DRAFT DECISION
Endeavour Energy
Distribution determination

2019–24

Attachment 5
Capital expenditure

November 2018

AUSTRALIAN ENERGY REGULATOR

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Note

This overview forms part of the AER's draft decision on the distribution determination that will apply to Endeavour Energy for the 2019-24 regulatory control period. It should be read with all other parts of the draft decision.

The draft decision includes the following documents:

Overview

Attachment 1 – Annual revenue requirement

Attachment 2 – Regulatory asset base

Attachment 3 – Rate of return

Attachment 4 – Regulatory depreciation

Attachment 5 – Capital expenditure

Attachment 6 – Operating expenditure

Attachment 7– Corporate income tax

Attachment 8 – Efficiency benefit sharing scheme

Attachment 9 – Capital expenditure sharing scheme

Attachment 10 – Service target performance incentive scheme

Attachment 11 – Demand management incentive scheme

Attachment 12 – Classification of services

Attachment 13 – Control mechanisms

Attachment 14 – Pass through events

Attachment 15 – Alternative control services

Attachment 16 – Negotiated services framework and criteria

Attachment 17 – Connection policy

Attachment 18 – Tariff structure statement

Contents

Shortened forms

Shortened form	Extended form
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
augex	augmentation expenditure
capex	capital expenditure
CAM	Cost Allocation Methodology
CCP10	Consumer Challenge Panel
CESS	capital expenditure sharing scheme
CPI	consumer price index
DMIA	demand management innovation allowance
DMIS	demand management incentive scheme
distributor	distribution network service provider
EBSS	efficiency benefit sharing scheme
ECA	Energy Consumers Australia
EMCa	Energy Market Consulting associates
Expenditure Assessment Guideline	Expenditure Forecast Assessment Guideline for Electricity Distribution
EUAA	Energy Users Association of Australia
F&A	framework and approach
NEL	national electricity law
NIEIR	National Institute of Economic and Industry Research
NEM	national electricity market
NEO	national electricity objective
NER	national electricity rules
NSP	network service provider
opex	operating expenditure

Shortened form	Extended form
PIAC	Public Interest Advocacy Centre
PTRM	post-tax revenue model
RAB	regulatory asset base
repex	replacement expenditure
RFM	roll forward model
RIN	regulatory information notice
RPP	revenue and pricing principles
SAIDI	system average interruption duration index
SAIFI	system average interruption frequency index
STPIS	service target performance incentive scheme
WACC	weighted average cost of capital

5 Capital expenditure

Capital expenditure (capex) refers to the investment made in the network to provide standard control services. This investment mostly relates to assets with long lives (30–50 years is typical) and these costs are recovered over several regulatory control periods.

On an annual basis, the financing cost and depreciation associated with these assets are recovered (return of and on capital) as part of the building blocks that form Endeavour Energy's (Endeavour) total revenue requirement.[1]

This attachment sets out our draft decision on Endeavour's total capex forecast. Further detailed analysis is provided in the following appendices:

- Appendix A - Assessment techniques
- Appendix B - Assessment of capex drivers
- Appendix C - Engagement and information gathering process
- Appendix D - Repex Modelling Approach
- Appendix E - Demand
- Appendix F - Ex post statement of efficiency and prudency
- Appendix G - Contingent Project

We have based our draft decision on our analysis of the information we have to date. We will be informed by Endeavour's revised proposal, submissions and further analysis in arriving at our final decision in April 2019.

5.1 Draft decision

Our draft decision substitutes a capex forecast of $1.7 billion for the 2019–24 regulatory control period. This is 20 per cent lower than the $2.13 billion in Endeavour's April 2018 proposal.

In assessing forecast capital expenditure, we are guided by the National Electricity Objective (NEO) and underpinning capex criteria and objectives set out in the National Electricity Rules (NER). We must accept a distributor's capex forecast if we are satisfied that the total forecast capital expenditure for the regulatory control period reasonably reflects the capex criteria.[2]

These criteria outline that a distributor's capex forecast must reasonably reflect the efficient costs of achieving the capex objectives, the costs that a prudent operator

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1 NER, cl. 6.5.2 and NER, cl.6.5.5.

2 NER cl. 6.5.7(c).

would require to achieve the capex objectives, and a realistic expectation of the demand forecast and cost inputs required to achieve the capex objectives.

The capex objectives relate to a distributor's ability to comply with regulatory obligations and maintain the quality, reliability and security of supply of standard control services.

Where a distributor is unable to demonstrate that its proposal complies with the capex criteria and objectives, the NER requires us to set out a substitute estimate of total capex that we are satisfied reasonably reflects the capex criteria, taking into account the capex factors.

Our review identified a number of concerns with Endeavour's proposal, many of which were shared by stakeholders. In light of these concerns, we formed an initial estimate of capex of $1.674 billion. Our initial estimate was the result of our standard assessment approach, which includes, but is not limited to, trend analysis, bottom-up review of Endeavour's cost benefit analysis, EMCa's independent advice and results from our repex modelling.

However, since submitting its proposal, Endeavour genuinely committed to engage constructively with us on these concerns, as reflected in its open dialogue throughout the review process and willingness to better understand our assessment. As part of its engagement, Endeavour provided further information—including an updated capex forecast of $1.7 billion—in response to our issues paper on 30 August 2018.[3] These efforts were commended in subsequent submissions from each of the Consumer Challenge Panel (CCP10),[4] Public Interest Advocacy Centre (PIAC)[5] and Energy Consumers Australia (ECA).[6]

We welcome Endeavour's response to the AER issues paper, and view it as a positive outcome from meaningful and genuine engagement. Having regard to all the information before us and weighing up a number of factors, we consider that the updated forecast in Endeavour's response to the AER's issues paper of $1.7 billion is consistent with a capex allowance that would be incurred by a prudent and efficient operator and reasonably reflects the capex criteria. For the purpose of this draft decision, we do not accept Endeavour's total forecast of $2.13 billion. We have adopted Endeavour's updated capex forecast, namely $1.7 billion, as our substitute forecast. We are satisfied that this total substitute forecast reasonably reflects the capex criteria.

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3 Endeavour Energy, *Response to AER issues paper – NSW electricity distribution determinations 2019-24*, public, p.1.

4 CCP10*, Endeavour Energy 19–24 draft revenue proposal - letter to the AER*, Public, 21 September 2018.

5 Public Interest Advocacy Centre, *Endeavour Energy - Revised 2019-24 Capital Forecast*, Public, 19 September 2018.

6 Energy Consumers Australia, *Endeavour Energy's response to the AER Issues paper: NSW Electricity Distribution Determinations 2019-24*, Public, 30 August 2018.

Below, we have set out our assessment of capex forecast of $2.13 billion ($2018–19), particularly noting our concerns with the capex forecast that Endeavour first proposed in its proposal. This will help inform the revised proposal and future resets. This attachment sets out the analysis we undertook in reviewing Endeavour's initial capex forecast of $2.13 billion ($2018–19).

Table 5.1 outlines our draft decision, including the difference between Endeavour's proposal and updated forecast.

Table 5.1 Our draft decision on Endeavour's total forecast capex ($m 2018–19)

	2019-20	2020-21	2021-22	2022-23	2023-24	Total
Proposal	449.5	430.8	423.9	411.8	417.6	2133.5
Endeavour's updated proposal and our draft decision	354.7	336.3	332.3	342.6	334.3	1,700.3
Difference	(94.7)	(94.5)	(91.6)	(69.1)	(83.3)	(433.2)
Percentage difference (%)	-21%	-22%	-21.6%	-16.7%	-20%	-20%

Source: AER Analysis

Note: Numbers may not add up due to rounding.

Note: The figures above do not include equity raising costs, asset disposals and capital contributions. For our assessment of equity raising costs, see attachment 3.

The substitute estimate that we have adopted for our draft decision includes Endeavour's initial forecasts of non-network, other system and reliability compliance capex, and its proposed allowance for capitalised overheads. However, consistent with the updated capex forecast provided by Endeavour in its 30 August submission, the following factors have contributed to our draft decision to include Endeavour's lower forecast of $1.7 billion ($2018–19) in its forecast revenue for 2019–24:

- The lower forecast of augmentation capex (augex) in this draft decision reflects a more realistic expectation of demand management and deferral opportunities, and recognises that Endeavour has accommodated significant growth in the current period with less investment than its proposal suggested it would need for 2019–24.
- Our draft decision recognises that connections volumes, particularly in Sydney's west, are expected to increase in 2019–24. The effect of the higher volumes will be largely offset by lower forecast unit rates for connections works compared with the current period. The key difference between Endeavour's proposal and this draft decision (and Endeavour's updated capex forecast) is the way it recovers the costs of new connections.

In July 2017, Endeavour changed its reimbursement policy so that certain classes of shared assets,[7] which until then had been funded by the connecting customer, would instead be added to the RAB so that all network customers would fund these costs through Endeavour's distribution tariffs. As a result, the net connections capex that would be rolled into the RAB would increase by approximately four times, when compared to immediately prior to the change in policy. We do not consider that the proposed reimbursements to developers and other connecting customers that result from this change are prudent and efficient.

We engaged extensively with Endeavour, flagging our concerns, including stakeholder feedback. Endeavour responded through its updated capex forecast, and decided to reverse this change, which has reduced its net connections capex by 62 per cent, and increased the share of connections funded by capital contributions by 33 per cent.

- Endeavour has proposed an increase to its replacement capex (repex) relative to the current period. Our modelling identified that Endeavour's initial repex had assumed higher unit rates and an earlier replacement of assets than compared to its peers. We have adopted Endeavour's updated repex forecast for this draft decision, which is broadly in line with Endeavour's actual repex in the current period.

Appendix B sets out in detail our assessment of Endeavour's initial capex forecast of $2.13 billion.

In addition, Appendix G sets out our assessment of Endeavour's proposed contingent project, which relates to the Western Sydney Airport growth area. We have not included Endeavour's project contingent project in our draft decision. We consider that Endeavour can meet the connection requirement with a less capital-intensive solution and further augmentation in future, if demand forecasts materialise. We will continue to engage with Endeavour and other stakeholders on this issue as it prepares its revised proposal.

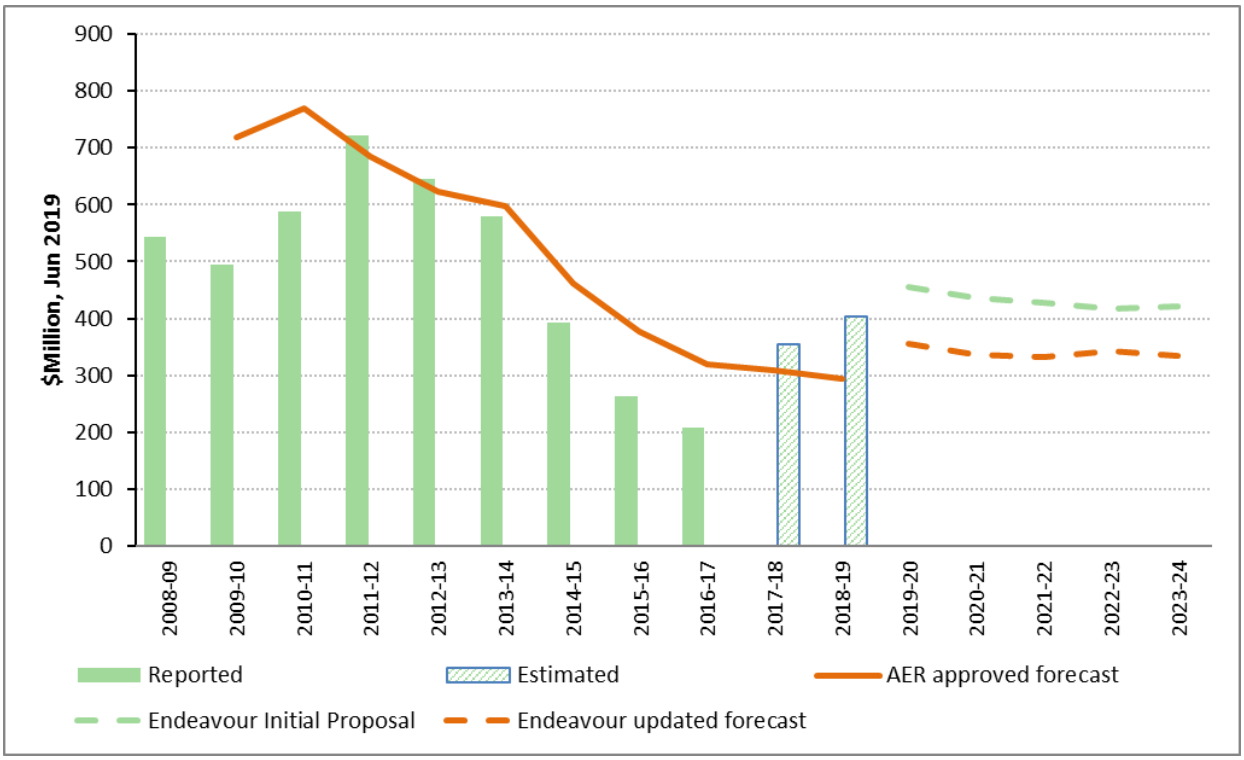
5.2 Endeavour's proposal

In its proposal, Endeavour proposed total net capex is $2.13 billion ($2018–19) for the 2019–24 regulatory control period.[8] This forecast is 33 per cent higher than its actual/expected capex over the 2014–19 period. Subsequently, Endeavour provided a response to our issues paper, which updated its capex forecast to $1.7 billion, a reduction of 20 per cent from its initial total forecast (the updated capex forecast).

[7] The reimbursement policy refers to the changes that Endeavour has made to the application of its connection policy.

[8] This amount does not include capital contributions and asset disposals.

Figure 5.1 Endeavour's historical vs forecast capex, including 2014–19 allowance ($m 2018–19)



The key drivers of Endeavour's initial forecast capex proposal are:

- About 36 per cent of total forecast capex is for asset replacement where Endeavour forecast $800 million for repex; this compares to its actual expenditure over the current period of $619 million, which is 22.6 per cent below its forecast.
- Forecast augex of $416.8 million, including targeted augex projects to meet expected demand; this compares to its actual/estimated augex in the current regulatory control period of $255.8 million. Endeavour submits that its forecast augex is heavily driven by its greenfield developments, which make up 72 per cent of its augex forecast.
- Forecast connections capex of $309 million for connection works for new and existing customers. This is a significant step up from the current regulatory control period and the step up is due to a change to the application of the capital contribution policy.
- Non-network capex of $170 million relating to Information, Communication and Technology (ICT); fleet and plant; buildings and property; and, tools and equipment assets. Forecast capex in this category is below the estimated current period expenditure of $187 million.
- Capitalised overheads of $400 million, including $323 million of total business overheads that are allocated to capex in accordance with Endeavour's cost allocation method, and $77 million of direct capex overheads, which relate only to the capex program.

- Endeavour proposed a $61.2 million ($2018-19) contingent project, which relates to the Western Sydney Airport growth area. Endeavour considered the timing of the investment to be uncertain and proposed a trigger requiring a written request from the Western Sydney Airport Corporation to provide a connection to the airport.

5.3 Our assessment approach

We must determine whether Endeavour's proposal reasonably reflects the capex criteria as set out in the NER.[9] We use various qualitative and quantitative assessment techniques to assess the different elements of Endeavour's proposal.

We will accept a distributor's proposal if we are satisfied that it reasonably reflects the capex criteria.[10] If we are not satisfied, the NER require us to set out an estimate that we are satisfied reasonably reflects the capex criteria.[11]

In deciding whether we are satisfied that Endeavour's proposed total capex forecast reasonably reflects the capex criteria, we have regard to the capex factors.[12] The weight we placed on some capex factors relative to others is discussed in Appendix B, where we discuss how we came to our position.

More broadly, we also take into account the revenue and pricing principles set out in the NEL.[13] In particular, we take into account whether our overall capex forecast provides Endeavour with a reasonable opportunity to recover at least the efficient costs it incurs in:[14]

- providing direct control network services; and
- complying with its regulatory obligations and requirements.

When assessing capex forecasts, we also consider that:

- the capex criteria relating to a prudent operator and efficient costs are complementary. Prudent and efficient expenditure reflects the lowest long-term cost to consumers for the most appropriate investment or activity required to achieve the expenditure objectives.
- past expenditure was sufficient for the distributor to manage and operate its network in previous periods, in a manner that achieved the capex objectives.[15]

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9 NER, cl. 6.5.7(c).
10 NER, cl. 6.5.7(a).
11 NER, cl. 6.12.1(3)(ii).
12 NER, cl. 6.5.7(e).
13 NEL, ss. 7A and 16(2).
14 NEL, s. 7A.
15 AER, *Better regulation: Expenditure forecast assessment guideline for electricity distribution*, November 2013, p. 9.

5.3.1 Considerations in applying our assessment techniques

Appendix A outlines our assessment approach and appendix B details how we came to our position on Endeavour's capex forecast. In summary, some of these assessment techniques focus on total capex, while others focus on high-level, standardised sub-categories of capex. Importantly, while we may consider certain programs and projects in forming a view on the total capex forecast, we do not determine which programs or projects a distributor should or should not undertake.

This is consistent with our ex-ante incentive based regulatory framework. Our approach is based on approving an overall ex-ante revenue requirement that includes an assessment of what we find to be a prudent and efficient total capex forecast.[16] Once the ex-ante allowance is established, distributors are incentivised to provide services at the lowest possible cost because their returns are determined by the actual costs of providing services. If distributors reduce their costs to below the estimate of efficient costs, the savings are shared with consumers in future regulatory control periods.

This ex-ante incentive-based regulatory framework recognises that the distributor should have the flexibility to prioritise its capex program given its circumstances over the course of the regulatory control period. The distributor may need to undertake programs or projects that it did not anticipate during the distribution determination process. The distributor may also not need to complete some of the programs or projects it proposed during the forecast regulatory control period if circumstances change. We consider a prudent and efficient distributor would consider the changing environment throughout the regulatory control period and make decisions accordingly.

Therefore, recognising the interplay between the broader incentive framework and program and project investment considerations, when reviewing a capex forecast we use a combination of bottom-up and top-down assessment techniques. Assessment of the bottom-up build of forecasts including underlying assumptions is an informative way to establish whether the forecast capex at the program or project level is prudent and efficient. Many of the techniques we apply at this level encompass the capex factors that we are required to consider. However, we are also mindful that a narrow focus on only a bottom-up assessment may not itself provide sufficient evidence that the forecast is prudent and efficient. Bottom-up approaches tend to overstate required allowances, as they do not adequately account for interrelationships and synergies between programs, projects or areas of work.

Thus, we also review the prudency and efficiency of aggregate expenditure areas or the total capex forecast.[17] Top-down analysis provides us with assurance that the

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16 AEMC, *Final rule determination: National electricity amendment (Economic regulation of network service providers) Rule 2012*, 29 November 2012, p. vii.

17 For example, see AER, *Draft decision: Ergon Energy determination 2015−16 to 2019−20: Attachment 6 − Capital expenditure*, October 2015, p. 21; AER, *Draft decision: SA Power Networks determination 2015−16 to 2019−20: Attachment 6 − Capital expenditure*, October 2015, pp. 20–21.

entire expenditure program is prudent and efficient, and allows us to consider a distributor's total capex forecast. We use holistic assessment approaches that include a suite of techniques such as trend analysis, predictive modelling and detailed technical reviews. Consistent with our holistic approach, we take into account the various interrelationships between the total capex forecast and other components of a distributor's distribution determination, such as forecast operating expenditure (opex) and Service Target Performance Incentive Scheme (STPIS) interactions.[18]

In the event that that we are not satisfied that the proposed capex forecast reasonably reflects the capex criteria, we are required to determine a substitute estimate. We do so by applying our various assessment techniques. We then use our judgement to weigh the results of these techniques case-by-case, in light of all the relevant information available to us.

Broadly, we give greater weight to techniques that we consider are more robust in the particular circumstances of the assessment. By relying on several techniques, we ensure we consider a wide variety of information and take a holistic approach to assessing the distributor's capex forecast. Where our techniques involve the use of a consultant, their reports are considered when we form our draft decision position on total forecast capex.

Importantly, our decision on the total capex forecast does not limit a distributor's actual spending. We set the forecast at the level where the distributor has a reasonable opportunity to recover its efficient costs. As noted previously, a distributor may spend more or less on capex than the total forecast amount specified in our decision in response to unanticipated expenditure needs or changes.

The regulatory framework has a number of mechanisms to deal with these circumstances. Importantly, a distributor does not bear the full cost where unexpected events lead to an overspend of the approved capex forecast. Rather, the distributor bears 30 per cent of this cost if the expenditure is subsequently found to be prudent and efficient. Further, the pass through provisions provide a means for a distributor to pass on significant, unexpected capex to customers, where appropriate.[19]

Similarly, a distributor may spend less than the capex forecast because it has operated at a more efficient level than expected. In this case, the distributor will keep on average 30 per cent of this reduction over time, with the remaining benefits shared with its customers.

5.3.2 Safety and reliability considerations

Our position in this draft decision is that our approved capex forecast will provide for a prudent and efficient service provider in Endeavour's circumstances to maintain

[18] NEL, s. 16(1)(c).

[19] NER, r. 6.6.1.

performance at the targets set out in the STPIS. Therefore, it is appropriate to apply the STPIS, as set out in attachment 10.

In particular, a capex allowance should not be set at a level such that Endeavour systematically under or over performs against its STPIS targets. More broadly, our analysis in appendix B outlines how our assessment techniques factor in network safety and reliability. We consider our substitute estimate will allow Endeavour to maintain the safety, service quality and reliability of its network, consistent with its legislative obligations.

5.3.3 Interrelationships

Consistent with our holistic approach, we take into account the various interrelationships between the total capex forecast and other components of a distributor's distribution determination, such as forecast opex, forecast demand, Capital Expenditure Sharing Scheme (CESS) and STPIS interactions.

5.4 Reasons for draft decision

In this draft decision, we have substituted a capex forecast that is 20 per cent lower than the $2.13 billion in Endeavour's April 2018 proposal. Our substitute forecast is consistent with Endeavour's updated capex forecast of $1.7 billion over the 2019–24 regulatory control period.

Firstly, in coming to this position, we assessed the proposal as submitted, which had all the accompanying supporting documentation, regulatory information notices, strategic asset management plans and expenditure modelling. From this assessment, we concluded that Endeavour did not demonstrate that its proposed total forecast capex reasonably reflects the capex criteria. On this basis, we determined an initial estimate of $1.674 billion.

Secondly, as noted above, Endeavour then submitted an updated capex forecast of $1.7 billion in response to our issues paper. Having regard to all the information before us and weighing up a number of factors, we consider that the updated forecast in Endeavour's response to our issues paper, of $1.7 billion is consistent with a capex allowance that would be incurred by a prudent and efficient operator and reasonably reflects the capex criteria. For the purposes of this draft decision, we have adopted Endeavour's updated capex forecast of $1.7 billion as our substitute forecast.

It is important to note that the updated capex forecast, which Endeavour provided as a letter, did not have any accompanying supporting documentation or detailed cost-benefit analysis that usually accompanies a capex forecast. Therefore, our conclusion regarding the prudency and efficiency of the updated overall capex forecast, particularly for repex and augex, is not made in its own right, rather, it is made in reference to our initial assessment of Endeavour's forecast capex proposed in its proposal.

Below we have set out our assessment of capex forecast of $2.13 billion ($2018–19), particularly noting our concerns with the capex forecast Endeavour proposed in its

proposal. This will help guide future reviews. We also took into account EMCa's independent advice, in its review of Endeavour's repex and augex for the 2019–24 regulatory control period.

We appreciate the effort Endeavour has taken to work through some of the issues raised by us and stakeholders. Endeavour has made a genuine commitment to engage constructively with us, as reflected in its open dialogue throughout the review process and willingness to better understand our assessment. This is particularly evident for its connections capex and the reversal of the reimbursement policy.[20] We extensively engaged with Endeavour on this issue and Endeavour's updated connections capex forecast reflected that engagement. Appendix C sets out further details on our engagement with Endeavour.

Table 5.2 sets out the capex amounts by driver that we included in our eventual substitute estimate of Endeavour's total capex forecast for the 2019–24 regulatory control period. These substitute capex forecasts has been constructed using the approach and techniques outlined in appendices A and B.

