the impact of energy efficiency, rooftop PV and battery storage countering underlying demand. We are also expecting lower economic growth in NSW, which would suppress energy demand in our area. We also made refinements to block load and large customer requirements, and modelled the most recent economic data on economic growth, population growth and the impact of electricity prices.

Further information about our forecast impact of distributed energy resources on peak demand forecasts can be found in Attachment 5.07.

6.5.3 Demand management

The AER's Draft Decision rejected our proposed 11kV augmentation demand management program on the basis that we provided insufficient information. In this Revised Proposal, we have undertaken a detailed cost-benefit analysis to verify the initiative. This updated analysis shows that the demand management opex of $4.1 million offers an efficient capex-opex trade-off to defer $17.9 million in capex. This is reduced from opex of $5 million in our original proposal, due to further consideration of demand management delivery strategies. Our revised capex and opex forecasts incorporate the savings from this demand management initiative.

We provide further commentary on our demand management initiatives in section 7 below and Attachment 6.05.

6.5.4 Strategic property

Initially, we proposed strategic property to be included as part of the repex forecasts. The AER did not consider strategic property to be repex and instead classified it as augex. In relation to the expenditure forecast, the AER accepted our strategic property purchases for White Bay, but did not accept our proposed property purchases for non-specific sites in Sydney and Hunter.

We have accepted the AER's Draft Decision. As a consequence, our growth capex forecasts include $17.8 million in strategic property (re-categorised from repex) consistent with the AER's Draft Decision.

6.5.5 Connection capex

Our connection capex has been updated to reflect the latest available information regarding new customer connections. The most material change relates to changes in timing of large customer connections where any delays pushes non-contestable connection capex from this period into the next regulatory period.

We have materially retained our proposed connection policy in terms of how we recover capital contributions from our customers. Customer funded capex is not included in our RAB. Only our net capital expenditure is rolled into the regulatory asset base and recovered from customers through network charges.

Our proposed connection policy has been updated based on feedback from the AER and customer advocates. The proposed capital contributions policy is presented in Attachment 5.17.

6.6 Justifying the revised growth forecast

6.6.1 Review of project and programs in the Initial Proposal

We have reconsidered our growth capex projects and forecasts in light of the AER's Draft Decision and customer feedback. Further consideration and justification for key projects and programs that form part of our Revised Proposal are presented in Table 26 below.

Table 26

Justifying position on revised growth projects and programs

Major project or program	Initial Proposal	AER Draft Decision	Revised Proposal
Macquarie Park subtransmission substation	We proposed to invest $28.1 million in 2019-24 to provide 33kV supply capacity to Macquarie Park Precinct in the Carlingford area of Sydney. This project was included as a conditional project with 75% likelihood of proceeding.	The AER found that we satisfactorily demonstrated the need for this project. The AER included our forecast in its substitute estimate.	Subsequent to the Initial Proposal we have reviewed the project using updated information. The project's likelihood of proceeding has increased to 100%. A RIT-D has been completed with the project becoming committed. Based on this updated information our revised forecast for Macquarie Park subtransmission substation is $33 million.
Conditional projects. White Bay zone substation establishment and Pyrmont subtransmission substation augmentation	These projects were proposed as 'conditional projects'. White Bay had a likelihood of proceeding of 10% and Pyrmont had a likelihood of 50%. We included $34.6 million of projects under this classification.	The AER considered that we had not fully justified the White Bay zone substation and the Pyrmont sub-transmission substation projects. The AER included a lower $29.6 million in its substitute estimate for these projects.	Subsequent to the Initial Proposal we have reviewed these projects using updated information. Based on the updated information we no longer need to proceed with these projects and have not included forecast capex in our revised proposal.
Rozelle subtransmission substation	We initially proposed $17.4 million to construct a 33kV busbar and switch room at the Rozelle 132/33kV subtransmission substation, and to replace the existing 30MVA transformer with a 60MVA unit.	The AER considered that, based on information provided in the Feasibility Report, we only required two bus sections and six feeder panels to supply the existing and additional load. The AER included this configuration in its substitute estimate, which reflects a lower forecast than we originally proposed.	We have reviewed this project using updated information. Our revised proposal aligns with the AER's findings. The revised augex requirement for this project is $15 million. Further information about this project is presented in Attachment 5.16.1.
11kV network reinforcement program	We proposed $80.7 million for the 11kV network reinforcement program without demand management and $63 million with demand	The AER reviewed the modelling provided and considered the methodology to forecast augmentation needs on our 11kV network as reasonable. However, the AER	Our project review confirms that the 11kV network reinforcement and the accompanying demand management initiative are

	management. As already noted, we proposed a $5 million opex step change for demand management to mitigate against the additional $17 million of augmentation for the 11kV network.	questioned our application of a 10% diversity factor between feeder peaks and zone substation peaks. The AER commented that in the absence of any evidence to justify our proposed diversity factor, its substitute estimate for this program was $58.4 million.	justified. Our choice of diversity factor is reasonable and can be substantiated by measured data from across our network. Further information about this program is presented in Attachment 5.23.

6.6.2 Additional conditional project - Beresfield

Following the Initial Proposal, we have identified the need for an additional conditional project. We have received several industrial connection applications with a combined load of 39.3 MVA in the Beresfield area.

The Beresfield area is north of Newcastle and in an industrial area at the northern end of the M1 Motorway from Sydney. A number of load applications have been received for initial industrial loads of approximately 4 MVA in 2019 & 2020, with parallel development of an adjacent industrial estate contributing loads which grow to 27 MVA over the period from 2019-2027

The project is to establish a new 132/11kV zone substation to supply a number of existing and new industrial developments in the area. This project has been allocated a probability of 50% of proceeding.

Based on the timing of proposed connections, it is anticipated that the zone will be required by the end of 2023 in order to avoid significant high voltage development works. The forecast probability weighted project cost is $10.3 million in the 2019-24 period.

The driver for the scope and timing of the planned work is the need to provide connections, capacity and the relevant reliability to meet the requirements of the major customer connections. Due to the scale of the proposed connection loads, non-network options are extremely unlikely to be able to address the proposed loads. As the timing for initiation of the investment approaches, a detailed assessment will be completed.

Further information about this project is presented in Attachment 5.16.1.

6.6.3 Diversity factor

In our Initial Proposal, we accounted for the diversity in peak demand by applying a 10% increase to peak loads forecast at the some substation level, when deriving 11kV feeder forecast loads. This is a normal practice to reflect the fact that individual feeders experience their peak loads at different times, so the peak zone substation load is less than the sum of the peak feeder loads.

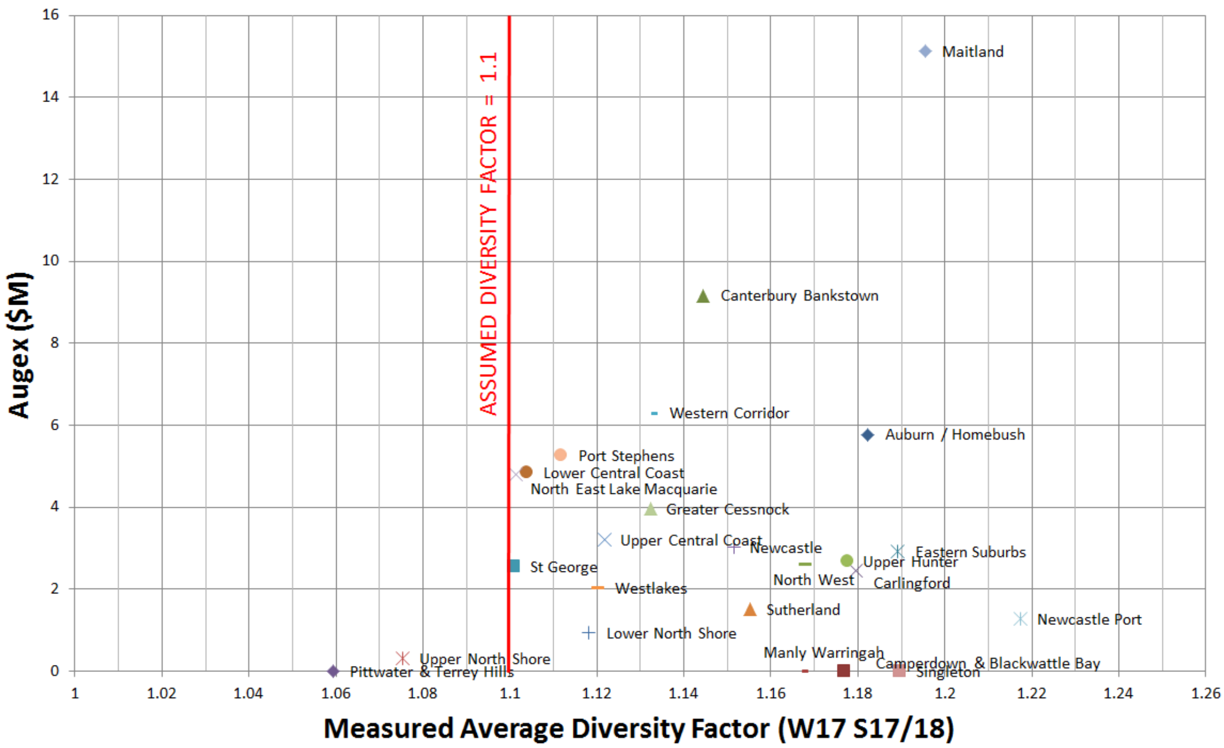
In its Draft Decision, the AER commented that while it is appropriate to apply a diversity factor, the 1.1 factor that we applied appeared to be arbitrary and unsubstantiated. The AER concluded that the diversity factor we applied may be overstating feeder loads and therefore our expenditure requirements. As noted above, the AER reduced our proposed expenditure accordingly.

In response to the AER's Draft Decision, we have undertaken a detailed analysis of the diversity factors as follows:

1. Reviewed all zone substation peak loads and the summation of all feeder peak loads
2. Diversity factor was calculated as summation of feeder peaks divided by substation peaks
3. Zones with obvious network changes (e.g., switchgear replacement, new zones etc) that invalidated the calculation were omitted
4. Zones were aligned to their area plans
5. Area plan capital forecast was compared to the average diversity factor at that area plan

Figure 19

Area plan augex by average diversity factor



Source: Ausgrid analysis

The analysis presented above shows that an average diversity factor of 1.1 is at the low end of the range supported by the data. A higher diversity factor would likely increase our capex requirements, while a lower diversity factor reduces capital requirements, all other things being equal. We have chosen a diversity value which results in capex at the low end of the range of possibilities. Only two area plans had a diversity <1.1 (Terrey Hills & Pittwater and Upper North Shore). Neither of these areas has significant capital forecast in the 2019-24 period. The analysis demonstrates that the AER's concerns in the draft decision regarding our choice of diversity are not substantiated and that a diversity factor of 1.1 is reasonable.

In relation to the 11kV augmentation program, our Revised Proposal therefore reinstates our original forecasts, which includes deferral of capital expenditure as a result of two demand management initiatives. Our revised forecast in relation to this augex program is therefore $63 million over the 2019-24 period.

Further information about this project is presented in Attachment 5.23.