Table 5.2 Our draft decision by capex driver 2019–24 ($m 2018–19)

Category	2019-20	2020-21	2021-22	2022-23	2023-24	Total
Augmentation	64.8	64.5	70.13	78.3	72.1	349.8
Connections	34.0	24.4	20.8	19.9	19.6	118.7
Replacement	109.2	120.2	118.7	124.1	127.8	600.3
Non-Network	49.7	35.1	31.7	30.0	23.6	170.0
Capitalised overheads	79.4	79.7	80.5	80.0	80.5	400.0
Other System	13.6	8.2	6.4	6.3	6.7	41.4
Reliability Compliance	4.0	4.0	4.0	4.0	4.0	20.0
Net Capex	**354.7**	**336.3**	**332.3**	**342.6**	**334.3**	**1,700.3**
Capital Contributions	148.4	139.8	139.1	139.5	142.8	709.8
Asset Disposals	5.3	5.02	4.85	4.73	4.62	24.5
Gross Capex (includes capital contributions and asset disposals)	**508.5**	**481.1**	**476.3**	**486.9**	**481.7**	**2,434.6**

Source: AER analysis. Numbers may not add up due to rounding.

Notes: The figures above do not include equity raising costs. For our assessment of equity raising costs, see attachment 3.

[20] The reimbursement policy refers to the changes that Endeavour has made changes to the application of its connection policy.

Below is a summary of the main reasons for the substitute net capex forecast of $1.7 billion ($2018–19).

- Endeavour has not demonstrated that the proposed augex of $416.8 million ($2018–19) in its proposal would form part of a total capex forecast that reasonably reflects the capex criteria. The augex forecast does not appear to be a reasonable estimate of the prudent efficient costs. Using our standard assessment techniques, we have estimated an initial augex estimate of $333.7 million ($2018–19).
- Endeavour has updated its augex forecast and we consider the difference between our initial augex estimate and Endeavour's updated capex forecast to be relatively immaterial in the context of the overall capex forecast. Therefore, we have included $349.8 million ($2018–19) in our substitute forecast of total capex. The update augex forecast reflects our conclusion that Endeavour will be able to prudently defer some of the augex into later regulatory control periods, thereby reducing augex in the next control period.

Connections and customer contributions

- Endeavour has not demonstrated that its forecast net connections capex of $309.4 million is prudent and efficient. The forecast for net connections capex includes around $200 million for reimbursements to developers and other connecting customers for certain classes of assets. This is the result of changes that Endeavour made to the application of its connection policy (the reimbursement policy) in August 2017.
- After engagement with us and other stakeholders, Endeavour has committed to reversing its reimbursement policy. We have worked closely with Endeavour to quantify the effect that the current reimbursement policy will have on forecast net connections capex. In response to our feedback, Endeavour updated its net connections capex forecast, and we have adopted the updated capex amount of $118.7 million as our substitute forecast.
- We have included $709.8 million for capital contributions in our substitute forecast, which is 33 per cent higher than Endeavour's initial forecast. This reflects that the value of the reimbursements will be transferred from net connections capex—and therefore all customers—to developers and other connecting customers.

Replacement

- Based on all the information before us, we do not consider that Endeavour has justified that its proposed initial repex forecast of $800.5 million would form part of a total capex forecast that reasonably reflects the capex criteria. We, along with our consultant EMCa, have identified a systemic lack of cost-benefit analysis or justification that supports Endeavour's repex portfolio.
- In addition, our repex modelling indicated that Endeavour's modelled repex is above our predictive modelling threshold. We have identified that Endeavour's replacement practices appear to exhibit a bias towards early replacement of assets, when compared to other distributors on expected replacement lives. This has likely resulted in a systemic overestimate of repex. We have estimated an initial repex estimate of $590 million ($2018–19).

- Endeavour has updated its repex forecast and we consider the difference between our initial repex estimate and Endeavour's updated capex forecast to be relatively immaterial. Therefore, we have included $600 million ($2018–19) in our substitute forecast of total capex. This amount is below Endeavour's estimated expenditure of $619 million ($2018–2019) in the current period.

Non-network

- We consider that Endeavour's proposed non-network capex forecast of $170.1 million ($2018–19) is justified and would form part of a total capex forecast that reasonably reflects the capex criteria. Endeavour's non-network capex forecast at a category level is broadly in line with historical levels of expenditure for each category. We have included $170.1 million ($2018–19) in our substitute forecast of total capex.
- The largest component of Endeavour's forecast relates to ICT capex ($91 million, or 53 per cent). While we have identified specific concerns with Endeavour's forecasting methodology, including its cost-benefit analysis, Endeavour submitted that its updated lower capex forecast takes into account the expected efficiencies of its transformation of its ICT systems and capabilities.[21]
- Our review of the information provided in support of the proposed $79 million for remaining categories (fleet and plant; buildings and property; and 'other') has found no specific concerns with Endeavour's forecast.

Capitalised overheads

- We consider that Endeavour's proposed capitalised overheads forecast of $400.0 million ($2018–19) is justified and would form part of a total capex forecast that reasonably reflects the capex criteria. While we have some concerns with Endeavour's forecast we consider that these are not material in the context of Endeavour's overall updated capex forecast. We have included $400.0 million ($2018–19) in our substitute forecast of total capex.

Other System

- Endeavour has established that its proposed other system capex forecast of $41.3 million ($2018–19) reasonably reflects the capex criteria and is consistent with an expenditure that would be incurred by an efficient of prudent operator. While we have some concerns with its technology capex, particularly with its underlying cost-benefit analysis, this has not changed our position on Endeavour's overall forecast capex. We have included $41.3 million ($2018–19) in our substitute forecast of total capex.

[21] Endeavour Energy, *Response to AER Issues Paper - NSW Electricity Distribution Determinations 2019-24*, Public, 30 August 2018, p.1.

Reliability compliance

- Endeavour has demonstrated through compliance obligations that its forecast of reliability compliance capex would form part of a total capex forecast that reasonably reflects the capex criteria. We have included $20 million ($2018–19) for reliability compliance capex in our substitute forecast of total forecast capex.

Real cost escalators

- Consistent with our opex decision in Attachment 6, we have revised Endeavour's real cost escalator estimates. Our estimate is based on the average of the forecasts of growth in the wage price index (WPI) for the New South Wales utilities industry by our consultant Deloitte Access Economics and Endeavour's consultant BIS Oxford Economics. BIS Oxford's nominal WPI forecast was converted to real WPI using our inflation forecast. This has a consequential effect on all categories of forecast capex.

Contingent Project

- Based on all the information before us, Endeavour has not demonstrated that its proposed contingent project, for the Western Sydney Airport growth area, is reasonably required to achieve the capex objectives. Although the timing of the request is uncertain, we consider Endeavour will be required to undertake augmentation in the 2019–24 regulatory control period to provide a timely connection to the airport. However, we consider Endeavour can meet the connection requirement with a less capital-intensive solution and further augmentation in future, if demand forecasts materialise. We will continue to engage with Endeavour and other stakeholders on this issue as it prepares for its revised proposal.

A Assessment techniques

This appendix describes the approaches we applied in assessing whether Endeavour's total capex forecast reasonably reflects the capex criteria. Appendix B sets out in greater detail the extent to which we relied on each of these techniques.

The techniques that we apply in capex are necessarily different from those we apply when assessing opex. This is reflective of differences in the nature of the expenditures that distributors propose. We outline this in the Expenditure Assessment Guideline.[22]

A.1 Trend analysis

We consider past trends in actual and forecast capex as this is one of the capex factors.[23] We also consider trends at the asset category level to inform our view on the prudency and efficiency of a distributor's capex forecast.

Trend analysis involves comparing a distributor's forecast capex and volumes against historical levels. Where forecast capex and volumes are materially different to historical levels, whether below or above, we seek to understand the reasons. In doing so, we consider the reasons the distributor provides in its initial proposal, as well as any potential changing circumstances.

In considering whether the total capex forecast reasonably reflects the capex criteria, we need to consider whether the forecast will allow the distributor to meet expected demand and comply with relevant regulatory obligations.[24] Demand and regulatory obligations (specifically service standards) are key capex drivers. More onerous standards or growth in maximum demand will increase capex. Conversely, reduced service obligations or a decline in demand will likely cause a reduction in the capex the distributor requires.

Maximum demand is a key driver of augmentation or demand-driven expenditure. Augex often needs to occur prior to demand growth being realised. Forecast demand, rather than actual demand, is therefore most relevant when a distributor is deciding the augmentation projects it will require in the forecast regulatory control period. However, a distributor should continually reassess project needs over time as new information about population growth and energy usage becomes available. Growth in a distributor's network will also drive connections-related capex. For these reasons, it is important to consider how capex trends, particularly for augex and connections, compare with demand and customer number trends.

There is generally a lag between when capex is undertaken or not and when a distributor's service improves or declines. This is important when considering the

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22 AER, *Better regulation: Expenditure forecasting assessment guideline*, November 2013, p. 8.

23 NER, cl. 6.5.7(e)(5).

24 NER, cl. 6.5.7(a)(3).

expected change in service levels following an increase or decrease in capex. It is also relevant to consider when service standards have changed and how this has affected the distributor's capex requirements.

For the three distributors in NSW, an amendment to their licence conditions came into effect on 1 July 2014.[25] This amendment removed the design planning requirements that imposed a particular standard on the design and planning of the network. Without these requirements, distributors should only undertake capex where the benefits outweigh the costs. We have had regard to this change when undertaking our trend analysis.

We analysed capex trends across a range of levels including at the total capex level and the category level (e.g. augex, connections and repex). We also compared these with demand trends and any relevant changes in service standards.

A.2 Category analysis

Expenditure category analysis allows us to compare expenditure across distributors, and over time, for various levels of capex. The comparisons we analyse include:

- overall costs within each category of capex;
- unit costs across a range of activities;
- volumes across a range of activities; and
- expected asset lives across a range of repex asset categories.

Using standardised reporting templates, we collect data on augex, repex, connections, non-network capex, overheads and demand for all distributors in the NEM. Using standardised category data allows us to make direct comparisons across distributors. Standardised category data also allows us to identify and scrutinise different operating and environmental factors that affect the amount and cost of works that distributors incur and how these factors may change over time.

A.3 Predictive modelling

Background

Our repex model is a statistical based model that forecasts asset replacement capex for various asset categories based on their condition (using age as a proxy), unit costs and expected asset replacement lives. We only use the repex model to assess forecast repex that can be modelled. This typically includes high-volume, low-value asset categories and generally represents a significant component of total forecast repex.

[25] For more information, refer to https://www.ipart.nsw.gov.au/files/sharedassets/website/trimholdingbay/electricity_-_regulatory_instruments_-_dnsp_conditions_14_-_19_-_july_2014.pdf.

The repex model forecasts the volume of assets in each category that a distributor would expect to replace over a 20-year period. The model analyses the age of assets already in commission and the time at which, on average, these assets would be expected to be replaced, based on historical replacement practices. We refer to this as the calibrated expected asset replacement life. We derive a total replacement expenditure forecast by multiplying the forecast replacement volumes for each asset category by an indicative unit cost.

We can use the repex model to advise and inform us where to target a more detailed bottom-up review and assist us to define a substitute estimate if necessary. We can also use the model to compare a distributor against other distributors in the National Electricity Market (NEM)[26]. We have also had regard to feedback from distributors on some of the underlying assumptions and modelling techniques throughout our ongoing engagement during both the pre-proposal and proposal stages.

Scenario analysis

Our repex modelling approach analyses four scenarios that consider both a distributor's historical replacement practices and the replacement practices of other distributors in the NEM. The current approach builds on our assessment in previous determinations by considering intra-industry comparative analysis for unit costs and expected asset replacement lives. The four scenarios analysed are:

1. historical unit costs and calibrated expected replacement lives (***Historical Performance Scenario***)
2. comparative unit costs and calibrated expected replacement lives (**Cost Scenario**)
3. historical unit costs and comparative expected replacement lives (**Expected Lives Scenario**)
4. comparative unit costs and comparative expected replacement lives. (**Combined Scenario)**

Comparative unit costs are the minimum of a distributor's historical unit costs, its forecast unit costs and the median unit costs across the NEM. Comparative replacement lives are the maximum of a distributor's calibrated expected replacement life and the median expected replacement life across the NEM.

The 'cost, lives and combined' scenarios rely on a comparative analysis technique that compares the performance of all distributors in the NEM. The technique analyses the two variable repex model inputs – unit costs and expected replacement lives.

The 'cost scenario' analyses the level of repex a distributor could achieve if its historical unit costs were improved to comparative unit costs. The 'lives scenario' analyses the level of repex a distributor could achieve if its calibrated expected replacement lives were improved to comparative expected replacement lives.

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[26] This includes Power and Water Corporation.

Previous distribution determinations where we have used the repex model have primarily focused on the 'historical scenario'. This scenario forecasts a distributor's expected repex and replacement volumes based on its historical unit costs and asset replacement practices (which are used to derive expected replacement lives).

Repex model threshold

Our 'repex model threshold' is defined taking these results and other relevant factors into consideration. For the 2019–24 determinations, our approach is to set the repex model threshold equal to the highest result out of the 'cost scenario' and the 'lives scenario'.[27]

This approach considers the inherent interrelationship between the unit cost and expected replacement life of network assets. For example, a distributor may have higher unit costs than other distributors for particular assets, but these assets may in turn have longer expected replacement lives. In contrast, a distributor may have lower unit costs than other distributors for particular assets, but these assets may have shorter expected replacement lives. Further details about our repex model are outlined in appendix D.

A.4 Assessment of bottom-up and top-down methodologies

In assessing whether Endeavour's capex forecast is prudent and efficient, we examined the forecasting methodology and underlying assumptions used to derive its forecast. In particular, some of the evidence that we can use to evaluate the prudency and efficiency of a bottom-up forecast at the program or project level is:

- identifying and quantifying all reasonable options in a cost-benefit analysis, including deferral or 'do-nothing' scenarios;
- cost-benefit analysis that incorporates a proper quantified risk assessment, where the most beneficial program or project is selected, or clear and justified reasoning as to why another option was chosen; and
- reasons to support the expenditure timing for the forecast regulatory control period, particularly if the expenditure may have been deferred in previous regulatory control periods.

Our industry practice application note[28], which relates to asset replacement planning, aims to assist network businesses with this bottom-up forecast. The final industry practice application note will be published in late November 2018. We therefore

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[27] Our modelling approach means the 'historical scenario' will always be higher than the 'cost scenario' and the 'lives scenario', and the 'combined scenario' will always be lower than the 'cost scenario' and the 'lives scenario'.

[28] For more information, refer to https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/industry-practice-application-note-for-asset-replacement-planning.

encourage Endeavour to have regard to the final application note and the consultation process in its revised proposal.

The industry practice application note does not replace published guidelines. Rather, it supplements the guidelines by outlining principles and approaches that accord with good industry practice, asset management strategies and risk management practices. Good asset management and risk management practices are often aligned with international standards of practice, such as ISO 55000 for asset management and ISO 31000 for risk management. These practices and approaches are consistent with what we have considered in previous decisions, and the industry practice application note helps to articulate these practices and approaches.

In addition to a bottom-up build, a holistic and strategic consideration or assessment of the entire forecast capex portfolio would be evidence that some discipline has been applied at the top-down level. In particular, a top-down assessment would give us confidence that:

- the bottom-up builds have been subject to overall checks against business governance and risk management arrangements;
- synergies between programs or projects have been identified, which may reduce the need for, scope or cost of some programs or projects over the forecast regulatory control period;
- subjectivity from the bottom-up forecasts has been addressed; and
- the timing and prioritisation of capital programs and projects have been determined over both the short and long term, such that delivery strategy has been considered.

A.5 Economic benchmarking

Economic benchmarking is one of the key outputs of our annual benchmarking report.[29] The NER require us to have regard to the annual benchmarking report, as it is one of the capex factors.[30] Economic benchmarking applies economic theory to measure the efficiency of a distributor's use of inputs to produce outputs, having regard to the operating environment and network characteristics.[31]

Economic benchmarking allows us to compare the performance of a distributor against its own past performance and the performance of other distributors. It also helps to assess whether a distributor's capex forecast represents efficient costs.[32] The AEMC stated:

[29] AER, *Annual benchmarking report: Electricity distribution network service providers*, December 2017.

[30] NER, cl. 6.5.7(e)(4).

[31] AER, *Better regulation: Expenditure forecasting assessment guideline*, November 2013, p. 78.

[32] NER, cl. 6.5.7(c).

> "Benchmarking is a critical exercise in assessing the efficiency of a distributor".[33]

Several economic benchmarks from the annual benchmarking report are relevant to our capex assessment. These include measures of total cost efficiency and overall capex efficiency. In general, these measures calculate a distributor's efficiency with consideration given to its inputs, outputs and its operating environment.

We consider each distributor's operating environment in so far as there are factors outside of a distributor's control that affect its ability to convert inputs into outputs.[34] Once we consider these exogenous factors, we expect distributors to operate at similar efficiency levels. One example of an exogenous factor we consider is customer density.

A.6 Other assessment factors

We considered several other factors when assessing Endeavour's total capex forecast. These factors included:

- safety and reliability statistics (SAIDI and SAIFI[35]);
- internal technical and engineering review;
- external consultant review;
- submissions made by various stakeholders; and
- other information provided by Endeavour.

[33] AEMC, *Final rule determination: National electricity amendment (Economic regulation of network service providers) Rule 2012*, November 2012, p. 25.

[34] AEMC, *Final rule determination: National electricity amendment (Economic regulation of network service providers) Rule 2012*, November 2012, p. 113. Exogenous factors could include geographic, customer, network and jurisdictional factors.

[35] System average interruption duration index and system average interruption frequency index.

B Assessment of capex drivers

This appendix outlines our detailed analysis of the categories of Endeavour's capex forecast for the 2019–24 regulatory control period. These categories are augex, customer connections capex, repex, reliability improvement capex, capitalised overheads and non-network capex.

As we discuss in the capex attachment, Endeavour has not established that its proposed total capex forecast reasonably reflects the capex criteria. In this appendix, we set out analysis in support of this view. We also explain the basis for our alternative estimate of Endeavour's total capex forecast, which we are satisfied reasonably reflects the capex criteria. In coming to our views and our alternative estimate, we applied the assessment techniques outlined in appendix A.

This appendix sets out our findings and views on capex category. The structure of this appendix is:

- Section B.1: Substitute estimate
- Section B.2: forecast augex
- Section B.3: forecast customer connections capex, including capital contributions
- Section B.4: forecast repex
- Section B.5: forecast other system capex
- Section B.6: forecast reliability compliance capex
- Section B.7: forecast capitalised overheads
- Section B.8: forecast non-network capex.

In each of these sections, we explain our assessment of the amount of capex that we have included in our total substitute estimate that reasonably reflects the capex criteria.

B.1 Substitute estimate

Our substitute estimate of Endeavour's total capex forecast for the 2019–24 regulatory control period is $1.7 billion ($2018–19). After reviewing Endeavour's proposal, we formed an estimate of capex, which was $1.674 billion ($2018–19). Having regard to all the information before us and weighing up a number of factors, we consider that the updated forecast in Endeavour's response to our issues paper, of $1.7 billion is consistent with a capex allowance that would be incurred by a prudent and efficient operator and reasonably reflects the capex criteria. In reaching this decision, we have considered stakeholders' views, including submissions received from PIAC,[36] ECA[37] and CCP10.[38]

[36] PIAC, *Endeavour Energy - Revised 2019-24 Capital Forecast*, Public, 19 September 2018.

While we have concluded that the updated overall capex forecast is consistent with a capex allowance that would be incurred by a prudent and efficient operator, we have set out our assessment of capex forecast of $2.16 billion ($2018–19), particularly our concerns with Endeavour's initial capex forecast. Our assessment relied on the various assessment techniques described in appendix A.

B.1.1 Review of Endeavour's governance

In coming to our position, we have had regard to Endeavour's investment governance framework, approach to risk management, the application of top-down checks. Origin, in its submission to our issues paper, noted our assessment of those areas in Endeavour's 2014–19 determination.[39] In our previous determination, we identified that Endeavour, through its governance and risk management, failed to justify the timing and priority of its proposed capex.[40]

EMCa, in its review of repex and augex, has also assessed Endeavour's governance and risk management framework.[41] EMCa's premise of review is that the application of a sound expenditure governance and management framework is necessary to support a reasonable forecast that is prudent and efficient. Upon review of Endeavour's proposal, along with all supporting documentation, we agree with EMCa's conclusion that there are systemic issues with Endeavour's processes, which detract from its capacity to forecast prudent and efficient expenditure. We encourage Endeavour to review its overall governance and risk management framework in light of some of the issues we have raised in this determination.

Endeavour's Risk Management Framework

Endeavour's risk management is described in its Board Policy.[42] The framework is structured around ten risk categories, with risk assessed using a risk matrix. Endeavour states that it uses the Capital Allocation Selection Hierarchy (CASH) tool to select the projects that are included in its capex plan. Endeavour produces a prioritised list of programs and projects that forms its Portfolio Investment Prioritisation (PIP), which is submitted to the Board for Gate 1 approval. It is a current version of this PIP that has been provided to support Endeavour's proposal for the 2019–24 regulatory control period. The CASH/PIP model was also used to prioritise and forecast capex in the previous determination. In our previous 2014–19 determination, we found that

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37 Energy Consumers Australia, *Endeavour Energy's response to the AER Issues paper: NSW Electricity Distribution Determinations 2019-24*, Public, 30 August 2018.

38 CCP10, *Endeavour Energy 19–24 draft revenue proposal - letter to the AER*, Public, 21 September 2018.

39 Origin, *Submission to the AER issues paper - Regulatory Proposals for NSW Electricity Distributors 2019-24*, public, 8 August 2018.

40 AER, *Final Decision – Endeavour distribution determination – attachment 6 – capital expenditure*, Public, April 2015, p.23.

41 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, Public, August 2018, pp.10-41.

42 The Board Policy which is renewed on yearly basis. See Endeavour, *Response to AER Information Request 005 – Board Policy 2.0.5 Risk Management, Public,* August 2017 - Public.

Endeavour's approach to risk was overly conservative.[43] We noted that Endeavour's forecasting process had a bias towards early replacement of assets, which likely results in a systemic overestimation of repex. EMCa also identified concerns then with the CASH/PIP model.[44] We, along with our consultant EMCa, have sought to understand whether Endeavour's approach to risk has changed since our last review.

We have identified that Endeavour continues to rely on the CASH/PIP model and limited quantification of a risk based cost benefit analysis when forecasting its capital expenditure. We acknowledge that Endeavour has made some progress in its adoption of quantitative cost-risk benefit assessment in the area of its personnel and the public's health and safety[45]. However, on requesting evidence that those principles have been adopted across their capex portfolio, Endeavour stated that the only documentation, which demonstrates the application of those principles, relates to the probabilistic planning of network augmentation.[46] Network augmentation reflects 19 per cent of the total capex forecast. We discuss our assessment of Endeavour's augex in section B.2 below.

We have reviewed EMCa's advice and agree that Endeavour's risk management processes in its current form puts into question the prudency and efficiency of Endeavour's initial capex forecast.[47] We make the following observations about Endeavour's risk management framework:

- EMCa considered there was a lack of clarity as to whether the CASH/PIP model was actually used as a risk prioritisation tool for the purposes of forecasting capex over the 2019–24 RCP;
- Further, even if Endeavour did use the CASH/PIP model, EMCa consider that it is a poorly conceived tool for risk-based prioritisation. The model uses a subjective risk assessment process to produce weighted scores and rankings for capital projects. It provides a decision support tool for portfolio management within Endeavour's portfolio. The risk score is based on a subjective input for the overall project/program, which does not account for the likelihood of a risk occurring and the cost of consequence (Value of Customer reliability or Value of Statistical life).
- The 'topics' and 'scores' considered in the CASH model do not align with the risk categories listed in Endeavour's risk framework. This lack of alignment and also concerns with how risk is measured within the CASH/PIP model and lack of clarity

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43 AER, *Final Decision – Endeavour distribution determination – attachment 6 – capital expenditure*, Public, April 2015, p.23.

44 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, public, August 2018, pp.27-28.

45 Endeavour Energy, *Response to AER Information Request 005 Division Procedure GNV1119 Quantitative Risk Measures*, Public, May 2016.

46 Endeavour Energy, *Response to AER Information Request 005 Information Request Response*, Public, June 2018. p.6.

47 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, Public, August 2018, p.19.

around a defined risk appetite severely reduces the confidence we have that Endeavour's forecast capex is prudent and efficient.

Investment governance and top-down Challenge

Endeavour's investments are governed by its Investment Governance Framework (IGF), which provides guidance and accountability with respect to its investment decisions. The IGF consists of a three-gated process with defined milestones.