6.1 Further supporting material

Other supporting material includes:

- Attachment 5.02 Master List of Ausgrid forecast capex projects (January 2019)
- Attachment 5.05 Capital expenditure decision-making framework (January 2019)
- Attachment 5.11 Key assumptions and Directors' certification of key assumptions (January 2019)
- Attachment 5.16 Project justification of major projects (January 2019)
- Attachment 5.17 Connection policy (January 2019)
- Attachment 5.23 11kV Network reinforcement program (January 2019)
- Attachment 6.05.1 Demand management and cost-benefit analysis (2019).

7 Demand management

In some cases the most efficient way of meeting customers' needs is through a combination of network investment and non-network solutions such as demand management.

As part of our network planning process, we assess demand management options as alternatives to network capex projects and programs. Our approach is focused on identifying the most cost-effective way of delivering the services our customers want.

7.1 Initial proposal

In our Initial Proposal, we identified demand management opportunities that required a $26.1 million step change in opex to defer $66.1 million in replacement and augmentation expenditure projects that would otherwise commence in the 2019-24 regulatory control period.

A summary of the proposed demand management programs is presented in the Table 27 below.

Table 27

Initial Proposal demand management projects

Network driver	Opex-capex trade-off	Projects
Six replacement programs	$21.1 million opex to defer $50.7 million in capex	Lidcombe, Mascot, St. Ives, Concord and Leightonfield switchgear replacement projects Haymarket-Pyrmont 132kV feeder replacement project
11kV augmentation program	$5.0 million opex to defer $17.9 million in capex	11kV network augmentation

Our original proposal was derived using a detailed cost-benefit assessment for the six replacement projects and a top-down assessment for the 11kV network augmentation program.

7.2 AER Draft Decision

The AER did not accept all of the proposed demand management projects. The AER's Draft Decision was to accept an opex step change for three of the six replacement projects but not accept an opex step change for the remaining three projects. The AER sought further information on the demand management cost-benefit assessment for 11kV network augmentation program.

With regard to Mascot, Lidcombe and St Ives projects, the AER in its draft decision stated:

> *'Ausgrid's analysis shows the use of demand management provides a greater net benefit compared with the network (repex) option. This supports the view that these uses of demand management represent a prudent and efficient capex opex trade-off.'*[6]

With regard Concord, Leightonfield and Haymarket-Pyrmont 132kV feeder replacement project, the AER stated:

[6] AER Draft Decision (2018) Ausgrid 2019-24 Attachment 6 – Operating Expenditure, pg. 6-42

'Ausgrid's analysis shows the use of demand management provides a lower net benefit compared with the network (repex) option. This supports the view that these uses of demand management do not represent a prudent and efficient capex opex trade-off.' [7]

We have accepted the AER's draft decision in regard to major project demand management as set out in more detail below.

With regard to the 11kV network augmentation program, the AER stated:

'Ausgrid's proposal did not include a net benefit assessment of this project. We are seeking further information from Ausgrid on the net benefits of the demand management and network options in this case to allow further consideration of this issue in our final decision.' [8]

As requested by the AER, for the high voltage augmentation program we have provided an improved cost-benefit assessment to underpin our request for a step change in opex to defer elements of this program of works. The updated cost-benefit assessment shows that demand management opex of $4.1 million reduced from $5 million in our Initial Proposal), offers an efficient capex opex trade-off to defer $17.9 million in capex. Further information on the impact of the demand management initiatives on our capex program is presented in section 7.4 below.

7.3 What customers said

Customers expressed concern at the limited use of demand management in the Ausgrid area compared to some overseas jurisdictions. However, Ausgrid was praised for the inclusion of an option value in Ausgrid's assessment of demand management opportunities. This was considered to be innovative and welcomed by customers.

7.4 Our revised proposal

Our revised opex and capex forecasts relating to the impact of demand management are presented in the following Tables 28 and 29.

Table 28

Forecast demand management opex ($m, in real FY19 terms)

Opex	FY20	FY21	FY22	FY23	FY24	Total
Lidcombe 11 kV switchgear replacement	-	-	0.5	0.5	0.5	1.6
Mascot 11kV switchgear replacement	1.2	1.2	1.2	0.2	0.7	4.5
11kV network augmentation	0.2	0.6	0.6	1.4	1.3	4.1
Total	**1.3**	**1.8**	**2.4**	**2.2**	**2.5**	**10.2**

Source: Ausgrid

[7] AER Draft Decision (2018) Ausgrid 2019-24 Attachment 6 – Operating Expenditure, pg. 6-43

[8] AER Draft Decision (2018) Ausgrid 2019-24 Attachment 6 – Operating Expenditure, pg. 6-43

Table 29

Demand management project capex impact ($million, real FY19)

Capex adjustments		FY20	FY21	FY22	FY23	FY24	Total
Lidcombe 11kV switchgear replacement	**Pre DM**	-	0.2	1.1	4.6	3.6	**9.5**
	Post DM	-	-	-	-	0.2	**0.2**
Mascot 11kV switchgear replacement	**Pre DM**	1.2	10.5	13.4	6.8	0.1	**32.0**
	Post DM	-	-	0.4	1.2	10.5	**12.1**
High voltage augmentation	**Pre DM**	9.0	17.9	17.9	17.9	17.9	**80.7**
	Post DM	7.2	13.4	16.6	8.4	17.2	**62.8**
Total	**Pre DM**	10.2	28.7	32.4	29.4	21.6	**122.3**
	Post DM	7.2	13.4	17.0	9.6	27.9	**75.1**

Source: Ausgrid

We have revised our demand management projects in light of the latest available information to ensure that they are efficient and meet the needs of our customers.

Based on our review we accept the AER's Draft Decision to apply a step change in opex for demand management for the Mascot and Lidcombe switchgear replacement projects and to not apply a step change for the Concord, Leightonfield and Haymarket-Pyrmont projects.