At Gate 1, Endeavour submits a portfolio plan to its Board for approval, which appears to be based on an allowance-type forecast without the accompanying detailed cost-benefit analysis. As investments proceed to Gate 2 and Gate 3, they are rationalised, further developed and refined.[48] During discussions with Endeavour and further through formal information requests, we have observed that a significant portion of Endeavour's forecast is at Gate 1, without the detail that would accompany projects that have reached the Gate 2 stage. As an example, Endeavour has provided us with a Gate status update, which indicates that approximately 20 per cent of its proposed augex forecast is at the Gate 2 or 3 stage.[49] EMCa noted that, on balance, it is likely that some projects may be subsequently rationalised, found to be not justified or displaced by an alternative lower cost network or non-network option.

We sought to understand if there was a top-down challenge to the bottom-up build that resulted out of the approved portfolio at Gate 1. For repex, Endeavour has pointed to the use of Weighted Average Remaining Life (WARL) as an indicator of top-down assessment. EMCa has flagged a number of concerns with this approach. Most significantly, it questions why a decrease WARL justifies a certain level of expenditure.[50]

In addition, Endeavour has noted the use of the AER repex model as tool used to challenge its repex portfolio.[51] We have assessed the underlying assumptions behind Endeavour's repex top-down challenge and discuss this in Section B.4 below. EMCa has indicated in its advice, that the fact that Endeavour has forecast repex that is less than a particular scenario does not, in EMCa's view, indicate that its repex forecast represents an efficient estimate of its replacement needs and costs over the 2019–24 period.[52]

EMCa concluded that it is not clear whether the top-down assessment and re-ranking of a portfolio, through the CASH/PIP, sufficiently challenged the original need for an

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48 A business case with cost-benefit analysis is only produced at Gate 2. See Endeavour Energy, *Response to AER Information Request* 005 *Company Procedure GAM0111 Gate 2 Preliminary Program and Project Approval, August 2018*, Public, p.1.

49 Endeavour Energy, *Response to AER Information Request 014 Gate Approval Status*, June 2018, Public.xlsx.

50 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, Public, August 2018, p.26.

51 Endeavour Energy, *Repex Proposal*, March 2018, Public, p.3.

52 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, Public, p.26.

investment. EMCa added that it was not clear how Endeavour determined that a particular portfolio is 'risk-optimised' and directly relates to Endeavour's stated aggregate performance objectives. Given the lack of cost-benefit analysis and the lack of a meaningful top-down challenge, we agree with EMCa that there is likely to be an overstatement of requirements at the Gate 1 level. This means it is unlikely that Endeavour's initial capex forecast is prudent or efficient.

Endeavour capex program delivery model

In the proposal, Endeavour stated that following the lease transaction, the new owners identified an opportunity to derive further capital delivery efficiencies, which resulted in the development of a new contractual delivery model.[53] The contracts were established in late 2017 and are expected to continue until 2024, which means any effect is not observable in the historical expenditure.[54]

We have sought to clarify whether Endeavour has incorporated the effect of the delivery model in its costing methodology for its initial capex forecast, which is consistent with Endeavour's statement that it expects a reduction in costs as a benefit of the new delivery model.[55] During our initial assessment, we did not find any evidence of a forecast reduction in unit costs except in the Service lines' replacement program. We have raised our concerns with Endeavour during the on-site discussions and via formal information requests. Endeavour stated that the original capex forecasts do not incorporate the new delivery model.[56]

We, along with stakeholders, raised this concern, along with other issues with Endeavour, We were encouraged by Endeavour's response to stakeholder feedback through its reduction of its initial capex forecast. Endeavour noted that it expects that the recent changes to the capital delivery model may enable it to deliver the required capex program and associated outcomes at a lower cost than proposed. [57] Having regard to Endeavour's updated capex forecast, we are satisfied that our substitute estimate, which is Endeavour's updated capex, takes into account the expected benefits of the new delivery model.

B.2 Augmentation expenditure

Augmentation is typically triggered by the need to build or upgrade the network to address changes in demand and network utilisation. However, it can also be triggered

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53 This included the establishment of the Major Projects Unit as well as the Alliance partnership for low value, high volume programs of work. See Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, public, p.112.

54 Supporting documentation points to the continued forecast growth in construction costs' pricing due to strong anticipated major projects in Sydney. See Endeavour Energy, *Response to Information Request Response 025,* August 2018.

55 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, Public, April 2018, p.112.

56 Endeavour Energy, *Response to Information Request Response 025*, public, August 2018, p.2.

57 Endeavour Energy*, Response to AER Issues paper - NSW Electricity Distribution Determinations 2019-24*, Public, p.4.

by the need to upgrade the network to comply with quality, safety, reliability and security of supply requirements.

B.2.1 Endeavour's proposal

In its proposal, Endeavour proposed a forecast augex of $416.8 million ($2018–19, excluding overheads). This included: [58]

- $301.1 million ($2018–19) for greenfield augex
- $115.7 million ($2018–19) for brownfield augex

Endeavour submitted that the major augmentation projects it expects to undertake during the 2019–24 regulatory control period include:

- Construction of 16 zone substations in greenfield areas; 13 to service residential growth and three for industrial users. These substations would be constructed in the North West, South West, Western Sydney, Greater Macarthur and West Lake Illawarra Growth Areas.[59]
- Construction of the South Penrith and Riverside East zone substations, and the augmentation of Westmead zone substation, in existing areas.[60]
- High voltage development works, to address overloaded feeders and to manage 11kV feeder constraints, fault levels and voltage reductions.[61]

The updated capex forecast provided additional augex information and an updated augex forecast of $349.8 million ($2018–19).[62] We have had regard to this additional information in assessing the augex forecast that Endeavour proposed in its proposal.

B.2.2 Position

The information that Endeavour presented in its proposal is not sufficient to demonstrate that its proposed augex forecast of $416.8 million ($2018–19) is prudent and efficient.

We initially estimated an augex of $333.7 million ($2018–19) that we considered is efficient and prudent. This is a reduction of $83.1 million or 19.9 per cent relative to Endeavour's proposed augex forecast in its proposal. In coming to this view, we have assessed:

- trend analysis comparing recent actual and forecast expenditure
- the forecast peak load on Endeavour's network

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58 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, p. 123.
59 Endeavour Energy, *10.16 Capex Listing (PIP).xlsx,* April 2018.
60 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, pp. 123-4.
61 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, p. 124.
62 Endeavour Energy, *PIP Resubmission - v1.xlsx*, September 2018.

- the utilisation rates of Endeavour's assets
- the project documentation accompanying Endeavour's proposal and any further information provided by Endeavour
- advice from engineering/technical experts; and
- stakeholder submissions

However, we have compared our initial estimate with Endeavour's updated capex forecast of $349.8 million ($2018–19), which takes into account our and stakeholder concerns. We consider the difference to be immaterial. Therefore, we consider that the updated augex is prudent and efficient, and would form part of a total forecast capex that reasonably reflects the capex criteria.

Table 5.3 Our draft decision on Endeavour's total forecast augex (direct costs, $m 2018–19)

	2019–20	2020–21	2021–22	2022–23	2023–24	Total
Proposal	93.5	94.7	85.4	70.9	72.2	416.8
Our initial assessment	77.8	43.2	38.7	77.1	96.8	333.7
Endeavour update augex forecast and our substitute estimate	64.8	64.5	70.1	78.3	72.1	349.8
Total difference between our decision and the proposal	(28.7)	(30.2)	(15.3)	7.4	(0.1)	(67.0)
Percentage difference between our decision and the proposal	-30.7%	-31.9%	-17.9%	10.4%	-0.0%	-16.1%

Source: Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018 and Endeavour Energy, *PIP Resubmission - v1.xlsx*, September 2018

Reasons for our position

In coming to our position, we have considered the trend of historical and forecast expenditure, the accompanying demand forecast and asset utilisation. We also focused on the project documentation which accompanied Endeavour's proposal, particularly the additional information that Endeavour provided in its greenfield and brownfield augmentation programs.

Trend Analysis

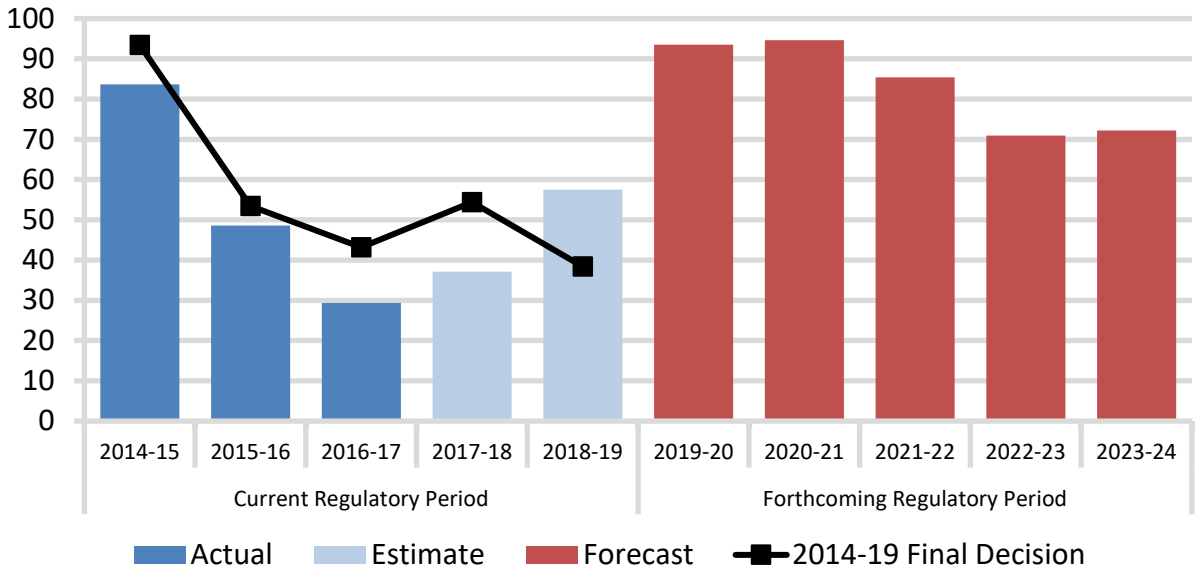
In accordance with the NER, we consider the actual and expected capital expenditure during any preceding regulatory control period.[63] The trend analysis enables us to

[63] NER, cl. 6.5.7(e)(5).

gauge how Endeavour's proposed augex for the forthcoming regulatory control period compares to its historical augex expenditure.

Figure 5.2 shows the actual and estimated augmentation expenditure for the 2014–19 regulatory control period, along with our final approved augex amount. We can see from Figure 5.2 that augex is forecast to increase at the beginning of the 2019–24 regulatory control period. Endeavour's proposal sees augex remain at high levels (averaging $83.4 million) throughout the 2019–24 regulatory control period compared to the current period's actual and estimated expenditure (that averages $51.2 million).

Figure 5.2: Endeavour historical and initial forecast augex (direct costs, $m 2018–19)



Source: Endeavour Energy RIN responses and AER, *Endeavour Energy 2014-19 Final Decision capex model.*

An increasing or decreasing trend in total augex by itself is not enough to determine whether a distributor's proposed augex is efficient and prudent. The majority of the increase in forecast augex is attributed to an increase in greenfield expenditure. In the 2019–24 regulatory control period, Endeavour forecasts $301.1 million greenfield augex, compared to $158.2 million in the current period. Endeavour submits that this increased greenfield expenditure reflects the rapid growth it expects in new regions of its network. We must assess whether this increased expenditure is reflective of what would be required by a prudent and efficient distributor to meets its obligations.

Demand forecast

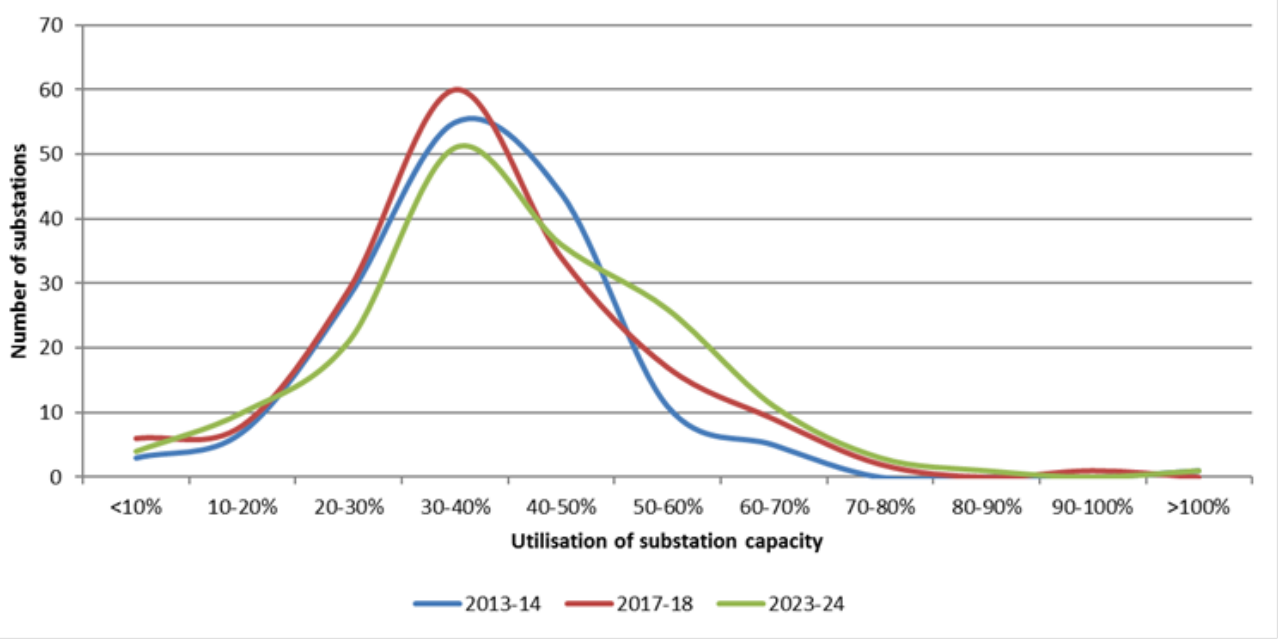
Peak demand is a fundamental driver of a distributor's forecast augex. Endeavour must deliver electricity to its customers and must therefore build, operate and maintain its network to manage expected changes in demand for electricity. We have considered Endeavour's peak demand forecast relative to the Australian Energy Market Operator's (AEMO) independent forecast of NSW peak demand.

We consider Endeavour's system peak demand forecasts to be reasonable. Its forecasts are generally higher than AEMO's forecasts for the NSW region, due to differences in the forecast approach and assumptions of future trends. AEMO, for example, includes more aggressive post-modelling adjustments for the effect of solar PV and energy efficiencies. Endeavour's forecasting approach is simpler, but remains valid. Our full review of the peak demand forecasts is in Appendix E.

Asset utilisation

We have assessed the network utilisation rates across Endeavour's network to examine the effect of Endeavour's demand forecast. Network utilisation is a measure of the installed network capacity that is, or is forecast to be, in use. Where utilisation rates increase over time (such as where there is increasing maximum demand), total augex requirements may increase.

Figure 5.3: Endeavour's zone substation utilisation 2013–14 and 2017–18 actual, and 2023–24 forecast



Source: AER Analysis and Endeavour Energy, *Reset RIN*

Note: Utilisation rates are based on substation normal cyclic zone substation capacities.

Figure 5.3 shows that given the demand forecasts included in Endeavour's proposal, utilisation rates in the absence of additional augex are set to increase moderately over the next regulatory control period. In 2023–24, there is forecast to be more substations with utilisation rates between 50–60 per cent, 60–70 per cent and 70–80 per cent relative to 2017–18, and a decrease in the number of substations with lower levels of utilisation.

Endeavour's proposal highlights that greenfields high growth areas are likely to put pressure on the substations nearby. The increase in asset utilisation indicates that some augmentation of the network will likely be required in the upcoming regulatory control period.

Review of network augmentation projects

We reviewed a number of Endeavour's proposed augex projects. This review included both greenfield and brownfield projects that were demand driven and projects with non-demand drivers (such a strategic land acquisitions). Our review included an assessment of the business cases that Endeavour has put forward in support of its proposal, and additional supplementary information. [64]

Endeavour has not shown that a number of its augex projects would be required to be completed by a prudent and efficient operator, particularly in the timeframes proposed. Specifically, we have concerns that:

- based on the probabilistic value of customer reliability model used in Endeavour's business cases, a number of the projects proposed by Endeavour will be completed before it is economically efficient to do so.
- Endeavour has not provided sufficient evidence to demonstrate it has fully considered non-network alternatives to its augex proposals.
- although Endeavour has successfully deferred projects in the current regulatory control period, it has failed to adequately account for possible deferrals that could arise in the 2019–24 regulatory control period.

Probabilistic value of customer reliability model

We consider a number of Endeavour's projects can be prudently deferred so they are completed when it is efficient to do so. This conclusion is reached using Endeavour's probabilistic value of customer reliability model.

In its business cases, Endeavour employs a probabilistic value of customer reliability model (VCR model). The VCR model compares the congestion costs[65] that will arise if a proposal is not completed to the annualised cost of the project. The congestion costs are expected to rise over time with expected demand growth. We consider that an efficient operator would plan to complete a project when the benefit of avoided congestion exceeds the annualised cost of the project. However, in some cases, Endeavour proposes to complete augmentation some years prior to when the benefits outweigh the costs.

Endeavour has not established that its application of its VCR model would result in the completion of certain augmentation proposals at the most appropriate time. Instead, we consider that the investment could be prudently deferred so that the augmentation is completed at the point it is economic to do so. We have identified two brownfield projects (the construction of the Riverside East and South Penrith zone substations) that could be prudently deferred.

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[64] NER, clauses 6.5.7(c)(1) and 6.5.7(c)(2).

[65] This is the cost of energy not served multiplied by the value of customer reliability.

Consideration of alternatives to network investment

We consider Endeavour has not shown that it fully considered viable alternatives for its augex proposals. Although Endeavour's business cases usually present some alternative options, they are generally only considered at a high level. In the case of many greenfield projects, non-network alternatives to augmentation have not been considered at all.

As previously highlighted in section B.1.1, many of Endeavour's proposed greenfield projects are at Gate 1 of the planning process. These projects have not been subject to a review, which occurs at Gate 2 and 3, where non-network alternatives are fully scoped and all feasible options are considered.[66] EMCa noted its concern that Endeavour had failed to allow for the likelihood in that projects could be deferred when they reach Gate 2 and Gate 3 of the planning process. This is particularly pertinent for projects in the later years of the 2019–24 regulatory control period. [67]

Accounting for deferral opportunities

We consider that Endeavour has not sufficiently accounted for the deferral options that are likely to arise in the 2019–24 regulatory control period.

Endeavour noted that it undertakes a staged approach to augmentation expenditure, in which it defers "significant network investment until it is self-evidently necessary."[68] The staged approach entails using cheaper investments, such as minor network extensions or non-network solutions, to defer larger investments until they are absolutely required. Using this approach during the current regulatory control period, Endeavour forecasts to underspend $55.4 million ($2018–19) on augex.[69]

We consider that deferring expenditure in this manner is consistent with the approach a prudent and efficient operator would take. We consider that in the 2019–24 regulatory control period, it is highly likely that similar opportunities for deferral will arise. In forming this view, we have had regard to:

- Endeavour's demonstrated ability and willingness to defer projects in the 2014–19 regulatory control period
- The prospect of deferral options arising as projects move to later stages of planning (Gates 2 and 3)
- The continued influence of new disruptive technologies, such as demand management, which could increase the viability of non-network alternatives.

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66 Endeavour Energy, *Response to AER Information Request* 005 *Company Procedure GAM0111 Gate 2 Preliminary Program and Project Approval, August 2018*, Public, p.1.

67 EMCa*, Review of Endeavour Regulatory Proposal 2019-24 Capex,* August 2018, p. 75.

68 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2014*, April 2018, p. 122.

69 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2014*, April 2018, p. 123.

In its proposal, Endeavour has not provided sufficient evidence that it has considered these factors. Endeavour has not included any adjustment that accounts for possible opportunities to defer during the 2019–24 regulatory control period. By failing to allow for these likely deferral opportunities, Endeavour's approach to forecasting augex in the upcoming regulatory control period is inconsistent with the approach actually taken in the current regulatory control period.

AER initial assessment

We recognise Endeavour will be required to augment its assets in the future. Some of this will occur during the 2019–24 regulatory control period. However, for the reasons outlined above, we consider that some of the proposed augex may be prudently deferred until after the 2019–24 regulatory control period.

By deferring a number of projects until they are economic, we arrive at an initial estimate of $333.7 million for the 2019–24. There are two projects that we consider could be prudently deferred until the next regulatory control period. There are a further five projects that could prudently be deferred so that some of their proposed cost would fall outside the 2019–24 regulatory control period.

To arrive at our initial estimate, we have reviewed each business case and identified projects that can be deferred until it is efficient to undertake augmentation of the network. We examined the output of Endeavour's probabilistic VCR model, which compares the predicted congestion cost in each year without augmentation, to the annualised cost of the project. We adjusted the timing so that the project was completed in the year that the congestion costs avoided exceed the annualised cost of the project.

This methodology reduced brownfield expenditure in the 2019–24 regulatory control period by $44.1 million, and affected the following projects:

- the Riverstone East zone substation - we consider this project can be deferred by three years so that it will begin after the regulatory control period. This reduces the expenditure in the regulatory control period by $20.6 million ($2018–19)
- the South Penrith zone substation - we consider that this project can be deferred by four years so that it will begin in FY2024. This reduces the expenditure in the regulatory control period by $23.5 million ($2018–19)

For greenfield projects, we consider that as projects progress through to later stages of development, Endeavour will fully consider alternatives, including non-network alternatives. In doing so, it is likely to find some opportunities for deferral.

EMCa highlighted that for projects that are scheduled to begin in the later part of the regulatory control period, there is considerable time for Endeavour to assess network and non-network alternatives that may allow for prudent deferral. We consider that deferral of imminent greenfield projects may be more difficult than brownfield infrastructure, due to the general absence of existing infrastructure that can be utilised in alternative solutions.

Considering this, we have assessed greenfield project that will commence in or after the third year of the regulatory control period, and applied the approach outlined for the brownfield projects above.

This approach reduced the proposed greenfield expenditure in the regulatory control period by $39.0 million and affects the following projects:

- Penrith Lakes zone substation – we consider that Endeavour could defer this project by two years, so that is will begin after the regulatory control period. This reduces expenditure in the regulatory control period by $3.6 million
- West Dapto zone substation – we consider that Endeavour could defer this project by one year, so that it will begin in FY2023. This reduces expenditure in the regulatory control period by $4.9 million
- Western Sydney Employment Lands zone substation – we consider that Endeavour could defer this project by two years, so that it will begin in FY2024. This reduces expenditure in the regulatory control period by $18.8 million
- Termeil zone substation – we consider that Endeavour could defer this project by one year, so that it will begin in FY2024. This reduces expenditure in the regulatory control period by $3.8 million
- Catherine Park zone substation – we consider that Endeavour could defer this project by two years, so that it will begin in FY2024. This reduces expenditure in the regulatory control period by $7.7 million

B.2.3 Updated augex forecast

Endeavour provided additional augex information as part of its updated capex forecast, which reduced augex by 16.1 per cent from $416.8 million ($2018–19) to $349.8 million ($2018–19).[70]

Endeavour's updated information acknowledged stakeholder concerns and recognised that a reduction in its proposal was required to address the following:

- Insufficient evidence to show that the augex forecast reflects a realistic expectation of demand management opportunities.
- Concerns around the efficiency of the 'staging approach' model of augex investment.
- Significant growth in the current period has been accommodated with lower volume of investment than the forecast period.
- A decline in key metrics such as asset utilisation and augex per new customer.

We consider that Endeavour's updated augex information better reflects our concerns discussed above. This updated augex forecast is 4.8 per cent higher than our initial

[70] Endeavour Energy, *PIP Resubmission - v1.xlsx*, September 2018

estimate. We do not consider this difference to be material when considering the $349.8 million in augex as part of the broader updated capex forecast. Therefore, we have included $349.8 million for augex in our substitute estimate for total capex.

We also note that Endeavour's updated capex forecast has the support of CCP10[71], PIAC[72] and ECA[73]. We are supportive of the manner in which Endeavour has engaged with consumer groups meaningfully to this point in the process to achieve a material reduction in its forecast augex.

This material reduction in Endeavour's forecast augex, relative to that which it proposed in its proposal, is a driver of Endeavour's lower updated capex forecast which we are satisfied would form part of a total forecast capex that reasonably reflects the capex criteria.

B.3 Customer connections

Connections capex is expenditure incurred to connect new customers to the network and, where necessary, augment the shared network to ensure there is sufficient capacity to meet the new customer demand.

The contestability framework in NSW allows customers to choose their own accredited service provider and negotiate efficient prices for connection services. Given the competition between service providers, we do not regulate the majority of connection services in NSW. However, some connection works that involve augmenting and extending the shared network to connect new customers are regulated and funded by all customers. These works are referred to as net connections capex.

In NSW, the majority of capital contributions are made up of the value of assets constructed by third parties, which are then gifted to Endeavour to be operated and maintained. In some cases, Endeavour requires payments for connection works that are not contestable. These contributions are subtracted from total gross capex and, as such, decrease the revenue that is recovered from all customers.

B.3.1 Endeavour's proposal

Endeavour proposed $844.1 million ($2018–19) for gross connections capex for the 2019–24 regulatory control period. The forecast is $21.3 million, or 3 percent higher than its actual gross connections expenditure of $807.2 million in 2014–19.[74] This is shown in Table 5.4.

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71 CCP10, *Endeavour Energy 19–24 draft revenue proposal - letter to the AER*, Public, 21 September 2018.

72 PIAC, *Endeavour Energy - Revised 2019-24 Capital Forecast*, Public, 19 September 2018.

73 Energy Consumers Australia, *Letter - 'Endeavour Energy's response to the Australian Energy Regulator (AER) Issues Paper: NSW Electricity Distribution Determinations 2019 to 24*, 30 August 2018.

74 Endeavour Energy, *Responses to Regulatory Information Notices*, April 2018.

Table 5.4 – Endeavour's proposed connections capex for 2019–24 (direct costs, $m 2018–19)

	2019-20	2020-21	2021-22	2022-23	2023-24	Total
Gross connections capex	175.3	166.4	165.9	166.4	170.0	844.1
Net connections	63.5	61.1	61.0	61.3	62.4	309.4
Capital contributions	111.8	105.3	104.8	105.1	107.6	534.7

Source: Endeavour Energy, *Reset RIN*, April 2018.

The expected increase in gross connections capex is due to high forecast connections volumes, particularly in Sydney's west, in 2019–24. However, Endeavour has forecast lower unit rates compared with the current period, which has largely offset the increase in volumes.

Endeavour's forecast connections capex included:

- net expenditure (costs incurred by Endeavour) of $309.4 million
- capital contributions of $534.7 million.

Forecast net connections capex for the 2019–24 regulatory control period is 158 per cent—or $189.3 million—higher than actual expenditure of $120.1 million in 2014–19. Only net connections capex is rolled into the regulatory asset base.

Endeavour submitted that the increase in net connections capex reflects changes to the application of its connection policy (its reimbursement policy), which came into effect in August 2017. These changes mean that Endeavour—and therefore all network customers—will provide reimbursements for certain new assets that will be, or are likely to be, shared by the network. The reimbursements are paid to developers and other connecting customers to cover the costs of high-voltage cables and distribution substations.

Following ongoing engagement with us and stakeholders, Endeavour provided an updated forecast of $118.7 million for net connections capex (a decrease of around $190 million from its proposal) and $726 million for capital contributions (an increase of around $190 million).[75] The changes are largely due to the reversal of its reimbursement policy. In arriving at the updated forecast for net connections capex, Endeavour has worked closely with us to resolve issues such as the timing and future effect of a reversal to the reimbursement policy.

[75] Endeavour Energy, *Response to AER issues paper - NSW electricity distribution determinations 2019-24*, public, 30 August 2018.

B.3.2 Position

Endeavour has not demonstrated that its proposed gross connections forecast of $844.1 million ($2018–19) would form part of a total capex forecast that reasonably reflects the capex criteria. Specifically, we consider that Endeavour has not justified its increase to forecast net connections capex.

Our substitute forecast includes $828.4 million for gross connections capex, which is $15.7 million (2 per cent) lower than Endeavour's forecast. This is summarised in Table 5.5.

Table 5.5 – Endeavour's proposal and AER's draft decision for connections capex, 2019–24 (direct costs, $m 2018–19)

	Endeavour Proposal	AER draft decision	Difference ($m)	Difference (%)
Gross connections capex	844.1	828.4	-15.7	-2%
Net connections	309.4	118.7	-190.7	-62%
Capital contributions	534.7	709.8	175.1	33%

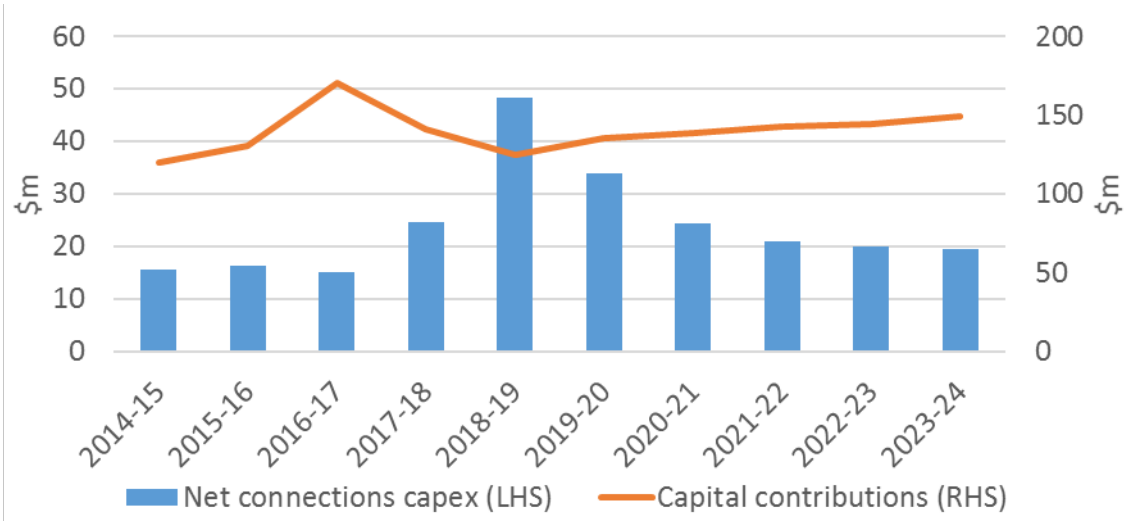
Source: Endeavour Energy, *Reset RIN*, April 2018, and AER analysis.

Our estimate for gross connections capex reflects changes to Endeavour's modelling and assumptions, which it has provided to us with its updated forecasts.

We have engaged closely with Endeavour regarding its connection capex, as such we have adopted its updated forecast for net connections capex as part of our substitute estimate for total capex. Our substitute forecast includes $118.7 million, which is 62 per cent less than Endeavour's proposed forecast in its proposal. This change reflects our view that Endeavour should reverse the changes to its reimbursement policy.

The reversal of Endeavour's reimbursement policy will increase capital contributions by around $175 million in 2019–24, because the assets that are currently eligible for reimbursement will be treated as gifted assets. Figure 5.4 below shows our substitute forecast along with Endeavour's capital contributions in the current and forecast regulatory control period.

Figure 5.4 Draft decision—annual net connections capex and capital contributions, 2014–15 to 2023–24 (direct costs, $m 2018–19)



Source: AER Analysis

Forecast annual average net connections in 2019–24 are higher than annual average actual expenditure in 2014–15 to 2016–17. This is due to the effect of connections reimbursements for the period August 2017 to December 2018, the duct installation program, and higher forecast new connection volumes. Net connections capex is expected to peak in 2018–19 as many connection works commencing in 2017–18—when the reimbursement policy was in effect for most of the year—will be completed. By 2021–22 reimbursements will contribute only around $2 million to net connections capex.

B.3.3 Reasons for our position

In coming to our position, we have had regard to Endeavour's methodology, historical costs and trends and expected customer growth. We were informed by stakeholder views, in particular those views regarding Endeavour's reimbursement policy. We have also assessed Endeavour's forecast capital contributions and its proposed connection policy.[76]

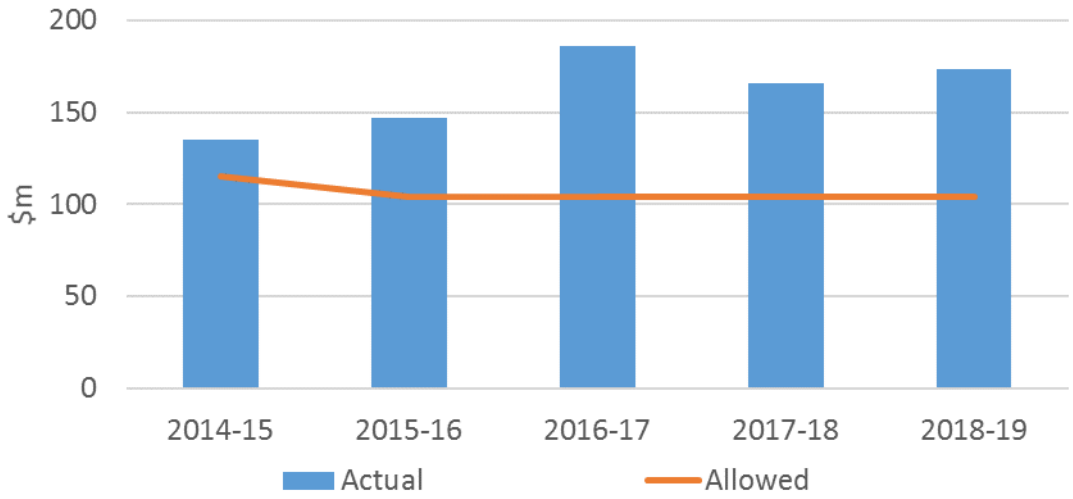
Connections capex in 2014–19

Endeavour has overspent on its connections capex considerably, compared with our final determination allowance. Figure 5.5 compares Endeavour's 2014–19 estimated gross connections capex with our allowance. Endeavour estimates connections capex of $807.2 million in 2014–19. This is 52 per cent higher than our final determination allowance of $531.1 million.

[76] Please refer to Attachment 17 of the draft decision for our assessment of Endeavour Energy's proposed connection policy.

Compared with our allowance, Endeavour estimates that actual net connections capex will be 42 per cent higher, and capital contributions 54 per cent higher, in the 2014–19 regulatory control period. This reflects higher than expected new connection volumes in 2014–19.

Figure 5.5 Annual gross connections capex, actual expenditure compared with AER allowance, 2014–19 (direct costs, $m 2018–19)



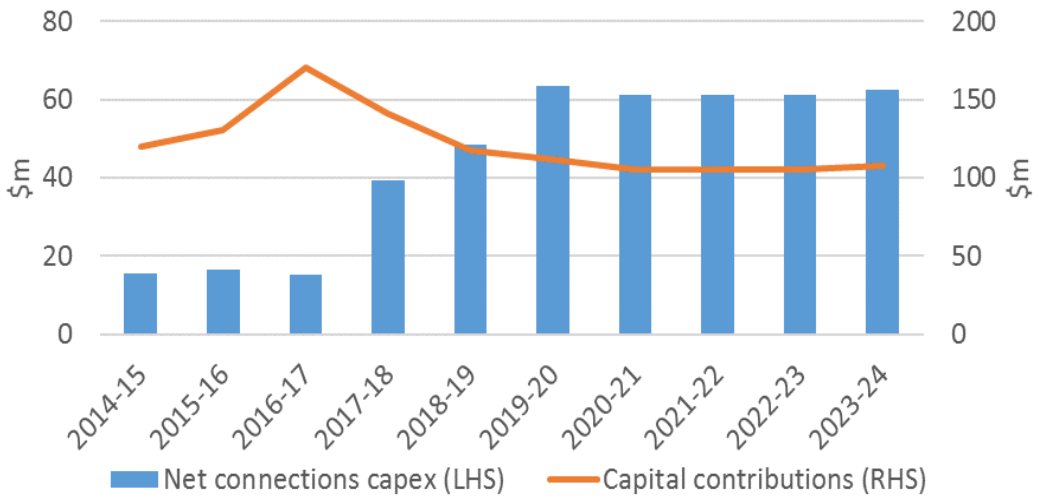
Source: AER Analysis.

Forecast connections capex compared with current period

Figure 5.6 compares Endeavour's 2019–24 forecast net connections capex and capital contributions with actual/estimated expenditure in 2014–19.

Net connections capex increased sharply from 2017–18. While Endeavour experienced an increase in the number of new connections from around this time, the increase in expenditure was largely driven by the introduction of its reimbursement policy. This change meant that certain classes of shared assets are now fully funded by Endeavour and therefore all network customers. Prior to the change, the connecting customer generally funded these costs. For this reason, forecast net connections capex is around four times higher than in the period 2014–15 to 2016–17.

Figure 5.6 Annual net connections capex and capital contributions, 2014–15 to 2023–24 (direct costs, $m 2018–19)



Source: AER Analysis

Our assessment of forecast net connections capex

Methodology

Endeavour forecasts net connections capex for asset relocation, industrial and commercial, non-urban, underground residential and duct installation connection works.

The forecast for each year is based on the previous three years of actual or forecast capex. A step change is added to each connection category to reflect the introduction of the reimbursement policy. The step change is calculated based on the historical proportion of the "URD 11kV underground cable" and "Ground Sub excluding Transformer" categories to total capital contributions.[77] These assets are eligible for Endeavour's reimbursement.

The forecast capex is adjusted to reflect the forecast number of new connections for each year. In its forecast, Endeavour includes capex related to duct installation. It has not reported this expenditure prior to 2018–19. We have asked Endeavour to explain why it has included this new expenditure in its forecast. It replied that:[78]

> This new category of expenditure is for the installation of conduits for future transmission feeders in major RMS road works in Western Sydney Growth areas. Installing conduits at the same time as road works avoids digging up newly constructed roads and driveways in the near future, and in most cases is cost efficient as Endeavour does not have to pay for road restoration works.

[77] Endeavour Energy, *Response to information request 017*, public, July 2018.

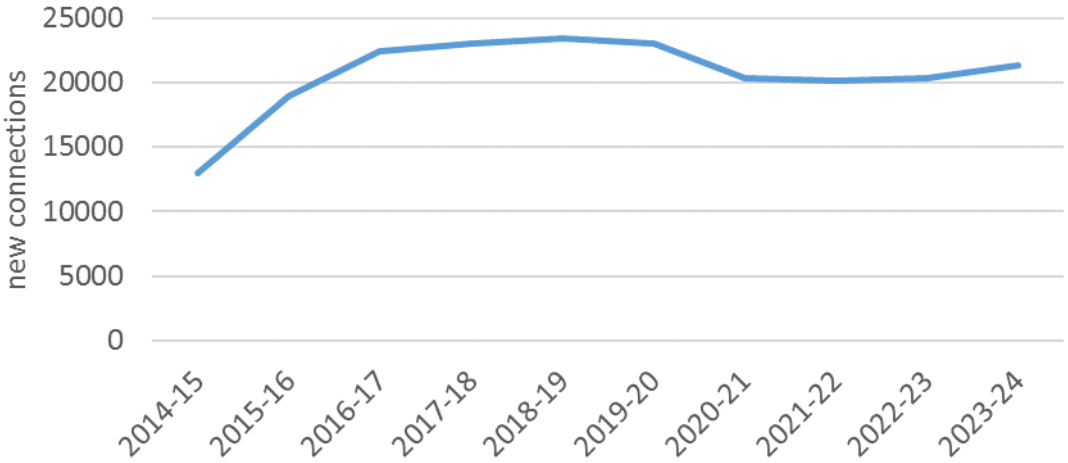
[78] Endeavour Energy, *Response to information request 017*, public, July 2018.

In the context of the rapid pace of development in the Western Sydney growth areas, we consider that this forecast connections capex for duct installation is likely to offset more costly augmentation works in the short- to medium-term.

New connection volumes

Endeavour forecast 105,000 new customers to connect to its network in 2019-24. This is shown in Figure 5.7. The majority of these will be residential customers in Western Sydney's growth areas.

Figure 5.7 Actual and forecast new customer connections, 2014–15 to 2023–24



Source: Endeavour Energy, *Reset RIN*, April 2018.

Endeavour forecast new residential customer connections using historical trend analysis for 2017–18 and 2018–19. New residential connection numbers in the 2019–24 regulatory control period are based on forecast new household growth rates in the Endeavour region from NIEIR.[79] We compared Endeavour's short- and long-term forecasts with historical trends, and data from NIEIR and NSW Department of Planning. Endeavour demonstrated that its forecast for new residential connection numbers are the best estimate based on available information.

Endeavour forecasts around 1500 new industrial and commercial customers per year for 2019–24. We asked Endeavour to provide reasons for a large decrease in implied unit rates for industrial and commercial connections in 2019–24. It responded that, in retrospect, its forecast connections volumes may be overstated. However, it noted that any changes to its volumes forecast does not alter the total network industrial and commercial customer number forecast.[80]

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[79] NIEIR is a provider of forecasting services including energy customer and peak demand and customer numbers.

[80] Endeavour Energy, *Response to information request 017*, public, July 2018.

Endeavour has provided sufficient justification for its methodology in forecasting connections capex. However, we have a number of concerns regarding Endeavour's reimbursement policy, which we discuss below.

Endeavour's reimbursement policy

On 26 July 2017, Endeavour made changes to the application of its connection policy by establishing a reimbursement policy. Assets built for new connections would now be paid for in full by Endeavour if the assets are shared, or likely to be shared in the future, with other customers on the network. Endeavour identified these assets as underground residential 11kV cables and ground distribution substations.[81]

Endeavour described the reimbursement policy as being a 'beneficiary pays' model. The "approach ensures that…assets that provide current and/or future customers with supply, improved network connectivity services or supply resilience are funded across our customer base like all other common standard control service assets."[82]

Endeavour notes that the decision to introduce the reimbursement policy was driven by stakeholder feedback and a review of its existing practices:[83]

> We received feedback from developers and councils that our approach was detrimental to customers and out-of-step with other participants in the NEM. We reviewed our approach and determined that connecting customers were paying for more than just the assets dedicated to them. Due to the tax impacts of contributed assets this resulted in a higher overall cost when considering the contribution from connecting customers and DUOS prices, so we realigned our approach with our original intent.

Implications of the reimbursement policy on net connections capex

Under the new approach, a larger share of total connections expenditure will be rolled into the RAB than would have otherwise been included. The effect of the reimbursement policy on net connections capex is around $201 million in 2019–24.[84] Of this, underground residential net connections capex increases by around $148 million (or 74 per cent of reimbursements) and commercial and industrial net connections capex increases by around $44 million (or 22 per cent of reimbursements).

Figure 5.8 shows how the reimbursement policy affects net connections capex and capital contributions from 2017–18.

- If the reimbursement policy continues, as set out in Endeavour's proposal:

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81 Endeavour Energy, *Response to information request 017*, public, July 2018.

82 Endeavour Energy, *Customer Connections Capex: Basis of Preparation*, public, March 2018, p.2.

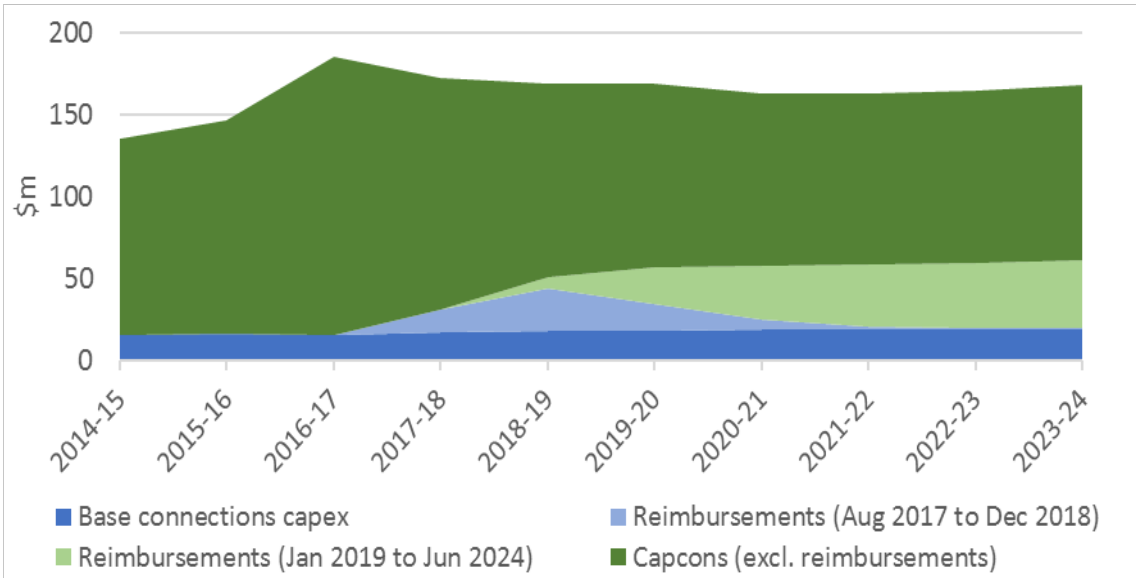
83 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2014*, p.106. Written feedback was only provided by the Urban Development Institute of Australia.

84 This is based on Endeavour Energy's updated capex forecast model. In its proposal, the effect of the reimbursement policy is around $212 million.

- net connections capex will include the dark blue, light blue and light green areas of Figure 5.8.
- capital contributions will include the dark green area.

- If the reimbursement policy is reversed:
  - net connections capex will include the dark blue and light blue areas
  - capital contributions will include the light green and dark green area.
- If the reimbursement policy was never initiated:
  - net connections capex would include the dark blue area
  - capital contributions would include the light blue, light green and dark green areas.

Figure 5.8 Effect of the reimbursement policy Annual net connections capex, 2014–15 to 2023–24 (direct costs, $m 2018–19)



Source: Endeavour and AER analysis.

Stakeholder response to the reimbursement policy

Endeavour's reimbursement policy has been a contentious issue. It has generated a lot of discussion at, and after, Endeavour's 'deep dives' in early 2018. We observed that stakeholders were overwhelmingly opposed to the reimbursement policy at the deep dives.

A number of stakeholders have put forward their views on this issue in response to our issues paper, which are summarised as follows:

- The Urban Development Institute of Australia (UDIA) supports the reimbursement policy. It recognises the issue of affordability among electricity users; however, it submits that this must be understood in the broader context of affordability. It notes the housing affordability crisis in Sydney and Endeavour's role in reducing the time

and cost of land releases which will go directly to improving affordability for consumers.[85]

Submissions were also put forward by CCP10, the Energy Users Association of Australia (EUAA) and PIAC. These stakeholders do not support the reimbursement policy.

- CCP10 is concerned that the reimbursement policy "had not been taken to the Endeavour Consumer Consultative Committee (CCC) for discussion and endorsement prior to its enactment, casting some doubt as to the effectiveness and approach to the role of their CCC". It is also concerned that the reimbursements paid to developers will not be passed on in full to land purchasers. CCP10 also expresses the view that Endeavour's previous capital contributions approach showed that it was "a 'leader' in representing emerging expectations of energy customers", and not an outlier as presented by Endeavour. For these reasons rejects the change in the connections policy.[86]
- In its submission the EUAA notes that it "strongly support the concept 'causer pays', particularly in relation to customer connections". The EUAA states that it does not support Endeavour's reimbursement policy, noting that "there was strong feedback from all consumer groups against this move which is seen as inequitable and contrary to the causer pays principle."[87]
- PIAC is concerned that the reimbursement policy will increase the value of Endeavour's RAB, which will have an effect on electricity affordability over the long term. It says that Endeavour is reducing the locational price signal for new connections, and the policy is a move away from the broader direction of 'causer pays' across the NEM. PIAC also considers that the reimbursement policy is inequitable:[88]

  > Under the new policy, costs associated with connecting new home buyers will be recovered from all other consumers, including low income and vulnerable households. PIAC does not support a change that will result in vulnerable consumers subsidising relatively wealthy home buyers.

Our preliminary position and early engagement with Endeavour

During the preproposal stage, we held a meeting with Endeavour to discuss its reimbursement policy. We noted that our preliminary view was to not support the reimbursement policy, because:

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85 UDIA, *Submission on Endeavour Energy 2019-24 regulatory proposal*, 8 August 2018.

86 CCP10, *CCP10 Response to AER Issues paper and revenue Proposals for NSW Electricity Distribution Businesses 2019-24*, August 2018.

87 EUAA, *NSW Electricity Distribution Determinations: Ausgrid, Endeavour, Essential Energy 2019–24*, public, August 2018.

88 PIAC, *Attachment C: PIAC's Submission on Endeavour Energy's 2019-24 Capex Proposal*, 17 August 2018.

- it will lead to a higher RAB, leaving the vast majority of customers worse off over the long term
- we are not satisfied that the arguments put forward by Endeavour justify the policy and its effect on future revenue requirements
- we had engaged with consumer groups who informed us that strongly oppose the policy
- a 'causer pays' policy is likely to be the more prudent and efficient approach for new connections.