For the St Ives project, following our review we no longer require a step change in opex as the updated estimates of the costs and benefits for the project result in a delay in the project need.

We have also revised our demand management modelling for the 11kV network augmentation program. We have included a detailed bottom-up cost-benefit approach for the demand management assessment based upon the same inputs as for the derivation of the 11kV network augmentation capex program.

Similar to our initial proposal for 11kV network augmentation, this modelling classifies 11kV network augmentation projects as small, medium and large, but further classifies projects by customer mix as identified in the 11kV network augmentation program model. The representative projects are then assessed using the costs and benefits from the program model. As with the assessment of large projects, an option value of 5% per year of deferral is applied to reflect the expected benefit from a delay in network investment that may arise from new future solutions. This benefit might reflect lower future demand or new lower cost options that address the identified need.

The demand management program for 11kV network augmentation assumes that costs for demand management solutions with residential and non-residential customers decline by 15% and 10% per year respectively to reflect increasing maturity and capability in the demand management market over time. This leads to a greater level of viable demand management in the later years of the 2019-2024, hence greater capex deferrals and demand management opex.

7.1 Further supporting material

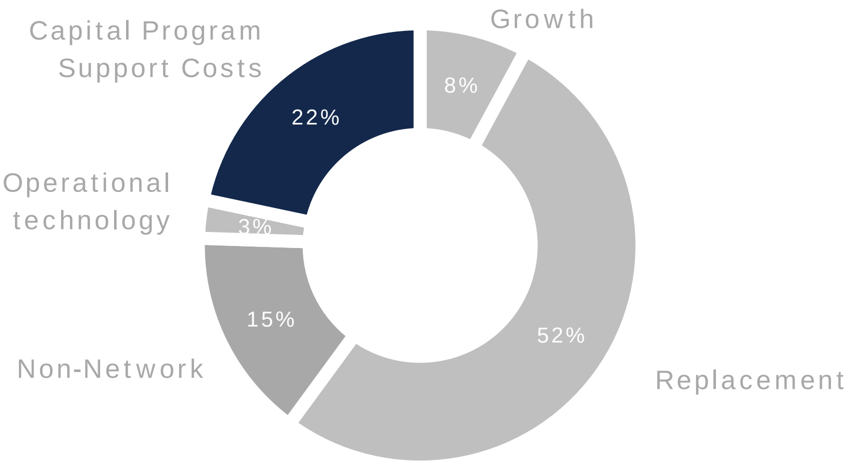
Attachment 6.05.1 sets out the cost-benefit assessment for the 11kV network augmentation program.

8 Capital program support

Capital program support (also known as capitalised overheads) includes the indirect costs we incur in the delivery of both our network and non-network capital programs. These costs cannot be allocated to individual projects, and so are bundled together as overheads. As shown in Figure 20 below, our capital program support costs make up 22% of our total forecast capex in the 2019-24 period.

Figure 20

Capital support costs as a proportion of total capex program in 2019-24



Source: Ausgrid

8.1 Revised forecast

We forecast $590 million in capital overhead support costs in the 2019-24 period. This is about 2% more than the $577 million the AER accepted in its Draft Decision.

The indirect costs that support our capital program include network planning, our corporate support functions, fleet, logistics and procurement, and ICT. These costs are not directly attributable to any one capital program or project. They are capitalised in accordance with Australian Accounting Standards and allocated to standard control services in accordance with our Cost Allocation Method (CAM) approved by the AER.

In its Draft Decision, the AER considered our approach to forecasting our capital support costs in the 2019-24 period to be reasonable. The AER stated: [9]

[9] AER, Draft Decision – Ausgrid Distribution Determination, November 2018, p. 5-118

we [the AER] are satisfied that, as a whole, Ausgrid's methodology for forecasting overheads overall reasonably estimates prudent and efficient expenditure over the 2019-24 regulatory control period.[10]

While acknowledging the reasonableness of our approach, the AER did not accept the capital support costs we put forward in our Initial Proposal. This was in line with its Draft Decision to reduce the direct capex associated with our network and non-network programs. The AER noted that 'reducing the scope of the capital program should reduce support requirements'.[11]

Our revised capex proposal includes more direct capex for network and non-network than the AER approved in its Draft Decision. As a result, our revised capital overhead support costs are higher than the AER Draft Decision. We forecast $590 million in capital overhead support costs in the 2019-24 period.

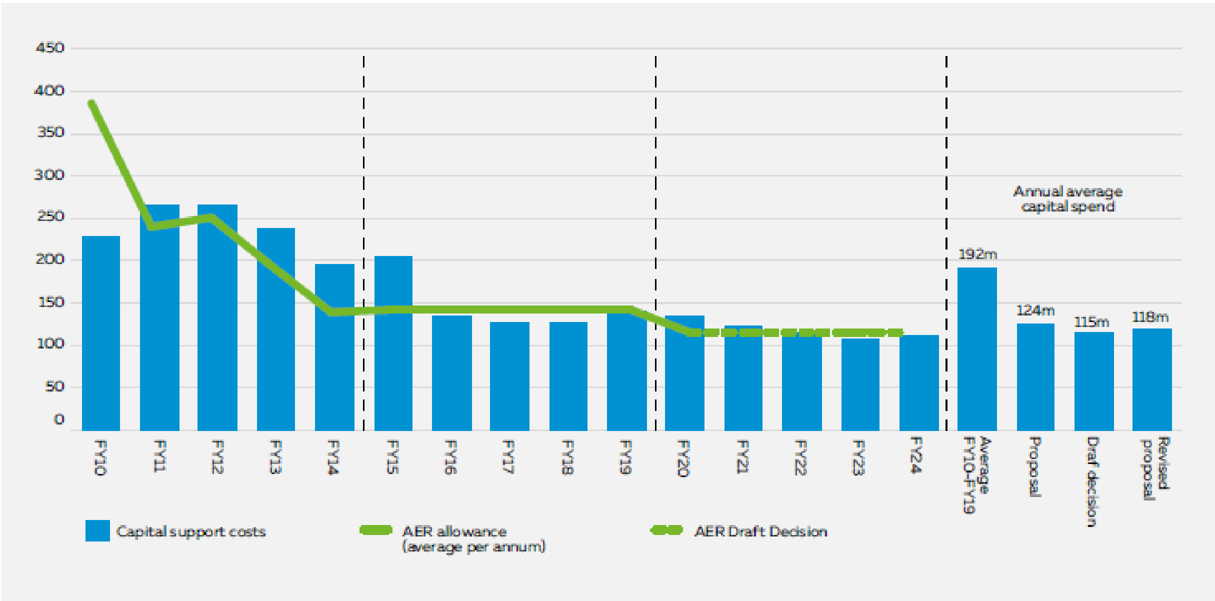
8.2 Our forecast reflects our prudent and efficient costs