In its proposal, Endeavour indicated it would continue with its reimbursement policy, and its forecast net connections capex included reimbursements. Endeavour did however recognise stakeholder sentiment and committed to further engagement on the issue:[89]

> [The reimbursement policy] was an area of contention during our capex deep dive sessions. Several stakeholders expressed concerns with our 'new' approach and considered it was unfair for existing customers...
>
> We have considered this feedback and at this stage are retaining our current practice given that the majority of our existing customers were connected on this basis (or an even more favourable basis). However, we understand our approach remains of concern to the AER's CCP10 and others and we are planning additional and broader industry engagement to resolve this issue.

Subsequent updates to connections capex forecast

In its response to our issues paper, Endeavour provided an updated forecast for net connections capex of $118.7 million.[90] This represents a reversal of its reimbursement policy—the majority of reimbursements in the original net connections capex proposal have been transferred to capital contributions. This means that the connecting customer will pay for those assets for which they would otherwise receive reimbursements under the existing policy. In its submission, Endeavour notes that:[91]

> Based on [stakeholders'] concerns, we understand that the majority of stakeholders consider we should return to our previous practice as they consider it to be more efficient and fair. We note that in making the changes our intention was to implement a fairer capital contribution policy for customers as a whole. We thought we had developed a policy that was consistent with the Rules and achieved this objective. However, we have heard clear feedback from stakeholders that a return to our previous policy would better serve the long-term interests of electricity customers.

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89 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2014*, public, April 2018, p.106.

90 Endeavour Energy, *Response to AER issues paper - NSW electricity distribution determinations 2019-24*, public, 30 August 2018.

91 Endeavour Energy, *Response to AER issues paper - NSW electricity distribution determinations 2019-24*, 30 August 2018, p.7.

In arriving at the updated forecast for net connections capex, Endeavour has worked closely with us to resolve issues such as the timing and future effect of a reversal to the reimbursement policy. In particular, Endeavour has provided data quantifying the lag between connection work initiation and completion. This shows that some connection works initiated under the reimbursement policy will be completed in the 2019–24 regulatory control period. These customers will still be eligible for the reimbursement. In putting together this new information, Endeavour recognises that its net connections forecast was overestimated by around $10 million because of its assumptions about the timing between the initiation and completion of connection works subject to reimbursement.

Endeavour's updated forecast of $118.7 million for net connections capex is based on the expectation that the reimbursement policy will be reversed from 1 January 2019. Endeavour has explained to us that 1 January 2019 is the earliest that the transition can reasonably take place. It allows Endeavour to:

- update its internal systems and processes;
- consult with affected stakeholders; and
- avoid a rush of potentially poorly drafted applications and to assess and respond to applications within 14 days (which it is obligated to do under its licence conditions).

Endeavour submitted that it is reasonable to await our draft decision prior to formally announcing this change. Based on Endeavour's arguments, we consider that a reversal date of 1 January 2019 is appropriate.

We have arrived at a substitute estimate for net connections capex forecast of $118.7 million, which is consistent with Endeavour's updated forecast. We are satisfied that this estimate forms part of a total capex forecast that reasonably reflects the capex criteria.

B.3.4 Our assessment of capital contributions

In its proposal, Endeavour proposed a forecast $534.7 million for capital contributions. Following the changes it made to its net connections in its updated capex forecast, Endeavour has also updated its capital contributions forecast to $726 million. While we are generally satisfied with this forecast, in arriving at its updated forecast Endeavour has included a calculation error and an incorrect assumption. We consider that Endeavour has overestimated its forecast by around $16 million.

Therefore, our substitute forecast includes $709.8 million for capital contributions. The difference between Endeavour's updated capital contributions forecast and our substitute estimate is due to changes in modelling assumptions and a correction of a modelling error, which Endeavour did not account for in its updated forecast. This is $22.7 million, or 3 per cent, higher than capital contributions for 2014–19. We consider that this reflects the expected increase in new connection volumes in the 2019–24 regulatory control period.

Forecasting approach

To forecast capital contributions Endeavour uses actual capital contributions in 2016-17 to establish a base value. Endeavour then makes adjustments to remove the value of the reimbursement that it will fund.

Endeavour assumes that 50 per cent of the value of capital contributions in 2019–24 will relate to residential connections. For these contributions, the base year value is adjusted to reflect the difference between forecast new customer connections and the number of connections incurred in the base year.

The remaining 50 per cent of the value of capital contributions in 2019–24 relate to major customer connections (including industrial/commercial connections and asset relocations). Endeavour does not adjust these contributions, as it considers that the value of these contributions do not correlate strongly with changes in new connection numbers.[92]

Endeavour further reduces its capital contributions forecast to reflect expected efficiencies in 2019–24, including delivery efficiencies and changes in standards. This reduction adds up to around $47 million over 2019–24.

We asked Endeavour to explain why it considered it appropriate to use only 2016-17 as the base year, and not a longer-term average. It replied that 2016-17 most appropriately reflected the expected mix of connection work types and market prices for connection works. Furthermore, the volume of works completed in 2016-17 was similar to the volumes expected each year over 2019–24.[93]

We also raised concerns that the capital contributions reported in the connections model were higher than those reported in the RIN. As a result, we were concerned that forecast capital contributions were overstated. Endeavour responded that the capital contributions reported in the connections model provide the correct value for the full 2016-17 financial value. Capital contributions reported in the RIN, however, include contributions only to year end 14 June 2017.[94]

B.4 Replacement expenditure

Repex must be set at a level that allows a distributor to meet the capex objectives. Replacement can occur for a variety of reasons, including when:

- an asset fails while in service or presents a real risk of imminent failure;

92 Endeavour Energy, *Customer connections capex forecast: Basis of Preparation*, p.5.

93 Endeavour Energy, *Response to information request 017*, Public, July 2018.

94 Endeavour Energy, *Response to information request 017*, Public, July 2018.

- a condition assessment of the asset determines that it is likely to fail soon (or degrade in performance, such that it does not meet its service requirement) and replacement is the most economic option;[95]
- the asset does not meet the relevant jurisdictional safety regulations, and can no longer be safely operated on the network; and
- the risk of using the asset exceeds the benefit of continuing to operate it.

The majority of network assets will remain in efficient use for far longer than a single regulatory control period (many network assets have economic lives of 50 years or more). As a result, a distributor will only need to replace a portion of its network assets in each regulatory control period. Our assessment of repex seeks to establish the proportion of Endeavour's assets that will likely require replacement over the 2019–24 regulatory control period and the associated capital expenditure.

B.4.1 Endeavour's proposal

In its proposal, Endeavour forecast repex of $800.5 million ($2018–19, excluding overheads)[96], which is 29 per cent higher than the $619 million ($2018–19) that it expects to spend over the current period.[97] In summary, Endeavour submits that this expenditure is driven by:

- asset renewal when the condition of the asset indicates that the continued safe and reliable operation is no longer economically viable.
- regulatory obligations that drive Endeavour's investment including public safety, workplace safety and environmental legislation.[98]

B.4.2 Position

Endeavour has not established that its proposed repex of $800.5 million ($2018–2019 dollars, excluding overheads) is efficient and prudent. Our analysis resulted in an initial estimate of $590 million relative to its proposal. However, as part of its updated capex forecast, Endeavour has updated its repex forecast to $600 million. Upon weighing up a number of considerations, including the immateriality between its updated repex forecast of $600 million and our initial estimate of $590 million, we consider Endeavour's updated repex, excluding overheads, to be prudent and efficient and would form part of our substitute. We have therefore included $600 million for forecast repex in our substitute estimate. This is 25 per cent less than that proposed in

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95 A condition assessment may relate to assessment of a single asset or a population of similar assets. High value/low volume assets are more likely to be monitored on an individual basis, while low value/high volume assets are more likely to be considered from an asset category wide perspective.

96 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2014*, April 2018, Public p.135.

97 This includes estimates for 2017-2018 and 2018-2019 as currently estimated by Endeavour. See, Endeavour Energy, *RIN0.01 Final RIN Workbook 1 Reset (Consolidated)* - 30 April 2018 - Public.

98 Endeavour, *Regulatory Proposal 1 July 2019 to 30 June 2014*, April 2018, Public p.135.

Endeavour's proposal. Table 5.6 summarises Endeavour's proposal, updated forecast and our substitute estimate for repex.

Table 5.6 Draft decision on Endeavour's total forecast repex ($m 2018–19)

	2019-20	2020-21	2021-22	2022-23	2023-24	Total
Proposal	151.0	153.0	159.7	164.0	172.7	800.5
Endeavour updated forecast and our draft decision	109.2	120.2	118.7	124.1	127.8	600.3
Total difference between our decision and the proposal	(41.7)	(32.7)	(40.9)	(39.8)	(44.9)	(200.2)
Percentage difference between our decision and the proposal (%)	-27%	-21%	-25%	-24%	-26%	-25%

Source: AER analysis. Numbers may not add up due to rounding.

B.4.3 Reasons for our position

In this section, we set out our review of Endeavour's initial repex forecast of $800 million, which it proposed in its proposal. We have applied several assessment techniques to assess Endeavour's forecast of repex against the capex criteria. These techniques include:

- trend analysis of Endeavour's past expenditure;
- predictive repex modelling based on Endeavour's assets currently in commission when compared to its industry peers;
- Endeavour's performance against several network health indicators;
- consideration of bottom-up and top-down methodologies, such as business cases and top-down challenges or constraints;
- advice from technical and engineering experts (if applicable); and
- stakeholder submissions.

When weighing up all the above techniques, we observed that Endeavour's initial forecast repex of $800 million is likely to be overstated. As an example, we have found that Endeavour has one of the youngest networks compared to its peers in the NEM. See Figure 5.17 below. We have also estimated its expected replacement age, as part of our repex modelling and based on Endeavour's historical asset replacement practices, and we have found that, it is generally relatively shorter than its peers.

In coming to our position, we have been informed by the results of our predictive modelling where our modelled repex for Endeavour is $540 million, which is approximately 67.5 per cent of its total initial repex. We used the outputs of the model to inform the areas of further investigation.

For the remainder of Endeavour's repex where we have not used predictive modelling, we have relied on several factors, including expenditure trends, asset health indicators and supporting material such as a sample of Endeavour's bottom-up build to assess Endeavour's repex forecast for the 2019–24 regulatory control period. In assessing both the modelled and unmodelled repex, we have also had regard to EMCa's independent advice in relation to Endeavour's repex. Table 5.7 shows Endeavour's forecast repex in each category as well as the breakdown between modelled and unmodelled repex.

Table 5.7 Endeavour's forecast repex and its breakdown into asset groups (direct costs, $m 2018–19)

Asset group	Forecast 2019-2024 ($m)
Poles	$160
OH conductors	$89
UG cables	$66
Services lines	$47
Transformers	$107
Switchgear	$72
Unmodelled Repex	$260
Total Repex	$800

Source: AER Analysis, *Response to Final RIN Workbook (Consolidated),* Public, 30 April 2018

Trend analysis

Trend analysis of a distributor's past expenditure allows us to draw general observations about how a distributor is performing, as well as to provide a sanity check against our predictive modelling results. In addition, one capex factor that we must have regard to is the actual and expected capital expenditure during any preceding regulatory control period.[99]

For some aspects of our assessment where we have not relied on predictive modelling, we have considered historical levels of expenditure to forecast repex or to determine our substitute estimate. In particular, where past expenditure was sufficient to achieve the capex objectives, this can be a reasonable indicator of whether an

[99] NER, cl. 6.5.7(e)(5).

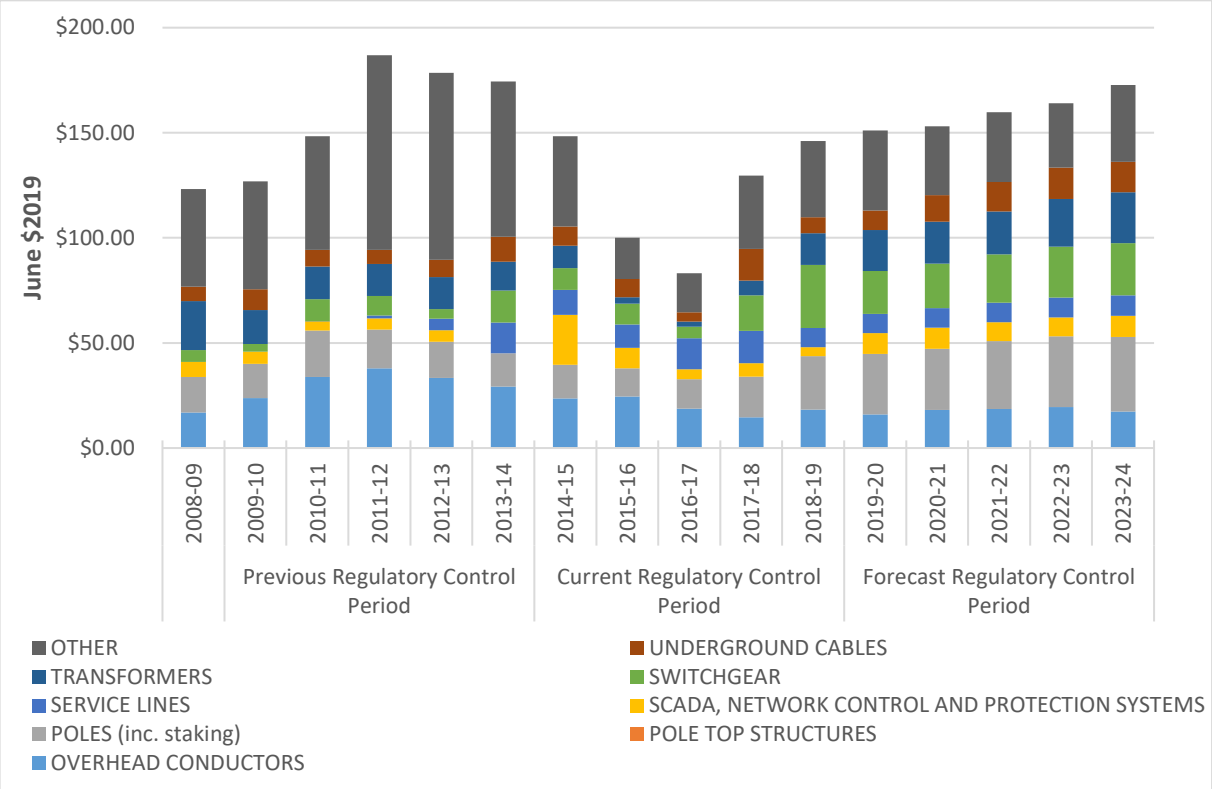
amount of forecast repex is efficient and prudent, and whether we would be satisfied forms part of a forecast capex that reasonably reflects the capex criteria.[100]

In coming to our position, we had regard to the following trends:

- Endeavour's proposed forecast repex for the 2019–24 regulatory control period relative to its actual spend in the current regulatory control period; and
- Endeavour's long term trend for repex.

Figure 5.9 below shows Endeavour's historical actual repex compared to its proposed forecast repex for the 2019–24 regulatory control period, where forecast repex is approximately 29 per cent above actual repex in 2014–19 regulatory control period.

Figure 5.9- Comparison of historical and forecast repex (direct costs, $m 2018–19)



Source: AER Analysis, Response to Regulatory Information Notices.

In viewing these trends, it is important to consider the particular circumstances that have led to the repex profile over the last 10 years. On 1 August 2005, the NSW Minister for Energy & Utilities introduced the New Licence Condition for NSW distributors requiring certain reliability and network design and planning standards to be met.

[100] AER, *Expenditure Forecast Assessment Guideline for Electricity Distribution*, November 2013, pp. 7–9.

The change in reliability standards explain the significant repex, as observed in the profile in the 2009-14 period. The licence conditions accelerated upgrades to the NSW distribution networks to meet improved network design planning criteria by 1 July 2014, and meet decreasing supply interruption duration and frequency targets between 2005 and 2010.

The AEMC final report on the review of distribution reliability outcomes and standards, which was published in 2012, noted Endeavour was currently outperforming against the existing reliability standards,[101] which may suggest that compliance with the standards could have been achieved with a lower amount of expenditure.

An amendment to the licence conditions took effect from 1 July 2014, and it removed the design planning requirements that imposed a particular standard on the design and planning of the network. Without these requirements, the distributor should only be undertaking capex where the benefits outweigh the costs. This explains the reduction in expenditure from 2014 onwards. Endeavour noted, in the proposal that the removal of the planning standards, in conjunction with the lease process and the remittal all led to the deferral of planned capital investment in from 2014 to 2017.[102] In its proposal, we observed that Endeavour is estimating a step-up in repex in the last two years of the current regulatory control period, namely 2017-19. Endeavour notes that following the completion of the lease transaction process, the new owners recognised the need to increase investment following the capital deferral in the first three years of the regulatory control period.

In assessing forecast repex, when viewing the longer term trend, we sought to understand the driver behind the apparent step-up in repex. Our analysis demonstrates that Endeavour has a relatively young fleet of assets in commission, which could be attributed to the abnormally high capex spend over the 2011–12 to 2014-16 period. Therefore, we sought to understand why there was an additional step up in repex. A few submissions, summarised in Table 5.8 below, have flagged similar concerns.

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101 AEMC, *Final Report - NSW Workstream - Review of Distribution Reliability Outcomes and Standards*, Public, 31 August 2012, p.i.

102 Endeavour, *Regulatory Proposal 1 July 2019 to 30 June 2014,* Public, April 2018, p.115.

Table 5.8 Public submission on Endeavour's repex profile

Stakeholder	Issue	Description
Consumer challenge Panel	Step-up in repex	CCP10 noted the significant step-up in repex. CCP10 highlighted that Endeavour has not justified its repex around actual failure rates and the effect of those. CCP10 questioned whether the current underspend in repex is due to efficient practices or not.
Consumer challenge Panel	Historical 'risk buffer'	CCP10 noted that Endeavour's proposal has not considered the 'risk buffer' due to the historical expenditure on those assets particularly during the deterministic planning license requirement.
Public Interest Advocacy Centre	Step-up in repex	PIAC noted the step up in repex and questioned the need behind such step-up.
Energy Users' Association Australia	Benefits of historical expenditure	EUAA observed the step-up in Endeavour's capex proposal and stated this is indicating that customers seem to have received little benefit for the huge capital investments over the last decade.
Energy Consumers Australia	Removal of planning standards	ECA noted the removal of the planning standards. ECA flagged that there may be opportunities to better manage the asset replacement program, with rapid response plans. ECA gave an example that the loading in the zone substations will only exceed demand in 27 out of 166 substations by 2024, which means that there is a very small exposure period where customers' supply is interrupted, which offers options to delay transformer replacement.

Repex modelling: a top-down assessment of modelled repex

The repex model can be used to advise and inform us where to target a more detailed bottom-up review and define a substitute estimate, if necessary. The model can also be used to compare a distributor against other distributors in the NEM. [103] In coming to our position, we have incorporated specific feedback on Endeavour's input data, when Endeavour established a basis for amending the input data.[104]

We recognise that it may be difficult to model some categories of repex. Sometimes expenditure cannot be forecast by the repex model due to a non-age related reason for the asset replacement (such as a change in jurisdictional safety or environmental

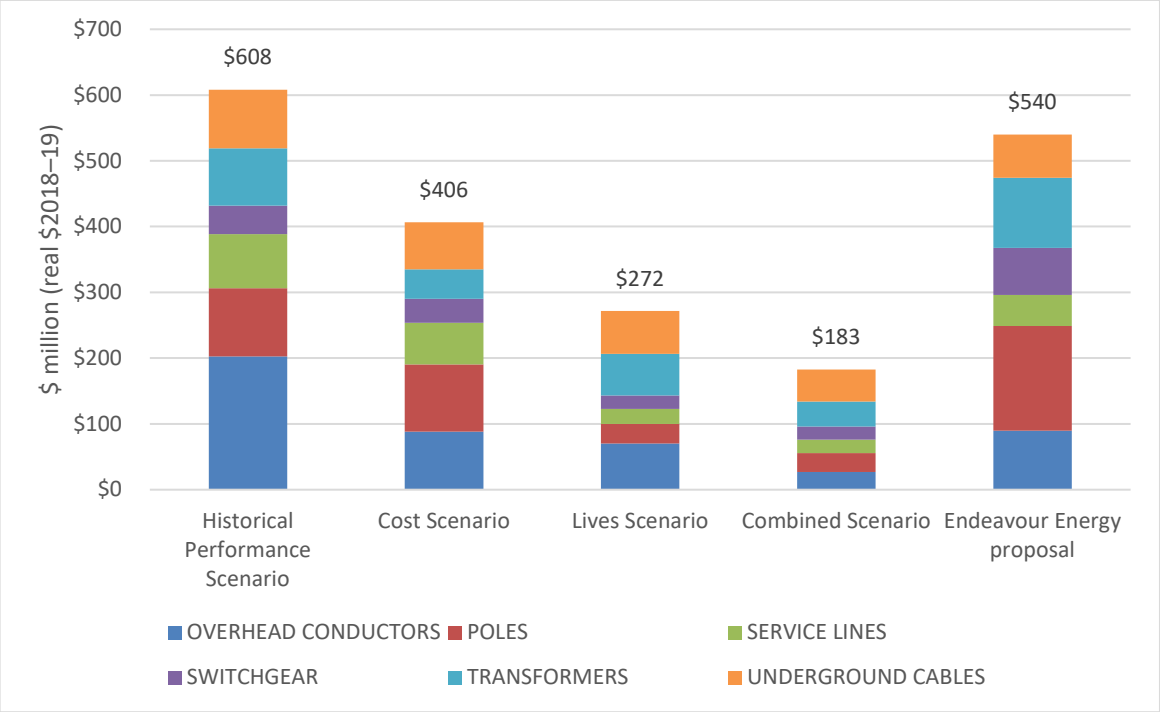
[103] This includes Power and Water Corporation.

[104] Endeavour, *IR018 Information Request Response - Question 3,* Public, July 2018.

legislation) or there may not be sufficient data on particular repex categories. We rely on other evidence to assess the prudency and efficiency of this unmodelled repex.

The results of our repex model show that Endeavour's forecast modelled repex, which is 69 per cent of total forecast repex, is 33 per cent above the threshold level of repex of $406 million. The outcomes from the scenario analysis are set out in Figure 5.10 below.

Figure 5.10 - Output of the repex modelling scenario comparison (direct costs, $m 2018–19)



Source: AER Analysis.

Note: Historical Scenario uses historical unit costs and calibrated expected replacement lives
Cost Scenario uses comparative unit costs[105] and calibrated expected replacement lives
Lives Scenario uses historical unit costs and comparative expected replacement lives[106]
Combined Scenario uses comparative unit costs and comparative expected replacement lives

As Figure 5.10 shows Endeavour's results are being driven by differences in its forecast units and forecast replacements volumes relative to the industry median on unit costs and expected replacement lives.

Endeavour's result is driven by forecast unit rates being higher compared to the industry median for three of the six asset groups we model, namely in poles, modelled switchgear and modelled transformers. Similarity, the expected replacement lives are shorter than the industry median for all the modelled asset groups. This is indicative of a tendency to replace its assets earlier than its peers.

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[105] Minimum of a distributor's historical unit costs, its forecast unit costs and the median unit costs across the NEM.

[106] Maximum of a distributor's calibrated replacement life and the median replacement life across the NEM.

Assessment of top down and bottom up methodologies

We reviewed Endeavour's bottom-up and top-down methodologies, which were used to forecast repex for the 2019–24 regulatory control period.

Endeavour used a number of approaches to forecast its repex. These include:

- Value Development Algorithm (VDA), which is a network investment and decision-support tool, which provides the capability to algorithmically model requirements in order to determine optimal levels of repex investment. The model is a primarily aged-based, however, it can use 'high-level' asset condition as an input.[107] Endeavour notes that it uses the VDA to provide a reasonableness check against the achievement of network outcomes.[108]
- Condition or reliability based repex forecast, which highlights the assets' renewal at the project and program level. Endeavour notes that short-term renewal needs are based on field assessments, operational requirements, industry experience, safety, environmental and regulatory requirements, maintenance issues, spares availability and age. We have observed that Endeavour uses the VDA model forecasts as a substitute for bottom-up condition based forecast for medium to long-term estimates.[109]
- Benchmarking, which is based on results from Nuttall Consulting who applied the AER's repex model,[110] based on our approach in recent determinations in Victoria and Tasmania.

We observe that, overall, Endeavour has engaged with us constructively, during the 'deep dives' stage, the on-site discussions and through its responses to our information requests. Since the 2014–19 determination, it would appear that Endeavour's businesses practices, for particular asset groups have improved. An example is the use of neutral integrity monitoring capability, to identify the sections of its underground cable (e.g. CONSAC) that are in poor condition and to assist in prioritising replacement of cable sections.[111]

However, we, along with EMCa, have identified systemic issues with Endeavour's forecasting and risk governance methodologies that are evident throughout the proposal, being:

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[107] The VDA model has asset condition as an input to the model. The input is general in nature and it treats assets as population, rather than as individual assets. For example, Endeavour can model one of its asset categories to have 20 percent of its population to be in a good condition and 20 per cent to be in a poor condition. See Endeavour Energy, *Information Request Response - Preproposal - Q1 - VDA Reg Capex scenario inputs and outputs*, Public, 19 February 2018.

[108] Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024, Public,* April 2018, p.110.

[109] Endeavour Energy, *Strategic Asset Renewal Plan FY19-FY28*, Public, 2018.

[110] Nuttall Consulting notes that the approach in the report is based on our most recent available determinations, which at the time of report were our determinations for Victoria and Tasmania.

[111] Endeavour Energy, *Response to Information Request 013 - Distribution Mains Asset Class Plan*, June 2018, p.15-16.

- Lack of clarity regarding the aggregate forecast repex - it is not clear how Endeavour established that its proposed repex forecast of $800 million is consistent with the capex criteria. EMCa's understanding, which is based on the on-site discussion, is that the repex forecast was determined through the modelling of tariff outcomes.
- Lack of justification for the replacement volumes proposed, which is a consequence of interplay between Endeavour's top-down challenge and bottom-up forecast. Endeavour has stated that it relies on forecasts from the VDA model for the medium to long-term only. However, EMCa has observed that if the bottom-up forecasts were less than the VDA model, then Endeavour used the VDA forecast. This blurs the line between the top-down challenge and the bottom-up forecast. [112]
- Limited application of risk analysis across the portfolio, which is coupled with a subjective approach to risk. This is evident in Endeavour's modelling of poles and pole tops' expenditure, where Endeavour relied on an age based replacement, without having regard to actual condition of the assets;[113]
- Short-term delivery orientation - Endeavour provided us with sample business cases for projects that are planned for the latter period of the current regulatory control period. However, we were not provided with business cases for any projects in the forecast period, which Endeavour stated is consistent with its IGF. In the absence of information, we sought to understand the basis behind the justification documents. Consistent with EMCa, we found them to be weighted towards resourcing and delivery rather than robust cost-benefit analysis.[114]

We have raised some of our concerns noted above with Endeavour. In addition, submissions to our issues paper have raised similar concerns with Endeavour's overall forecasting methodology.[115]

We have had regard to the updated repex forecast in coming up to our position. As discussed above, we have noted our detailed concerns with Endeavour's repex and forecasting methodology. We encourage Endeavour to consider these concerns and take steps towards continuous improvement in its forecasting approach, asset management practices and risk management in future resets.

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[112] EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.32 and Endeavour Energy, *Response to Information Request 014* - July 2018, p.8.

[113] Endeavour Energy, *Response to Information Request 013 - DS005 Distribution Pole Replacement*, Public, June 2018 and Endeavour Energy, *Response to Information Request 014 DS418 Pole Top Hardware*, Public, June 2018.

[114] EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.32.

[115] Energy Consumers Australia, *Endeavour submission - Final*, p.13.

Nuttall Consulting top-down review

Repex modelling

Endeavour commissioned Nuttall Consulting in the preproposal stage to assess its repex forecast.[116] From the outcome of these scenarios, Nuttall Consulting concluded that Endeavour's forecast modelled repex of $632 million would be below our alternative estimate, which was estimated to be $789 million.[117]

Nuttall Consulting compared Endeavour's forecast against three studies: applying historical costs (and historical replacement volumes and subsequently calibrated asset lives), applying forecast unit costs (and forecast replacement volumes and forecast asset lives) and then applying what Nuttall Consulting refer to as 'the AER's benchmark unit costs' (and historical replacement volumes and subsequently calibrated asset lives).[118] Nuttall Consulting's AER unit costs were derived from our past determinations for Victorian and Tasmanian distributors, which relied on the data at the time. [119] Nuttall Consulting also relied on a five-year historical calibration period.

We have reviewed Nuttall Consulting's report and associated supporting documentation. Nuttall Consulting rightly acknowledges that the repex modelling outcomes and conclusions assumes that the AER will produce estimates using a similar approach as was applied in previous decisions, which explains the divergence.

We consider the analysis and underlying assumptions to be sound. The differences between our modelled threshold alternative of $406 million versus Nuttall Consulting's forecast of $789 million is due to the following:

- our use of the most up-to-date industry data, which includes information request response;
- a more comprehensive comparative analysis using RIN data from all 14 distributors;
- a difference in the calibration period length[120];
- the modelling of specific asset categories that we do not consider can be modelled;

Nuttall Consulting assessed $850 million of repex, instead of $800, which was prior to Endeavour engaging with 'deep dives' with its stakeholders and us.

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116 Endeavour Energy, *Nuttall Report - 10.21 Assessing Endeavour's Replacement Forecast*, Public, February 2018.

117 Nuttall Consulting calculated a potential AER substitute estimate based on past decisions.

118 Endeavour Energy, *Nuttall Report - 10.21 Assessing Endeavour's Replacement Forecast*, Public, February 2018, p.10.

119 Endeavour Energy, *Nuttall Report - 10.21 Assessing Endeavour's Replacement Forecast*, Public, February 2018, p.9.

120 We have used three-year calibration period in this determination for Endeavour, as we consider that the years prior to 2014 to not be representative of Endeavour current replacement practices due to the reliability standards. For more information about our assumptions, please refer to the repex modelling workbook.

We have had regard to Nuttall Consulting's observations, which point to a more thorough assessment of a particular asset groups in Endeavour's forecast repex, being:

- Endeavour's forecast unit costs, in aggregate, are higher than historical unit costs.
- Endeavour's historical expected asset lives, in aggregate, are shorter than the expected asset lives. [121]
- For LV underground cables, Nuttall Consulting pointed to the unit costs being anomalously low for a true per unit costs of underground cable replacement. The report attributes this data anomaly to the effect of 'gifted assets' methodology, which Endeavour used to estimate the replacement volumes.

On the last point, following further engagement, Endeavour provided further information which explained and, in our view, justified this anomaly. We then assessed this and concluded that, on balance, it was justified.

During the 'deep dives' stage, we engaged with Endeavour regarding our modelling approach and the outcomes of our modelling. In Endeavour's response to our issues paper, Endeavour noted that it understands our modelling approach and is prepared to apply this approach moving forward.

Bottom-up Considerations

We also undertook a detailed assessment of a sample of Endeavour's bottom up analysis, where available. In determining the asset groups that required further investigation, we were informed by whether the repex forecast is materially above the repex model threshold, the performance on trend analysis, as well as the materiality of each asset group as part of total repex. Taking all those aspects into consideration, we have focused largely on poles, transformers, and modelled switchgear asset groups.[122]

The analysis below supports our use of the repex model threshold of $406 million as our substitute estimate for the modelled component of repex.

Poles

Endeavour is proposing $159 million for the replacement, including staking, of its poles and associated expenditure with pole top hardware. Endeavour has noted that it proportioned its pole top hardware across the different poles categories in the RIN.[123] Therefore we have assessed the two expenditure categories together.

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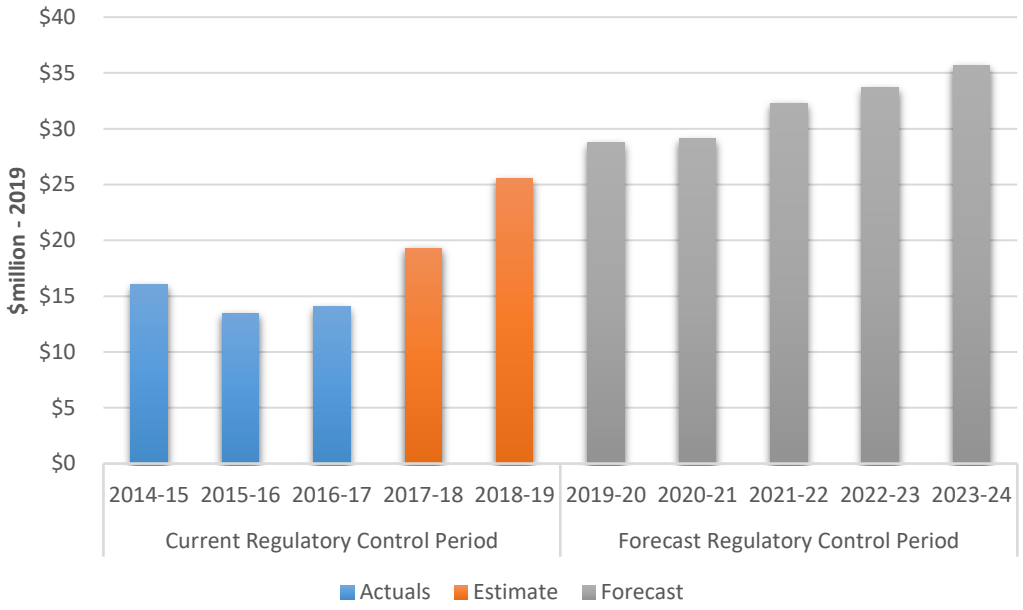
[121] Endeavour Energy, *Nuttall Report - 10.21 Assessing Endeavour's Replacement Forecast*, Public, February 2018, p.5.

[122] The three asset groups make up approximately 62 per cent of the modelled repex. The modelled switchgear are the component of the switchgear that have been consistently captured in the historical Category Analysis RINs.

[123] Endeavour Energy, *Response to Information Request Response 014 Information Request Response*, Public, July 2018, p.15

The Poles asset group is a material increase from the $88 million that it is expects to spend over the current period, and is a step-up of 55 per cent. Figure 5.11 below compares between the current and the forecast regulatory control periods.

Figure 5.10: Comparison between current and forecast expenditure for poles (direct costs, $m 2018–19)



Source: AER Analysis, Response to Regulatory Information Notices.

The largest programs in this asset group are the distribution poles' replacement program and the pole top structures' refurbishment program. Together they make up 68 per cent of this asset group.

EMCa's assessment of these two programs highlighted the following issues:

- The forecast for poles and pole top structures is based on an age-based assessment, in which timber poles that reach 55 years old are targeted for replacement or staking,[124] while pole top hardware is replaced in the period of a 26-30 and 51-55 year of a pole life.[125] EMCa noted that age-based forecasts are biased towards the overestimation of actual expenditure requirements.[126] EMCa added that Endeavour has not demonstrated that the age-based forecast, which underpins the forecast increased expenditure is superior to a condition based forecast[127].

[124] Endeavour Energy, *Response to Information Request Response 013 Distribution Pole Replacement*, June 2018.
[125] Endeavour Energy, *Response to Information Request Response 014 DS418 Pole Top Hardware*, June 2018.
[126] EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.49.
[127] EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.49.

- On comparing Endeavour's own estimate of condition based forecast for pole top hardware in 2018–19 financial year, with the age based forecast over the 2019–24 period, EMCa observed that the age based forecast results in a much higher volume than the condition-based approach.[128] Endeavour notes that there is a backlog of defects from the current regulatory control period[129]. However, EMCa has observed that Endeavour has not demonstrated whether it will successfully address the carryover defects or whether it will continue to accumulate a backlog of defects[130].
- Consistent with earlier statements in Section B.1.1, Endeavour did not provide cost-benefit analysis or quantified risk analysis for its poles' replacement program to fully examine the various options to demonstrate that the volumes selected, for replacement versus staking are justifiable.

EMCa's bottom-up assessment of Endeavour's poles and pole top hardware expenditure supports the repex model findings for this asset group.

Transformers

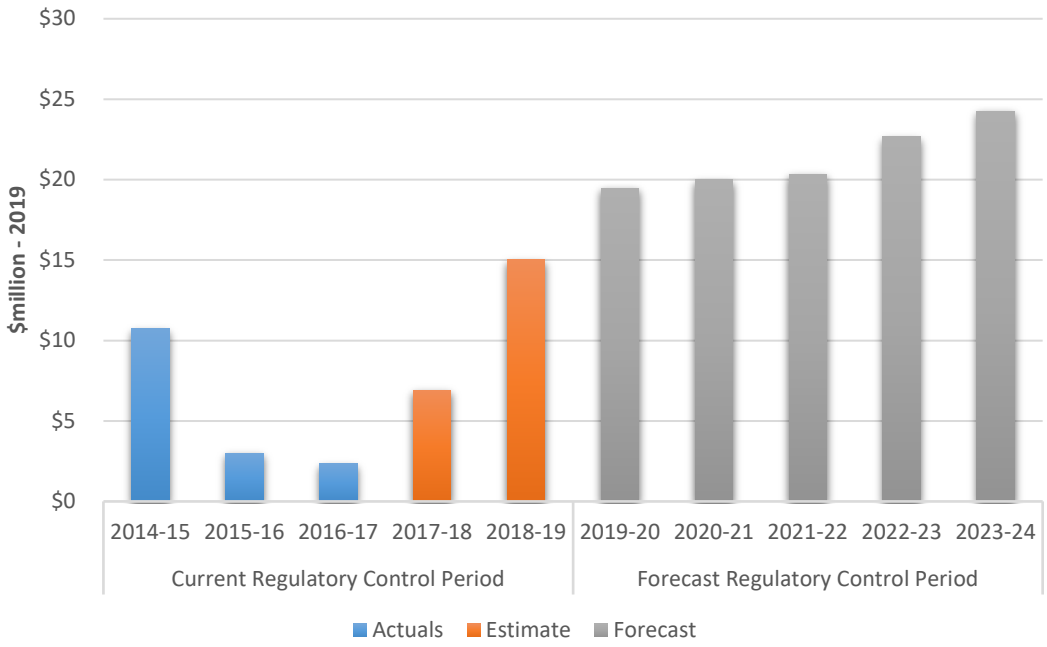
Endeavour is proposing $107 million of repex to replace some of its current transformer population over the 2019–24 period. We have compared the proposed repex amount to the historical repex in this asset group. The proposed amount is a 173 per cent increase from the estimated expenditure over the 2014–19 period. Figure 5.12 below compares the current and forecast regulatory control periods.

[128] Endeavour Energy, *Response to Information Request Response 015 DS005.19 Project Scope Distribution Pole Replacement*, March, p.4.

[129] Endeavour Energy, *Response to Information Request Response 014 DS418 Pole Top Hardware*, June 2018.

[130] EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.49.

Figure 5.11: Comparison between current and forecast expenditure for transformers (direct costs, $m 2018–19)



Source: AER Analysis, Response to Regulatory Information Notices.

The largest program in the transformer asset group is the power transformer replacement program, which is $62 million of repex in the 2019–24 period and makes up approximately 60 per cent of this asset group.[131]

EMCa has raised several concerns with this program, being:

- In the renewal program, 16 out of the 25 transformers that are scheduled for replacement in 2019–24 period are designated as medium priority. The remaining 9 transformers are low priority and it is unclear why the low priority ones are included in the forecast.[132]
- Endeavour's statements in its renewal plan, transformer asset class plan, condition reports and proposed volumes contradict each other. For example, Endeavour states that 17 transformers will be considered for replacement in its SARP.[133] This is considerably less than its forecast volumes of 25 transformers, without justification as to the difference between the two. Similarly, the asset class plan

131 This program makes up approximately 60 per cent of this asset group. See Endeavour Energy, *Response to Information Request Response 006 updated repex mapping*, Public, June 2018.

132 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.61. Following the completion of EMCa's review, we have received further information from Endeavour, which clarified that there is only one low priority transformer that is forecast to be replaced in 2019-24 period, due to its low insulation resistance. See Endeavour Energy, *Response to Information Request* Response *025 Information Request Response* - August 2018 - Public, p.4.

133 Endeavour Energy, *Response to Information Request Response 013 - Asset Class Condition Report - Power Transformers*, June 2017 p.21.

states that there will be a combination of transformers that will be replaced and some that will be refurbished, while the renewal plan includes transformers for replacement only, without any allowance for transformer refurbishment. EMCa noted that it is unclear how Endeavour has decided the quantum of replacement versus refurbishment.[134]

- Consistent with earlier statements in Section B.1.1, Endeavour has only provided a cost-benefit analysis, along with probabilistic analysis, for two projects that are scheduled for replacement in the 2019-20 financial year[135]. However, we have observed that the two projects are for reactive replacement of failed transformer units and are not in fact included in the list of transformers to be replaced in the forecast period[136]. Nevertheless, we have assessed the business cases and accompanying analysis and observed that the option analysis did not consider the retirement of the transformers. In addition, EMCa noted that the remainder of the transformer replacement projects do not have accompanying cost-benefit analysis that would allow us to fully understand Endeavour's decision making when it comes to the economic timing of the replacement, refurbishment or retirement.[137]

On the last point, we have received a public submission from ECA which supports EMCa's view regarding the lack of evidence or option analysis for transformer retirement[138]. ECA note that it is likely that even in the rare event of a transformer failure, customers may not be affected, or there may be a very small exposure until the load is transferred.[139] EMCa's advice, along with ECA's submission, supports our view that there is a lack of justification in the Endeavour transformer's repex forecast, which support the repex model findings for this asset group.

Modelled Switchgear

The modelled switchgear asset group is $71 million and is largely made up of an air break switch replacement program and 11 kV zone substation switchboard replacement program, which are discussed in turn below.[140]

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134 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, Public, August 2018, p.61.

135 Endeavour Energy*, Response to Information Request Response 013 TS619 Dundas ZS transformer replacement business case* - May 2018 - Public and Endeavour Energy, *Response to Information Request Response 013 TS620 Minto ZS transformer replacement business case* - June 2018 - Public.

136 Endeavour Energy, *TS600 power transformer replacement program*, Public, 14 August 2018.

137 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.61.

138 This is evident in the Minto and Dundas ZS replacement business cases. See Endeavour Energy*, Response to Information Request Response 013 TS619 Dundas ZS transformer replacement business case* - May 2018 - Public and Endeavour Energy, *Response to Information Request Response 013 TS620 Minto ZS transformer replacement business case* - June 2018 - Public.

139 Energy Consumers Australia, *Endeavour submission - final*, p.13.

140 The two programs make up approximately 75 per cent of this expenditure item. See Endeavour, *Response to Information Request Response 006 Updated Repex mapping,* Public, June 2018.

The air break switch program is a recurrent program and is forecast as $18 million in 2019–24 period. Endeavour noted that it revised its strategy for air break switches in 2016, which assesses whether air break switches could be removed from the network, if they are no longer required.[141] Endeavour expects to remove 20-30 per cent of the total number of switches that are currently in operation.[142] Despite the absence of detailed analysis for the forecast period, we have assessed the revised strategy and Endeavour's analysis for the 2017–18 financial year. On balance, we consider Endeavour's revised strategy to be prudent and efficient and is likely to result in prudent and efficient forecast expenditure.

On the other hand, our consultant, EMCa, has requested further risk analysis to understand the analysis underpinning the 11 kV zone substation replacement in the forecast period, which is forecast as $35 million of repex.[143] Endeavour has provided a risk assessment for its switchboard replacement program. EMCa has identified that 24 out of the 39 switchboards that are proposed for replacement in the forecast period did not pass the cost benefit analysis, as the cost of works exceeded Endeavour's calculated risk cost. Despite those results, Endeavour has overridden the 'do nothing' option with an option to replace the switchboard or to replace the truck, without a justification of why a change away from the 'do nothing' option is required.[144] The bottom-up analysis for this category of expenditure supports our repex model findings.

Unmodelled repex

For unmodelled repex, where we have not used predictive modelling, we have relied on several factors to assess Endeavour's repex. We relied on expenditure trends and supporting material, Endeavour's asset class plans,[145] statement of needs and project scopes. Based on the information before us, Endeavour has not established that the unmodelled component of repex is efficient and prudent. We have separated the unmodelled repex into three distinct groups:

- Substation establishment, which is the largest group of expenditure at approximately $171 million.
- Supervisory Control and Data Acquisition (SCADA), network control and protection systems, which is $47.9 million.
- The unmodelled component of the Switchgear asset group, which is $42 million.

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141 Endeavour, *Response to Information Request Response 005 DS405 ABS Replacement Process Improvement* - August 2016 - Public, p.3.

142 Endeavour, *Response to Information Request Response 005 DS405 Master List for ABS Replacement Scoping Lockout*, Public, June 2018.

143 Endeavour, *Response to Information Request Response 005 DS405 Master List for ABS Replacement Scoping Lockout*, Public, June 2018.

144 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.59.

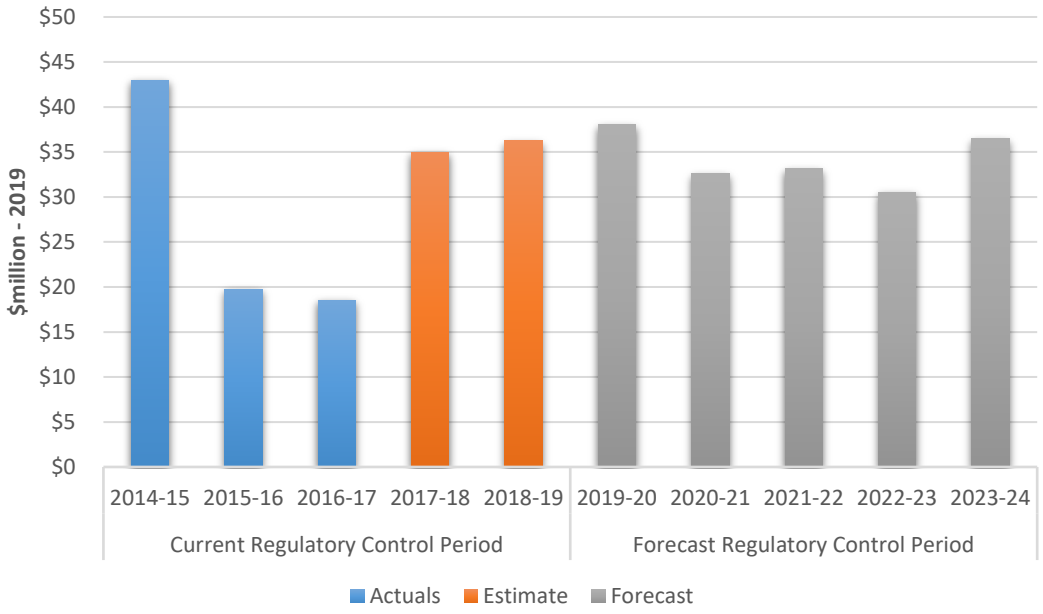
145 Endeavour describes asset class plans as documents that provide high level information on asset class population, condition and performance. Endeavour noted that the asset class plans aim to identify gaps and opportunities to improve asset data.

Substation Establishment

Endeavour proposed $171 million for substation establishment, which is the largest component of repex. Endeavour noted that this category is associated with the piecemeal like for like replacement of substation assets.[146] This includes, but is not limited to, buildings' refurbishment or replacement, battery replacement or duplication, roof refurbishment and civil works' development.

We have compared the proposed repex on this component with the historical expenditure. Figure 5.13 below demonstrates the comparison. The proposed amount is a 12 per cent step up from the estimated expenditure over the 2014–19 period, noting that the last two years of the 2014–19 period is a step up from actual expenditure in the preceding two years.

Figure 5.12: Comparison between current and forecast expenditure for substation establishment (direct costs, $m 2018–19)



Source: AER Analysis, Response to Regulatory Information Notices.

The substation establishment repex component is made up of 34 programs. EMCa has assessed this component of repex and has a number of concerns, summarised as follows:

- Endeavour has not demonstrated that it has optimised the portfolio of expenditure that relates to substation sites[147]. For the major substation renewal programs, Endeavour has allocated $50 million for Carlingford, Unanderra, West Wollongong,

146 Endeavour Energy, *AER Actions - Business cases for unmodelled repex*, Public, 13 February 2018.

147 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, Public, August 2018, p.66.

Sussex Inlet and Greystones. EMCa observed that Endeavour has not demonstrated the ability to find a lower cost solution employed for substation renewal projects. EMCa concluded that it is foreseeable that, through further option analysis, Endeavour is likely to find these lower cost solutions for those projects.

- There are more than 10 programs, totalling $32.3 million, which relate to ancillary substation items. Those programs appear to be based on an allowance-based approach without accompanying cost-benefit analysis[148]. Similarly, for Endeavour's future sub-transmission substation renewal project, there are no accompanying condition reports or risk assessment to justify $34 million of repex.[149]

Endeavour has initiated a RIT-D process for one of the projects in this category of repex, namely the Marayong ZS renewal. Our assessment of the RIT-D, indicated that Endeavour did not correctly define the identified need for the project, which subsequently led it to not fully considering the option to retire the substation[150]. This is consistent with EMCa's assessment of the transformer asset group below[151].