We have actively implemented measures to realise efficiencies in our program support costs. These measures, delivered by our transformation program, have reduced the total cost pool of our overheads, resulting in a reduction in our capital support costs.

Figure 21 below tracks the efficiencies we have been able to unlock. It shows that capital support costs averaged $192 million per annum in the last 10 years, whereas over the 2019-24 period we are forecasting $118 million per annum. Ultimately, this reduction will benefit our customers as they will pay less for the indirect support costs that are essential to the safe, reliable and efficient delivery of our capital program.

Figure 21

Historical and forecast capital support costs ($million, FY19)



Source: Ausgrid

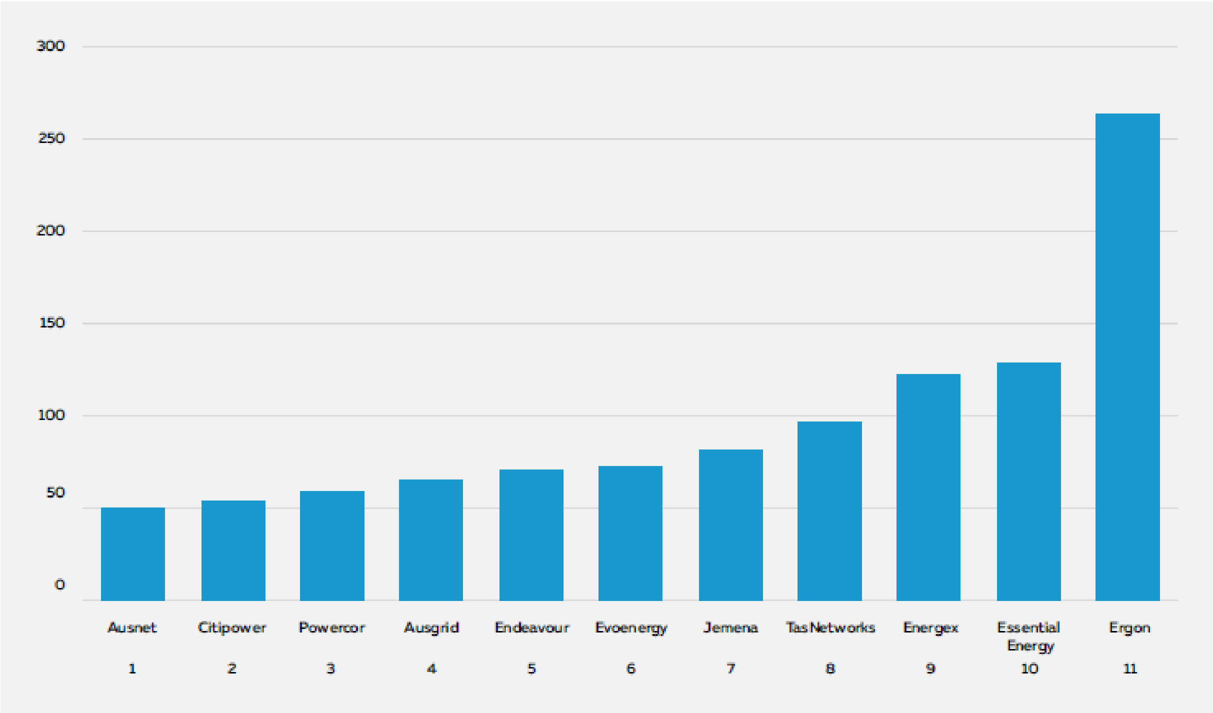
10 AER, Draft Decision – Ausgrid Distribution Determination, November 2018, p. 5-118

11 AER, Draft Decision – Ausgrid Distribution Determination, November 2018, p. 5-118

We have, in addition, tested the efficiency of our Revised Proposal using benchmarking. We began by just comparing our forecast capital support costs against our peers in the NEM. To provide a more complete view, we then benchmarked our total expenditure ('totex') on overheads, inclusive of both capital and operating costs. This analysis is set out in Figure 22 and Figure 23 below. It shows that on a per customer basis both our capital support costs and totex overheads are among the lowest in the NEM. We are in fact at the efficient frontier, along with United Energy, at the totex level.

Figure 22

Annual capital support costs per customer ($FY19)

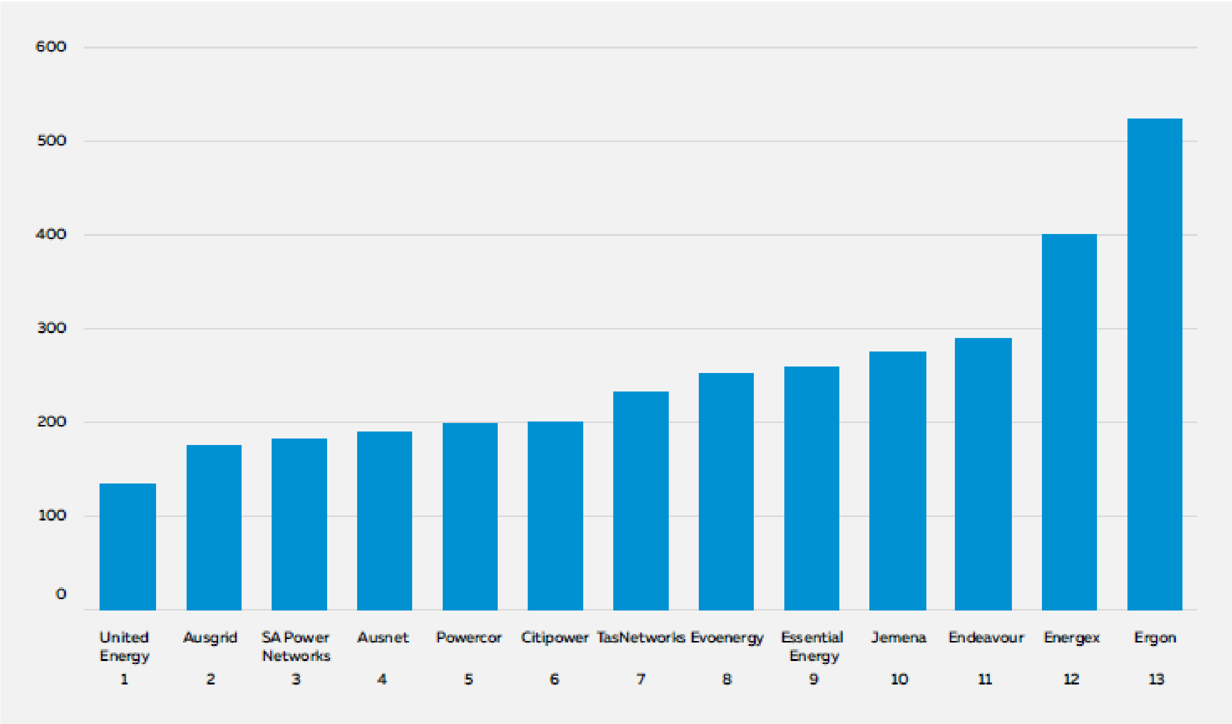


Source: Ausgrid analysis

Note: Capital support costs data for Ausgrid is a 5-year average for the FY20-24 regulatory period based on our revised proposal. Endeavour, Essential, Evoenergy and TasNetworks is a 5-year average for the FY20-24 regulatory period from the initial proposal reset RIN for each business. Overhead data for Energex, Ergon, SA Power Networks from 2016/17 CA RIN; Ausnet, CitiPower, Jemena, Powercor, United from 2017 CA RIN.

Figure 23

Annual totex overheads per customer ($FY19)



Source: Ausgrid analysis

Note: Overhead data for Ausgrid is a 5-year average for the FY20-24 regulatory period based on our revised proposal. Endeavour, Essential, Evoenergy and TasNetworks is a 5-year average for the FY20-24 regulatory period from the initial proposal reset RIN for each business. Overhead data for Energex, Ergon, SA Power Networks from 2016/17 CA RIN; Ausnet, CitiPower, Jemena, Powercor, United from 2017 CA RIN.

9 Our revised forecast capex is prudent and efficient

9.1 Governance and decision making processes

The improvements we have introduced to our governance and decision-making processes for capex plans and forecasts provide strong assurance that our total capex forecast is prudent and efficient in accordance with the requirements of the NER. In particular, we have strengthened the review and challenge process by enhancing the roles of the RREC and IGC to ensure that:

- The objectives of the business in approving capital expenditure is fully aligned with the requirements of the NER
- Customer feedback is given full consideration in our review, challenge and approval process.

In addition, the following improvements have been made to the development of our capex forecasts:

- Our risk management framework has been reviewed to ensure that risk is subject to an economic assessment in our expenditure proposals
- Our network asset management system is certified to ISO55001 standard, which provides confidence that our asset management processes are consistent internationally recognised good asset management practice.

In aggregate, these initiatives have significantly improved our approach to capex forecasting and played an essential role in ensuring that the resulting forecasts are prudent and efficient. In the sections below, we summarise why our revised capex forecast for each major network category is prudent and efficient. The prudency and efficiency of our non-network capex is explained in a separate supporting document.

By demonstrating that each major capex category is prudent and efficient, combined with rigorous testing at the overall portfolio level, it follows that our total capex is also prudent and efficient, consistent with the NER capex objectives and criteria and the long-term interests of customers.

9.2 Our revised repex forecast is prudent and efficient

In this revised Proposal, we have addressed the matters raised in the AER's draft decision and the feedback from our customers and stakeholders. We have revisited our plans to determine whether there is scope to defer replacement capex or implement efficient non-network alternatives.

In preparing our revised repex forecasts, we:

- undertook further cost-benefit analysis to demonstrate that our proposed expenditure is justified from an economic perspective
- reviewed our demand management projects to ensure that opportunities to substitute replacement projects with non-network solutions are fully reflected in our capex forecasts
- revisited the application of the AER's repex model to provide a top-down review of our forecasts using the AER's latest modelling approach.

In reviewing and updating our original repex forecasts using the methods described above, we have responded to the specific matters raised by the AER and our customers. This detailed review, coupled with the improvements in our decision-making processes for network capex, provide strong assurance that our revised repex forecast is prudent and efficient and reasonably reflects the capex objectives and criteria in the NER.