Based on EMCa's advice that this repex category is significantly likely to be overstated and is not prudent and efficient. Instead, we consider $128 million for the substation establishment component of repex is prudent and efficient. This is based on a pro-rata reduction of 25 per cent, which is in line with the repex model outcomes for the modelled components. In this instance, we consider that there is a correlation between the substation establishment category and the modelled component of repex. Therefore, we are satisfied that our substitute estimate of $128 million would form part of a total capex forecast that reasonably reflects the capex criteria. .

SCADA, network control and protection systems

Endeavour proposed $47.9 million for this asset group. We have compared the proposed repex amount to the historical repex for this asset group. The proposed amount is 5 per cent below the estimated spend over the 2014–19 period. However, we observed, consistent with our consultant EMCa, that there is an abnormally high expenditure in 2014/15 period as shown in Figure 5.14 below. The expenditure in 2014-15 is more than three time the average expenditure over 2015-19 period.

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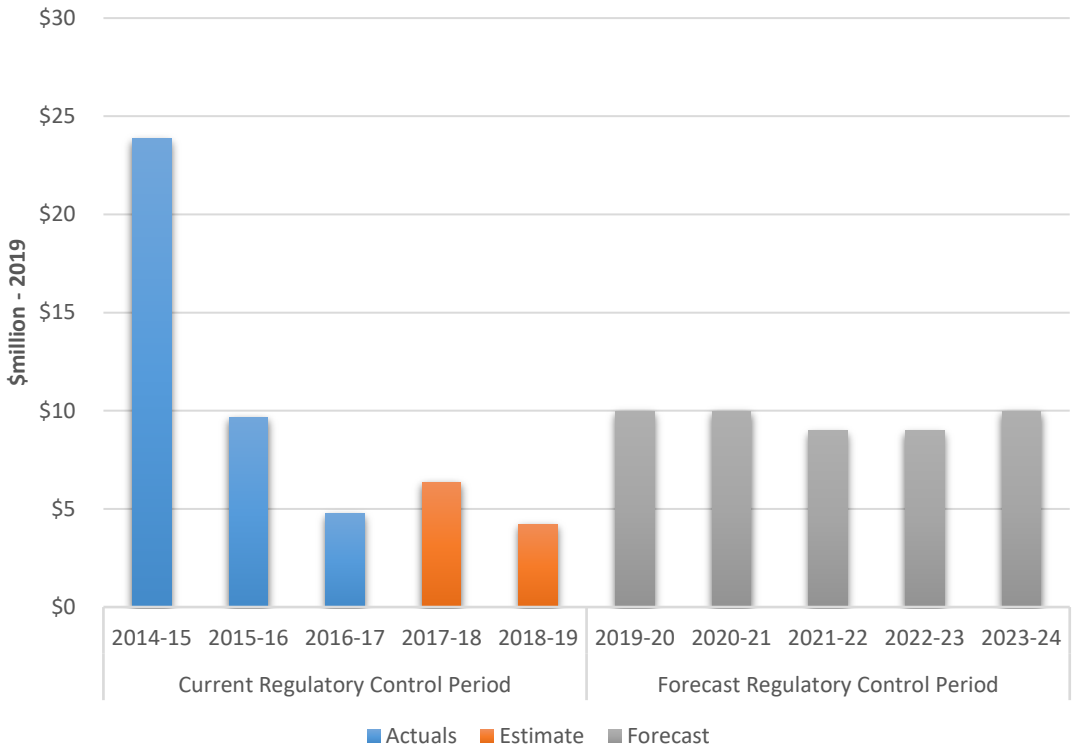
148 EMCa's notes that these programs relate to ancillary substation programs such as essential spares, battery replacement and earthing. See EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.67.

149 Endeavour Energy assumes a 20 per cent Endeavour Energy, *Response to repex questions - TS199 - Future sub-transmission renewal program*, 12 April 2018.

150 AER Letter for Endeavour Energy, Review of Compliance with clause 5.17.4 of the NER - Marayong ZSS Renewal RIT-D, 11 July 2018.

151 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, Public, August 2018, p.66.

Figure 5.13: Comparison between current and forecast expenditure for SCADA, network control and protection systems (direct costs, $m 2018–19)



Source: AER Analysis, Response to Regulatory Information Notices.

Endeavour has submitted that the proposed forecast repex amount is largely made up of expenditure, which is associated with replacement of remote terminal units, the upgrade of communication infrastructure and the enhancement and development of SCADA Master Station program.[152]

As part of information request 13 and 14, Endeavour has submitted five asset class plans that relate to this asset group. EMCa has observed that there is a lack of a comprehensive strategy, or evidence of optimisation, for this asset group, which suggests that the proposed expenditure is likely to be overstated.

For the RTU replacement program, which is $9.2 million in the forecast period, Endeavour describes a change in strategy from one of maintenance and repair to one of planned replacement, due to an increase in failure rates.[153] We acknowledge that there may be some observed failure rates, however, Endeavour has not shown the driver behind the change in strategy. Endeavour notes that most hardware and software failures can be resolved with little downtime of the asset, as such it does not

[152] See Endeavour Energy, *Response to Information Request Response 006 Updated Repex mapping* - June 2018 - Public.

[153] Endeavour, *Response to Information Request 013 Remote Terminal Unit Asset Class Plan* - June 2018, p.4.

have a consequence on service levels.[154] Therefore, based on the information before us, the consequence of failure does not warrant a change in strategy.

In addition, we have observed that the driver for prioritisation in the forecast period is mainly the age of the asset rather than condition. It is likely further analysis could re-prioritise or, plausibly, defer those RTU replacement as investments proceed towards Gate 2 and Gate 3.

Consistent with EMCa's observation, we sought to understand whether there was justification for the Wollongong pilot cable replacement program, which is $8 million in the forecast period. We have not received sufficient information pertaining to the risks that these projects are seeking to address.

Based on the information before us, Endeavour has not demonstrated that this proposed expenditure in this asset group is efficient and prudent. Instead, based on the historical average in the current period, being $6.25 per annum, and excluding the 2014-15 year (given the abnormally high spend in this year), we have included a forecast of $31.2 million in our substitute estimate.

Unmodelled Switchgear

Endeavour has proposed $42 million for ground type distribution substation switchgear. We have excluded this asset category from our modelled repex as Endeavour has noted that it has reported this category of expenditure as unmodelled repex in its 2014–17 Category Analysis RINs[155], as such it would not be captured in the repex model calibration process. We have assessed it as unmodelled repex.

This asset category is largely made up of the Holec MD4 epoxy switchgear replacement program, which is forecast as $35.9 million in the 2019–24 period. The remainder of this category is made up of low voltage switchgear replacement and compact LV switchgear replacement, which we are satisfied would form part of a total capex forecast that reasonably reflects the capex criteria.[156]

For the MD4 program, we have compared the proposed repex amount to the historical repex for this program.[157] The proposed amount is a significant step-up from the estimated spend over the 2014–19 period. The figure below shows the historical and forecast expenditure on this category.

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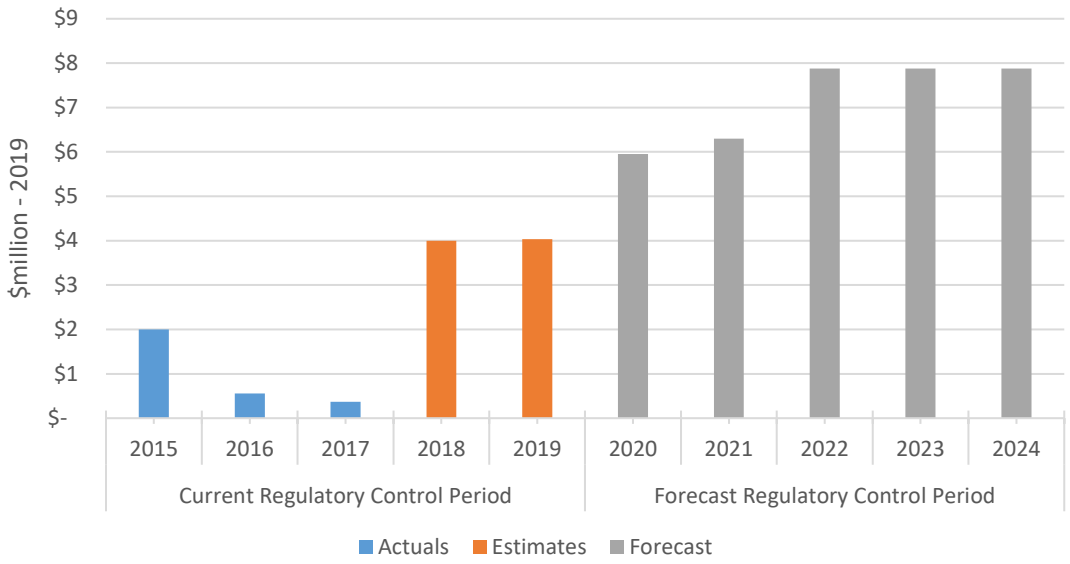
[154] Endeavour, *Response to Information Request Response 013 Remote Terminal Unit Asset Class Plan* - June 2018, p.6.

[155] Endeavour, *Response to Information Request Response 018 Information Request Response* - July 2018 - Public, p.2.

[156] The latter two programs show reasonably steady expenditure which is indicating the continuing nature of those programs. Endeavour, *Response to Information Request Response 018 Information Request Response* - July 2018 - Public, p.2.

[157] Endeavour, *Response to Information Request Response 018 Information Request Response* - July 2018 - Public, pp.3-4.

Figure 5.14: comparison between current and forecast expenditure for the unmodelled switchgear (direct costs, $m 2018–19)



Source: AER Analysis, Response to Regulatory Information Notices.

In response to our request for further justification regarding the observed step-up, Endeavour pointed to a recent review due to an observed increase in failure rate in padmount substations.[158] The changes have led to a new defect prioritisation process, which resulted in a significant uplift in the replacement of MD4 units.[159] There were no accompanying risk-based analysis. We, along with EMCa, are of the view, that Endeavour has not justified the significant step-up as we have not seen evidence to support the increase in risk in the forecast period.[160] Therefore, based on trending forward Endeavour's approved volumes and Endeavour unit rates in 2018-19,[161] we have included $24.5 million for the Holec MD4 switchgear in our substitute forecast.

Network Health Indicators

Network health measures provide useful information about the overall condition of a distributor's assets currently in commission. When assessing a distributor's proposed repex over the RCP, we will have regard to various network health measures to determine for instance whether a step up in forecast repex is required when a distributor has performed consistently well overtime on these health measures.

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158 Endeavour states that there are 10 failures per annum and refer to those failures as catastrophic. There does not appear to be an upward trend in the failures that would justify an increase in volumes beyond those forecast in 2018–19.

159 Endeavour - *Response to Information Request 018 - Information Request Response* - Juley 2018 - Public, p.3.

160 EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.58.

161 Endeavour, *Response to Information Request 018 - Project scope DS307.19 MD4 switchgear replacement* - November 2017 - Public, p.6.

In assessing Endeavour's network health, we have reviewed:

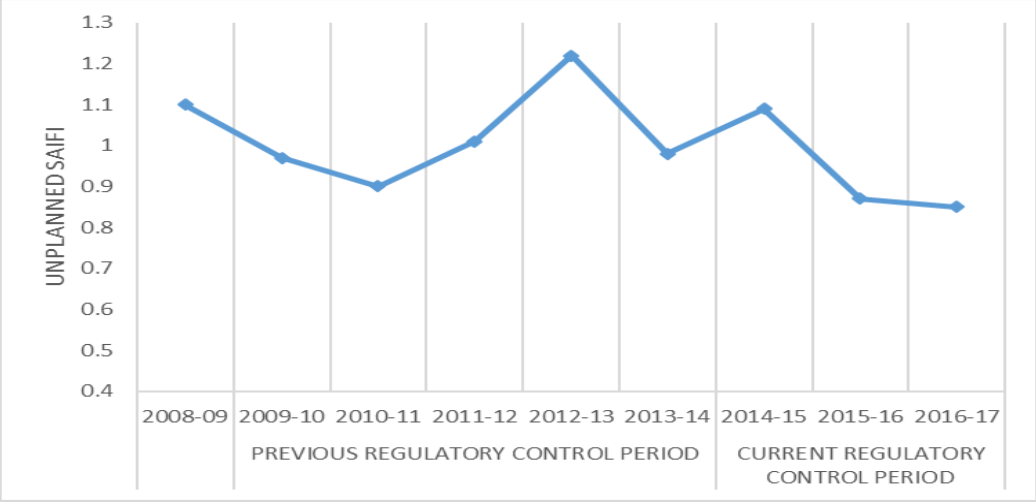
- measures of reliability on Endeavour's network.
- the age profile of assets in Endeavour's network, and where possible, relative to comparable networks.
- utilisation of Endeavour's network (where spare capacity should be correlated to asset condition). This is to provide an indication as to whether Endeavour's assets are likely to deteriorate more or less than would be expected given the age of its assets.

Overall, we observe a consistent improvement in trend for Endeavour's System Average Interruption Frequency Index (SAIFI) over the time. This indicates that Endeavour is likely to have a healthy network. This view is corroborated with Endeavour's average age, which is calculated to be the second youngest network in the industry. Endeavour's substation utilisation is stable between 2013-14 and 2017–18. Therefore, we expect that Endeavour's network should not have degraded from high usage.

Trends in reliability

We observe that Endeavour's SAIFI has improved over from 2008-2017. Our assumption is that a network that is in poor health is likely to experience more interruptions, which would correlate with a higher SAIFI. The improvement seen in Figure 5.16 suggests that Endeavour's network is likely to be in good health.[162]

Figure 5.15 - Endeavour whole of network unplanned SAIFI



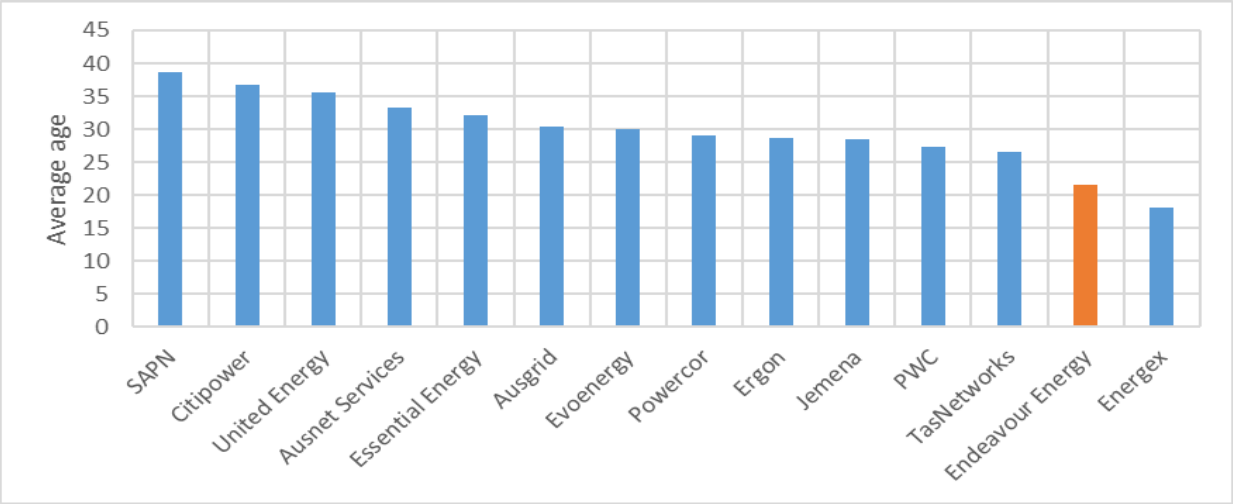
Source: AER Analysis, *Endeavour Economic Benchmarking Regulatory Information Notices - 3.6 Quality of Service*, 2008-17

[162] The SAIFI measures excludes Major Event Days (MEDs) and excluded outages.

Average Asset Age

We compared the average age of all Endeavour's assets with other distributors. Figure 5.17 below shows that compared to other distributors, Endeavour has a relatively young network. Endeavour's average asset age is below the industry average and is the second youngest in the NEM. This would suggest that Endeavour's network is likely to be in good health and would not support an increase in repex.

Figure 5.16 - Electricity distributor network average asset age



Source: AER analysis, *Category Analysis Regulatory Information Notice - 5.2 Asset Age Profile*, 2016-17.

Asset Utilisation

We consider that the degree of asset utilisation can have an effect on the condition of certain network assets. The relationship between asset utilisation and condition can vary across asset types. The relationship between asset utilisation and condition is not necessarily a linear one and the condition of an asset may be difficult to determine. As such, early-life asset failure may be due to utilisation, or one or a combination of other factors.

As Figure 5.3 shows that substation utilisation has been relatively stable between 2013-14 and 2017-2018. Although, we observe that there has been a marginal increase in the number of substations that have a capacity utilisation rate of 30-40 per cent in 2017–18 compared to 2013-14. Given the stable and generally low level utilisation, it is unlikely that Endeavour's network have suffered any material degradation that would substantiate a step up in repex.

B.5 Other system expenditure

Other system capex relates to capital expenditure items that Endeavour did not allocate to any of its major capex drivers. We have separately assessed these expenditure items under this capex category in this review.

We have examined the allocation of these costs to ensure that they are not included in any other capex driver. Endeavour confirmed that this expenditure was captured as

part of the 'balancing item' in the historical Category Analysis RINs[163]. We encourage Endeavour to consider allocating these items to capex drivers in its annual reporting and future reviews.

B.5.1 Endeavour's proposal

Endeavour has proposed other system capex of $41.4 million ($2018–19, excluding overheads)[164]. The forecast is 15 per cent, or $5.5 million, more than the $35.9 million ($2018–19) that it expects to spend over the current period.[165] Endeavour notes that this expenditure is driven by four categories, namely, technology, power quality, metering and relays and LV planning[166]. They are broken down as per Table 5.9 below. We have assessed each of those categories in turn.

Table 5.9 Endeavour's forecast other system and its breakdown into components (direct costs, $m 2018–19)

Asset group	Forecast 2019-2024 ($million)
Technology	$23.7
Power Quality	$4.6
Metering and Relays	$4.3
LV planning	$8.8
Total other system capex	$41.4

Source: Endeavour Energy, *Response to Information Request 006 - other repex item history*, June 2018, Public

B.5.2 Position

We are satisfied that the proposed other system capex forecast of $41.4 million reasonably reflects the capex criteria. In coming to our position, we were informed by a number of factors, namely, the performance of each category on trend analysis, the materiality of each component and its bottom-up composition. Taking all those aspects into consideration, we have largely focused on the other system component, technology capex.

Endeavour submitted that technology capex is made up of programs associated with the evaluation of operational technology solutions to assess their applicability and cost effectiveness in managing network issues.[167]

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163 Endeavour Energy, *Response to Information Request* 006, Public, June 2018.
164 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, Public, p.119.
165 Endeavour Energy, *Response to Information Request* 006, June 2018, Public.
166 Endeavour Energy, *Response to Information Request* 006, June 2018, Public.
167 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, Public, p.139.

Endeavour proposed $12.2 million capex for the forthcoming regulatory control period to upgrade its Outage Management System (OMS) to a Demand Management System (DMS), which Endeavour submitted is likely to result in a positive NPV of $3 million.[168] Endeavour has submitted that the existing system is now at end-of-life. Endeavour has commenced this project during the current period and the majority of the project is forecast to occur within this period. Endeavour has provided evidence demonstrating that the project has reached Gate 2.[169]

Based on the information before us, consistent with our findings in section B.1.1, we have some concerns with Endeavour's cost-benefit analysis. However, we acknowledge that the OMS is end-of-life and Endeavour has committed to the timing of this project.[170] On balance, despite our concerns, we have included an allowance for this program in our substitute estimate. However, we would expect that any improvement in operational efficiency, actual or forecast, to be delivered through this program would inform Endeavour's forecast for the 2024-29 regulatory control period.

As for the technology component of other system capex, Endeavour notes that its future network strategy details its approach to technology investment.[171] We have reviewed the strategy and have observed that it only provides a qualitative description of the project and programs, without any accompanying analysis or cost-benefit analysis. Importantly, we have identified the strategy includes projects that are not included in the forecast, and in the instances that the projects are included, they do not align with the numbers included in Endeavour's detailed capex program list.[172] It is unclear to us how Endeavour forecast this category of expenditure and what constitutes its projects - the technology pilots and the demand management trials.

Based on the information before us, we are not satisfied that the additional step up is justified, particularly for the technology component of other system capex. Despite our concerns with the justification for this program, we consider that the magnitude of the step up is immaterial in the context of the total capex forecast. Therefore, we have included the $41.4 million for the other system capex in our substitute estimate for total capex.

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168 Endeavour Energy, *Response to AER Information Request 002*, 8 August 2018.

169 Endeavour Energy, *Response to Information Request 002*, January 2017.

170 Endeavour Energy, *Response to Information Request 002*, November 2017.

171 Endeavour Energy, *Future Network Strategy*, March 2018, Public, p.140.

172 Endeavour Energy, *Capex Listing (PIP),* April 2018, Public.

B.6 Reliability compliance expenditure

Reliability compliance capex includes capex to meet network reliability performance obligations set out in Endeavour's licence conditions.

B.6.1 Endeavour's proposal

Endeavour proposed $20 million (excluding overheads) for reliability compliance capex. The forecast amount is $7.2 million ($2018–19) less than our allowance in 2014–19 period. However, the forecast is consistent with Endeavour's current estimated spend over the 2014–19 period, being $19 million ($2018–19).[173]

B.6.2 Position

Endeavour has demonstrated that its proposed reliability compliance capex forecast of $20 million reasonably reflects the capex criteria. Endeavour has identified that the expenditure will be used entirely to target compliance with NSW Licence Conditions Schedule 3, which relate to Individual Feeder Standards for the different feeders, such as rural long, CBD and rural short.[174] IPART monitors compliance with these licence conditions as part of its annual compliance report.[175] In 2016–17, IPART noted that the number of Endeavour's individual feeders that have not met the reliability standard has generally increased as a percentage of all feeders from 0.8 per cent in 2012–13 to 1.9 per cent in 2016–17.[176] This validates Endeavour's reliability strategy, which aims at maintaining performance at existing levels through operational actions and reduced capital intensive actions.[177]

We normally do not allow capex that aims at improving reliability beyond the current levels, unless it is due to a particular regulatory obligation. Any improvement is normally funded under STPIS. In this circumstance, our understanding is that Endeavour allocates these costs in order to target specific poor performing feeders. As such, it serves a small number of customers and will have no appreciable effect on SAIDI/SAIFI measures and therefore STPIS calculations.[178]

We have examined the allocation of these costs to ensure that they are not included in any other capex driver, in particular repex. We have requested further information to understand where the historical expenditure is reported. Similar to other system capex,

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[173] This includes estimates for the FY17-18 and FY18-19, Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, Public, p.138.

[174] Endeavour Energy, *STPIS Proposal and Reliability Licence Condition Compliance Capex Requirement: 2019-2024 Regulatory Control Period*, Public, p.9

[175] Endeavour Energy, *STPIS Proposal and Reliability Licence Condition Compliance Capex Requirement: 2019-2024 Regulatory Control Period*, Public, p.10

[176] IPART New South Wales, *Annual Compliance Report: Energy network operator compliance during 2016-17*, p.11-12.

[177] Endeavour Energy, *STPIS Proposal and Reliability Licence Condition Compliance Capex Requirement: 2019-2024 Regulatory Control Period*, Public, p.11.

[178] Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, Public, p.138.

Endeavour confirmed that this expenditure was captured as part for the 'balancing item' in the historical category analysis RINs[179]. As such, it has not been captured in the repex assessment or modelling.

On this basis, we are satisfied that the forecast expenditure of $20 million would form part of a total capex forecast that reasonably reflects the capex criteria, and we have included this amount in our substitute forecast.

B.7 Capitalised overheads

Overhead costs are business support costs not directly incurred in producing output, or costs that are shared across the business and cannot be attributed to a particular business activity or cost centre. The allocation of overheads is determined by the Australian Accounting Standards and the distributor's cost allocation methodology (CAM).