9.3 Our revised growth capex forecast is prudent and efficient

In this revised Proposal, we have carefully considered the feedback from the AER and customers. As explained above, we have revisited our plans to determine whether there is scope to reduce growth capex, by revisiting our demand forecasts; revising non-network solutions; and making better use of existing capacity by transferring loads between existing installations and, to a greater degree, retiring assets rather than replacing them. We have used the most up-to-date information in our revision of growth projects and programs.

Our revised growth capex forecast are based on:

- Best available information to forecast peak demand
- Revised modelling for energy efficiency, solar PV and batteries
- Revised strategic property portfolio to reduce capex
- Enhanced evidence of the need, options, timing for augmentation of our network
- Maintaining the existing connection policy which means that the customer that causes the need for augmentation pays for it and helps to reduce the RAB per customer
- More accurate customer connection information.

The use of the best available information helps to ensure that we meet the capital expenditure objectives and criteria by ensuring that we meet the demands of the network and our regulatory obligations. In addition, our enhanced governance process has placed more scrutiny on our growth capex forecasts.

Considered together, we believe that we have demonstrated that our revised forecast is prudent and efficient and we meet the capex objectives and criteria.

We are confident that our revised growth capex forecast complies with the NER requirements and will deliver outcomes consistent with our customers’ expectations and our regulatory compliance obligations.

10 Expenditure objectives, criteria and factors

In accordance with the NER, our Revised Proposal includes a total forecast capex for the 2019-24 regulatory period that we consider is required to achieve each of the capex objectives listed in clause 6.5.7(a) of the NER.

This revised capex forecast represents the expenditure we consider reasonably reflects:

1. The efficient costs of achieving the capex objectives listed in clause 6.5.7(a) of the NER
2. The costs that a prudent operator would require to achieve the capex objectives
3. A realistic expectation of the demand forecast and cost inputs required to achieve the capex objectives.

The AER is required to make a decision on whether to accept or reject our total capex forecast. The AER must accept the total capex forecast if it is satisfied that the forecast reasonably reflects each of the capex criteria, having regard to the capex factors. Below we identify how we have met the capex objectives, criteria and factors.

10.1 Achieving the capex objectives

Our revised capex forecast for the 2019-24 regulatory period consists of four key capital categories – repex, growth capex, non-network and capital program support. Each of these capital categories contributes to meeting our compliance and regulatory objectives, as described in Table 30 below.

Table 30

Description of activities by capex key capex categories

CAPEX CATEGORY	ACTIVITIES AND RELEVANCE TO CAPEX OBJECTIVES
Repex	Repex includes any capital activity to replace or renew assets to extend their life, and also includes new assets installed on our network to enable the retirement of end of life assets. We replace and renew network assets in planned, conditional and reactive programs, which comprise the largest driver in the total capex program. Repex replaces network assets that potentially pose a risk to safety and reliability. Replacement capex is required to ensure compliance with our regulatory obligations and to maintain system safety, security, reliability and quality of supply. Repex is required to achieve the capex expenditure objectives.
Growth capex	Growth-related programs involving connecting new customers and augmenting the network to meet our forecasts of peak demand on the network, as well as the needs of connecting customers and maintain appropriate utilisation of the network. Ausgrid has a regulatory obligation to connect customers to its network. Growth capex is necessary to achieve the capex objectives.
Non-network	Capital programs for non-network assets include investing in ICT, innovation projects, property, fleet and minor assets. These programs are needed to support repex and growth capex programs. Non-network capex is necessary to achieve the capex objectives.
Capital program support	Capital program support involves planning, managing and supervising capital projects and programs, scheduling jobs, administrative support and safety. These programs are needed to support repex and growth capex programs. Capital program support capex is necessary to achieve the capex objectives

We have prepared our forecast capex in a manner that complies with the capex objectives specified in the NER. Specifically, we consider that our forecast meets the capex objectives for the following reasons.

Table 31

How we comply with the capex objectives

CAPEX OBJECTIVES	RULE 6.5.7	ADDRESSED BY
Meet or manage the expected demand for standard control services	(1)	Our revised capex forecast has been prepared using the most up-to-date information for peak demand forecasts and customer connection information. We have revisited our plans to determine whether there is scope to reduce growth capex, by reviewing our demand forecasts; revising non-network solutions; and making better use of existing capacity on the network by transferring loads between existing installations and, to a greater degree, retiring assets rather than replacing them. Our non-network forecast capex has been reviewed to ensure that we invest sufficiently to enable us to deliver our repex and growth capex programs.
Comply with all applicable regulatory obligations or requirements associated with the provision of standard control services	(2)	Our revised capex forecast meets our regulatory obligations. The forecasts are underpinned by an Asset Management System that is certified to ISO 55001.The capex forecast is based on sound analysis that demonstrates our proposed expenditure is economically justified. The cost-benefit analysis supports timing of the investment no sooner than necessary.
Maintain the quality, reliability and security of supply of standard control services	(3)	We manage our assets in a manner that ensures that we maintain the quality, reliability, and security of supply of standard control services and our distribution system. We have taken on board feedback from our customers on quality, reliability and security of supply and addressed them in our revised forecast capex. Our enhanced governance and challenge processes ensure that our forecasts are focused on meeting these objectives. In addition to the above processes, we have a delivery strategy that will ensure that the required works are undertaken in a timely and efficient manner (refer to Attachment 5.12 of Ausgrid's Initial Proposal).
Maintain the safety and security of the distribution system through the supply of standard control services.	(4)	We manage our assets in a manner that ensures that the quality, reliability, and security of supply of the distribution system is maintained through the supply of standard control services. We have taken on board feedback from our customers on quality, reliability and security of supply and addressed them in our revised forecast capex. We have a delivery strategy that will deliver the network-related capital program. (refer to Attachment 5.12 of Ausgrid's Initial Proposal) to ensure that we are in a position to meet these requirements.

10.2 Meeting the capex criteria

In determining whether the AER accepts our capex forecast, it must have regard to capex criteria set out in the NER. Table 32 below shows how our capex forecast reflects these criteria.

Table 32

How we have addressed the capex criteria

NER Capex criteria	NER clause	Why our forecasts reasonably reflect the capex criteria
Reflects the efficient costs of achieving the capex objective	**6.5.7(c)(1)(i)**	In preparing our revised capex forecasts, we: • undertook further economic analysis to demonstrate that our proposed network and non-network forecasts are justified from an economic perspective • reviewed our demand management projects to ensure that efficient and prudent opportunities to substitute replacement projects with non-network solutions are fully reflected in our capex forecasts. Our demand management method incorporates option value of deferral into the analysis • incorporated productivity improvements in our network capex forecasts • applied the AER's repex model to provide a top-down review of our modelled repex forecasts • subjected our proposed forecasts to review and challenge by internal governance bodies and customers.
Reflects the costs that a prudent operator would require to achieve the capex objective	**6.5.7(c)(1)(ii)**	As a prudent operator: • we have carefully considered ways to meet our regulatory obligations and meet or manage expected demand for standard control services to ensure that the timing of the investment is no sooner than necessary • our capex program has been informed by strengthened economic analysis and review and challenge processes. We have engaged external reviewers to review our economic analysis. • we have a delivery and resourcing strategy that ensures capital works are planned and procured with the most efficient and effective blend of resources. The AER accepted our delivery and resourcing strategy presented in the Initial Proposal.
Reflects a realistic expectation of the demand forecast and cost inputs required to achieve the capex objectives	**6.5.7(c)(1)(iii)**	In preparing our revised capex forecasts: • our demand forecasts were derived from the most up-to-date information • we used robust models and customer connection information, including well developed models of the various drivers of activity, to inform our capex requirements • we reviewed our cost inputs and have adopted the AER's methodology for labour and have updated the numbers used in the Draft Decision with revised BIS forecasts for our Revised Proposal. We have adopted the AER's approach to land cost escalators and retained our approach to forecasting contract labour input costs.

10.3 Meeting the capex factors

In deciding whether the AER accepts our capex forecast, it must have regard to capex factors set out in the NER. Table 33 below shows that we have also had regard to these factors in developing our revised capex forecasts.

Table 33

Summary of how Ausgrid has met the expenditure 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)**	We have had regard to the annual benchmarking reports published by the AER under Rule 6.27. Our performance on key benchmarked measures was presented in our Initial Proposal. Further benchmarking analysis is presented in this Revised Proposal. Our repex capex for the modelled components has been assessed using the AER's refined repex model using benchmark unit rates and age profiles. Our 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.
The actual and expected capex of the DNSP during any preceding regulatory control periods	**6.5.7(e)(5)**	Our capex forecasts have had regard to historical trends in expenditure over the current and previous regulatory periods. We have discussed the reasons for the key changes in the forecast from the preceding regulatory periods.
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)**	Our revised capex forecast has been informed by careful consideration of the concerns and feedback from customers. Customer consultation has been a key consideration in the development of our capex forecast. We have engaged directly with customer advocates in workshops and meetings and addressed the feedback received in written submissions to our Initial Proposal. As explained in this Revised Proposal, our internal governance and challenge processes were specifically enhanced to ensure that customer feedback is addressed in our revised capex forecasts. As a result, our revised capex forecasts were reduced through successive internal reviews in order to address customers' concerns regarding affordability.
The relative prices of operating and capital inputs	**6.5.7(e)(6)**	The relative prices of operating and capital inputs are considered in our planning processes as we develop our expenditure plans. 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. This includes demand management options. Our ICT program trade-off the cost of infrastructure and the use of cloud technology. Our preferred solution is selected based on its ability to meet the capex objectives prudently and efficiently in accordance with the NER requirements.
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). Our capex forecasts are consistent with maintaining reliability in accordance with the Service Target Performance Incentive Scheme under clause 6.6.2 of the NER.
The extent the capital expenditure	**6.5.7(e)(9)**	All capex forecasts are referable to Ausgrid and reflect arm's length

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		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 capex proposal 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)
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 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 distributed energy resources 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)**	We have published eleven final project assessment reports in relation to projects which have forecast capital expenditure in the upcoming regulatory period. The final project assessment reports are: 1) Addressing reliability requirements in the Enfield network area (published 16 February 2018) 2) Addressing reliability requirements in the Inner West network area (published 13 April 2018) 3) Addressing reliability requirements in Sydney CBD (published 8 June 2018) 4) Addressing reliability requirements in Flemington load area (published 29 June 2018) 5) Modernising Ausgrid's Operational Control System (published 13 July 2018) 6) Addressing reliability requirements in the Lower North Shore Area (published 13 July 2018) 7) Addressing reliability in the Revesby and Milperra load areas (published 10 August 2018) 8) Addressing reliability in the Clovelly load area (published 10 August 2018) 9) Address increased customer demand requirements in the Macquarie Park area (published 19 October 2018) 10) Managing asset risks in the St George network area (published 1 November 2018) 11) Addressing increased customer demand requirements in the Rozelle area (published 14 December 2018) All project reports can be found on Ausgrid's website at https://www.ausgrid.com.au/ritd.
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.

10.4 Further material to support our capex proposal

This attachment has provided information to support our revised capex forecast for 2019-24. We have provided information in a way that reflects the AER's assessment process and its feedback in its Draft Decision. We are open to providing any other information requested by the AER and customers.

Further information has also been provided in attachments and models and forms part of our Revised Proposal.