B.7.1 Endeavour's proposal

Endeavour proposed $400.0 million ($2018–19) for capitalised overheads in 2019–24. This is $26.7 million, or 10 per cent, higher than its expected expenditure in 2014–19 of $363.3 million.[180]

Endeavour submitted that total business overheads are forecast to be at the same level in 2019–24 as they are in the current period. However, a higher share of overheads are allocated to capex in accordance with Endeavour's CAM, because it expects direct capex to make up a higher share of total direct costs in 2019–24 compared with the current regulatory control period.[181]

Endeavour has constrained its forecast for capitalised overheads to $400 million. This means that it forecast its capitalised overheads requirements, then reduced this amount to a target expenditure of $400 million. This was achieved by reducing its forecast for direct capitalised overheads over the 2019–24 period and well below its expected expenditure in the current regulatory control period.[182]

B.7.2 Position

We consider that Endeavour's proposed capitalised overheads forecast of $400.0 million ($2018–19) is justified. When considered as part of Endeavour's updated capex forecast, we are satisfied that its capitalised overheads forecast reasonably reflects the capex criteria. Therefore, we have included this amount in our substitute forecast of total capex.

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179 Endeavour Energy, *Response to AER information request 006 - Information Request Response*, Public, June 2018

180 Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, Public.

181 Endeavour Energy, *Response to AER information request 019 - Information Request Response*, Public, July 2019.

182 Endeavour Energy, *Response to AER information request 019 - Information Request Response*, Public, July 2019.

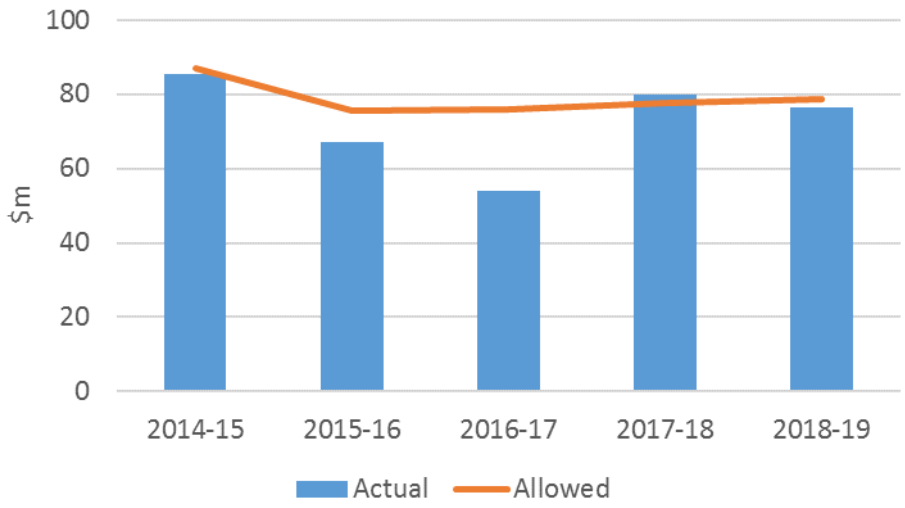
B.7.3 Reasons for our position

In coming to our position, we have assessed Endeavour's methodology, historical costs and trends, and considered total overheads across Endeavour's opex and capex functions. We have also had regard to Endeavour's updated capex forecast that it submitted in response to our issues paper.

Capitalised overheads in 2014–19

Figure 5.18 compares Endeavour's 2014–19 actual and estimated capitalised overheads with our allowance. Endeavour estimates capitalised overheads of $363.3 million in 2014–19. This is 8 per cent lower than our final determination allowance of $395.1 million ($2018–19).

Figure 5.17 Annual capitalised overheads, actual expenditure compared with AER allowance over 2014–19 regulatory control period (direct costs, $m 2018–19)



Source: AER Analysis.

Forecast capitalised overheads compared with current period

Figure 5.19 compares Endeavour's 2019–24 forecast capitalised overheads with actual/estimated expenditure in 2014–19. Endeavour has understated its historical capitalised overheads in its regulatory information notice. This was because direct capitalised overheads and network switching costs were previously reported as a 'balancing item' in the category analysis RIN.[183]

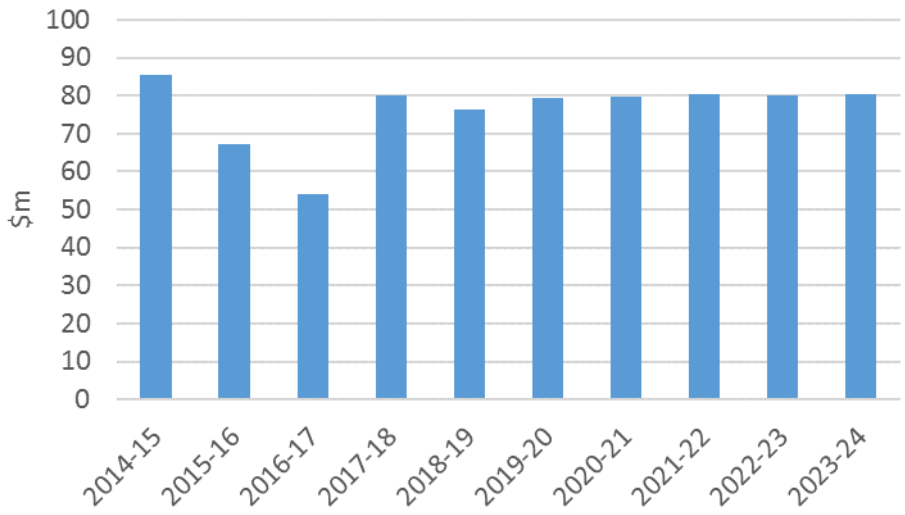
Capitalised overheads were lower in 2015–16 and 2016–17 because Endeavour incurred lower direct capital expenditure relative to total direct costs. As a result, a

[183] Endeavour Energy, *Response to AER information request 019 - Information Request Response*, Public, July 2019.

lower share of total indirect overheads were allocated to capex, while a higher share was allocated to opex. This is in accordance with Endeavour's cost allocation method (CAM).[184]

Conversely, capitalised overheads are expected to increase sharply in 2017–18 to around $80 million. This reflects a very large increase in direct capex and a decrease in direct opex. As a result, a greater share of the total indirect overheads pool will be allocated to capex. However, total overheads across capex and opex are expected to be largely unchanged in 2017–18 from the previous year.[185] Endeavour expects capex as a share of total direct costs to be broadly consistent from 2017–18 through to 2023-24.

Figure 5.18 Annual capitalised overheads, 2014–15 to 2023–24 (direct costs, $m 2018–19)



Source: AER Analysis.

Our assessment of forecast capitalised overheads

To estimate its forecast for capitalised overheads Endeavour calculates:

- total business indirect overheads, which are then allocated between capex and opex in accordance with Endeavour's CAM.
- direct capitalised overheads, which relate only to the capex program.

[184] Endeavour Energy's CAM stipulates that indirect overheads are allocated to capex or opex on the basis of their relative share of direct labour. This is highly correlated with direct capex.

[185] Endeavour Energy, *Response to AER information request 019 - Information Request Response*, Public, July 2019.

Calculation of the indirect overheads pool

Endeavour's forecast for total indirect overheads in 2019–24 is $784.6 million. This is $4.1 million, or 1 per cent, higher than expected expenditure in the current regulatory control period.[186]

Total indirect overheads are forecast by using 2017–18 base year and then applying a step-trend approach in accordance with Endeavour's forecasting methodology for opex.

Total indirect overheads in 2017–18 are expected to be at historically low levels. Endeavour notes that in the current regulatory control period it has achieved business efficiencies through its Endeavour 2020 program. These efficiencies were achieved through business model transformation, efficiency improvements to the network and corporate functions and a reduction to full-time employee numbers.[187] These savings have reduced total business overheads and therefore the level of indirect overheads that are allocated to capex. For these reasons, we consider 2017–18 to be an appropriate base year.

Endeavour has made no step-change adjustments to its forecast for indirect overheads. It has applied a trend to the forecast in line with its approach to its opex forecast. We have made adjustments to Endeavour's trend approach in our decision on opex; however, we do not consider that these changes will have a material effect on forecast capitalised overheads, therefore we do not propose adjustments to the forecast methodology for total indirect overheads.

Allocation to capex

Endeavour allocates total indirect overheads to capex based on direct capex labour to total direct labour for each year of the 2019–24 regulatory control period. This approach is consistent with its CAM. In 2019–24 direct capex labour is forecast to be 5 per cent lower than for the current regulatory control period. Direct capex labour as a proportion of total direct labour is forecast to decrease over time.

While we are generally satisfied with Endeavour's methodology, we have some concerns with this aspect of Endeavour's forecast. We consider that the reduction in forecast direct capex in Endeavour's updated forecast implicitly includes a corresponding reduction in direct capex labour. This in turn should lead to a reduction in forecast capitalised overheads, reflecting Endeavour's forecasting methodology. However, Endeavour has not put forward an updated forecast for capitalised overheads. In its revised proposal, we expect Endeavour to explain why it has not adjusted its overheads to reflect its lower direct capex labour forecast. This is in spite of Endeavour submitting that, in reference to its updated capex forecast, that "these

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[186] Endeavour Energy, response to information request 019 and 025. Endeavour has reported some overheads under the 'balancing item' in its annual regulatory information notices (category analysis RINs).

[187] Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, pp.163–164.

are material reductions which will…put upward pressure on our opex forecast given the increased maintenance and non-network costs that will be required to achieve the repex and augex reductions."[188]

Notwithstanding our concerns, we have considered Endeavour's forecast for capitalised overheads in the context of its updated capex forecast. We also note that the implication of Endeavour's updated lower capex forecast is that expensed (opex) labour makes up a larger share of total labour in 2019–24, compared with its proposal. This in turn may lead to an increase in forecast expensed overheads, reflecting Endeavour's cost allocation methodology. In considering the updated capex forecast we note that Endeavour has not updated it forecast for indirect expensed overheads.

If Endeavour were to make an increase to opex overheads in its revised proposal, as a result of its updated capex forecast, we would expect a downward revision of equal magnitude to its forecast for indirect capitalised overheads to ensure there is no increase to the overall overheads pool.

Direct capitalised overheads

Endeavour forecasts direct capitalised overheads using historical averages, with adjustments made for the known mix of proposed projects. It forecasts switching costs and other direct costs separately.[189]

Endeavour forecast $32.6 million for network switching costs. This represents 1.9 per cent of system capex. The forecast is based on the historical average of switching costs over the five years to 2016-17. Switching costs increased from 1.4 per cent of system capex in 2012-13 to an average of 2.4 per cent of system capex in the three years to 2016-17.[190]

Other direct capitalised overheads are forecast to be $44.1 million for the 2019–24 regulatory control period. This is primarily made up of program management and planning costs. While other direct capitalised overheads are forecast based on historical averages, this forecast decreases from $12.4 million in 2019-20 to $4.9 million in 2023-24. Endeavour submits that the decrease reflects "expected program efficiencies…associated with our Alliance and MPU delivery model and the ICT Transformation project. The reduction also ensures that total capitalised overheads are constrained to $400 million for the 2019–24 regulatory control period.[191]

We are satisfied that this element of Endeavour's capitalised overheads forecast would form part of a total capex forecast that reasonably reflects the capex criteria.

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[188] Endeavour Energy, *Response to AER issues paper – NSW electricity distribution determinations 2019-24*, September 2018, p.1.

[189] Endeavour Energy, *Response to AER information request 019 - Information Request Response*, Public, July 2018.

[190] Endeavour Energy, *Response to AER information request 025 - Information Request Response, Public,* August 2018.

[191] Endeavour Energy, *Response to AER information request 019 - Information Request Response*, Public, July 2018.

B.8 Non-network expenditure

The proposed non-network capex for Endeavour includes expenditure on information and communications technology (ICT), buildings and property, motor vehicles, and tools and equipment.

B.8.1 Endeavour's proposal

Endeavour has proposed $170 million ($2018–19, excluding overheads) for non-network capex for the 2019–24 regulatory control period. Endeavour's proposal is $16 million, or 9 per cent, less than total actual/estimated non-network capex of the current regulatory control period.

The largest component of Endeavour's forecast relates to ICT capex ($91 million, or 53 per cent). Endeavour has submitted that this investment is to protect customers from new cyber security risks and replace outdated systems, which are no longer supported.[192] Endeavour has also submitted that it will invest in modern technology to improve customer service, deliver efficiencies and lift performance across its business.

B.8.2 Position

We accept Endeavour's forecast capex of $170 million ($2018–19, excluding overheads) for non-network expenditure. We are satisfied that this non-network capex forecast forms part of a total capex forecast that reasonably reflects the capex criteria. We have included Endeavour's forecast amount in our substitute estimate of total capex.

B.8.3 Reasons for our position

We have had regard to the following information and applied several assessment techniques to assess Endeavour's proposed non-network capex forecast. This included:

- trend analysis comparing forecast expenditure to recent actual expenditure;[193]
- consideration of stakeholder submissions;
- category specific analysis of individual components of non-network expenditure;
- business case assessment and review of supporting information provided through information requests;

[192] Endeavour Energy, *Regulatory Proposal Overview*, April 2018, p. 20.

[193] NER, cl. 6.5.7(e)(5).

- assessment of Endeavour's overall expenditure forecast to assess the extent to which non-network capital investments are offset by reductions to Endeavour's overall expenditure proposal; and
- information provided by Endeavour in response to our issues paper on 30 August 2018.[194]

When weighing up all the above techniques, Endeavour has demonstrated that its non-network capex forecast is prudent and efficient. Trend analysis has found that Endeavour's forecast is lower than historical rates of expenditure. Our category based assessment of non-network capex has also found that Endeavour's forecast for each category is broadly in line with historical expenditure.

A number of stakeholders have raised concerns regarding Endeavour's ICT capex forecast. We have reviewed the information provided by Endeavour in support of its ICT capex proposal. Our review has found insufficient supporting information for individual projects. For example, with the exception of the Enterprise Resource Planning (ERP) and billing upgrade program, Endeavour did not provide quantitative cost-benefit assessment for any project. We note that the lack of sufficient cost-benefit analysis is indicative of the concerns that EMCa raised throughout its detailed review of Endeavour's governance framework, risk management processes and expenditure forecasting methodologies, which are discussed in detail in section B.1.1.

While we have identified specific concerns with Endeavour's forecasting methodology, including its cost-benefit analysis, Endeavour submitted that its updated lower capex forecast takes into account the expected efficiencies of its transformation of its ICT systems and capabilities.[195] As such, we consider that any issues we have with Endeavour's ICT forecast are likely immaterial in the context of the total capex forecast.

Trend Analysis

Trend analysis allows us to draw general observations about how a distributor is performing. In addition, one capex factor that we must have regard to is the actual and expected capital expenditure during any preceding regulatory control period.[196]

Figure 5.20 shows Endeavour's forecast non-network capex for each year of the 2019–24 regulatory control period. It also shows Endeavour's actual and estimated non-network capex from 2008–09 to 2018–19 as well as allowed capital expenditure relating to non-network expenditure for the current regulatory control period.

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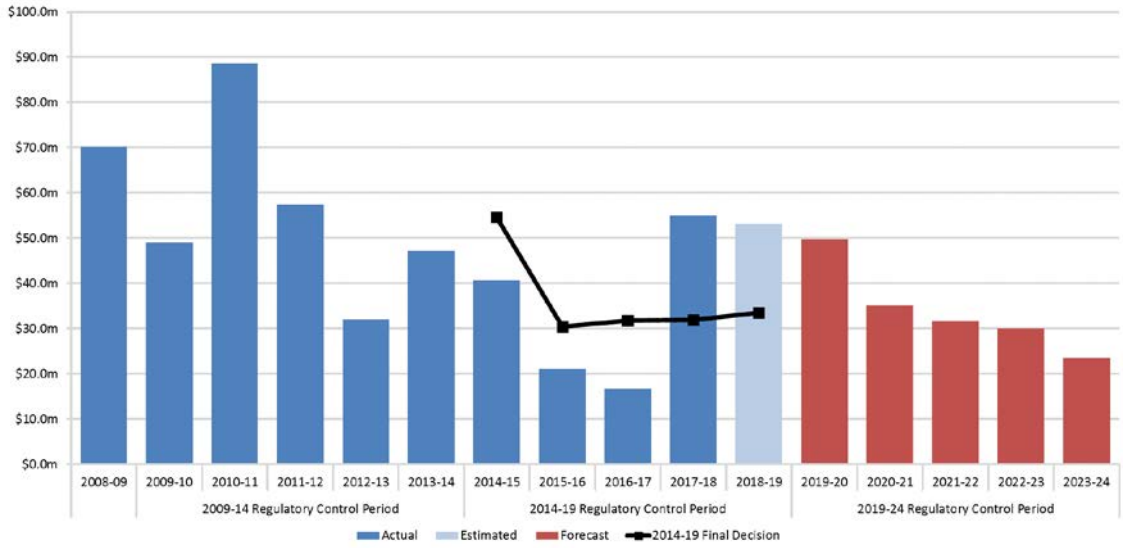
194 Endeavour Energy, *Response to AER issues paper - NSW electricity distribution determinations 2019-24*, Public, 30 August 2018.

195 Endeavour Energy, *Response to AER Issues Paper - NSW Electricity Distribution Determinations 2019-24*, Public, 30 August 2018, p.1.

196 NER, cl. 6.5.7(e)(5).

Figure 5.19 Endeavour's non-network capex (direct costs, $m 2018–19)



Source: Endeavour, *RIN Responses*; AER, *Final Decision Endeavour distribution determination - Endeavour 2015 - Capex Model*; April 2015; Endeavour, *Response to AER Information Request 025*, 06 September 2018.

Our analysis of longer term trends in non-network capex identified that non-network capex for Endeavour has followed an overall decreasing trend. Endeavour is also forecasting a reduction in non-network expenditure over the following six years, with each year's forecast expenditure less than the year preceding it. Endeavour's proposal is:

- 25 per cent lower than average actual non-network capex of the current and previous regulatory control periods (2009–10 to 2017–18)
- 6 per cent lower than average actual non-network capex incurred over the last 5 years of actual data (2013–14 to 2017–18).

We would therefore consider that our top-down review of total non-network expenditure has found that Endeavour's total forecast is reasonable when compared to historical expenditure.[197]

Submissions

While we received a number of submissions concerning Endeavour's non-network ICT capex proposal, we received no submissions concerning Endeavour's forecast capital expenditure for fleet, property or 'other' non-network. The submissions received are summarised as follows:

- ECA identified no specific concerns with Endeavour's non-network capex proposal and considered Endeavour's proposed expenditure across each category "is relatively moderate".[198]

[197] NER, cl. 6.5.7(e)(5).

- CCP10 submitted that it considered Endeavour's ICT investment plan was "not a customer-focussed document, and does not support transparent, validated and efficient ICT investment."[199] CCP10 also questioned whether investments, which would assist Endeavour in becoming more efficient, should be funded by consumers as opposed to being largely self-funded by the distributor. CCP10 also submitted that it can 'reasonably expect that having funded the capex required, the opex benefits will be incorporated in the forecast opex.' In particular, CCP10 submitted that it had two specific concerns with Endeavour's proposal:[200]
    - Lack of options analysis and consideration for deferment within the strategic plan
    - Lack of evidence of the benefits of these investments for customers
- PIAC submitted that while it considers Endeavour's proposed non-network ICT capex compares favourably with other networks,[201] it considered it important that ICT projects are well justified with clear ex-ante benefit quantification of the expected costs and benefits. PIAC submitted that it did not see the clear and measurable ex-ante benefits of ICT capex within Endeavour's proposal. PIAC also submitted that it expected distributors to achieve opex savings as a result of ICT investment, but found that these trade-offs were not well articulated through the proposals, making it difficult to assess whether both proposed capex and opex programs are efficient.

Category analysis

We have also undertaken trend analysis of each category of non-network capex. This category analysis has been used to inform our view of whether forecast non-network capex is reasonable relative to historical rates of expenditure in each category, and to identify trends in the different category forecasts, which may warrant further review.[202] Figure 5.21 shows Endeavour's actual/estimated and forecast non-network capex by sub-category for each regulatory control period. Figure 2 also shows total actual non-network capex of the most recent five years of actual data (2013-14 to 2017–18).

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198 ECA, *Submission on Endeavour Energy 2019-24 regulatory proposal*, Public, 10 August 2018, p. 13.

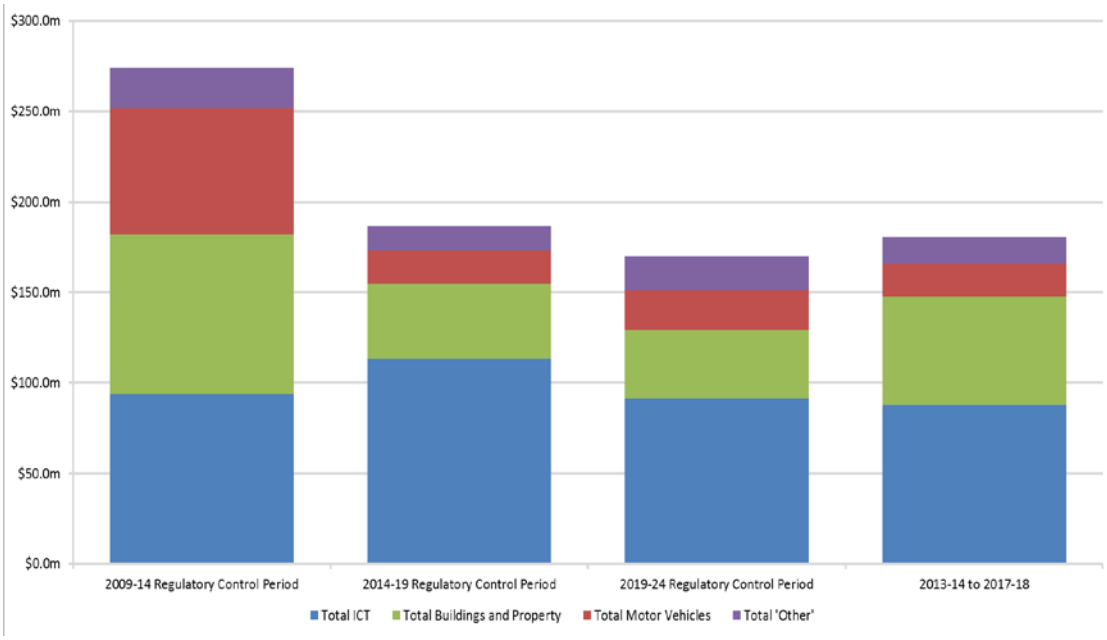
199 CCP10, *Submission on Endeavour Energy 2019-24 regulatory proposal*, Public, 8 August 2018, p. 4.

200 CCP10, *Submission on Endeavour Energy 2019-24 regulatory proposal*, Public, 14 August 2018, p. 57.

201 PIAC, *Submission on Endeavour Energy 2019-24 capex proposal*, Public, 17 August 2018, p. 8.

202 NER, cl. 6.5.7(e)(5).

Figure 5.20 Endeavour non-network capex by category (direct costs, $m 2018–19)



Source: Endeavour Energy, Response to Regulatory Information Notices.

As shown above, Endeavour's non-network capex forecast at a category level is broadly in line with historical rates of expenditure for each category. In our view, we would consider that Endeavour's forecast for these categories is reasonable having regard to historical expenditure for this category.[203]

Given that forecast reductions for the buildings and property category of non-network expenditure, we have considered whether this reflects the substitution possibilities between opex and capex for this category of expenditure.[204] For example, to some extent it is possible to substitute buildings and property asset replacement capex with increased opex for ongoing asset maintenance. However, at a total expenditure level, Endeavour's buildings and property forecast is 16 per cent lower than actual buildings and property total expenditure of the previous five years. Considering this, we are satisfied that Endeavour's forecast reduction in buildings and property capex does not simply reflect a reallocation of expenditure from capex to opex.

Based on our review of the information available, we consider that Endeavour's buildings, property and other non-network capital expenditure plan appears to be consistent with good management practices. Endeavour has submitted that it is forecasting no major buildings and property related projects for the 2019–24 regulatory control period.[205] Endeavour has submitted that its forecast is in large part based on

[203] NER, cl. 6.5.7(e)(5).

[204] NER, cl. 6.5.7(e)(7).

[205] Endeavour Energy, *Response to AER Information Request 002*, June 2018.

trend analysis,[206] or if no comparable costs were incurred, Endeavour based their forecast on current market costs[207]. We therefore consider that Endeavour's forecasting process is reasonable. On this basis, Endeavour has established that its forecast capex of non-network expenditure would form part of a total capex forecast that reasonably reflects the capex criteria.[208]

We have also reviewed the information provided by Endeavour in support of its motor vehicle forecast. On review of the documentation outlining Endeavour's fleet capital expenditure plan, we consider that Endeavour's fleet management practices appear in line with industry practice. As such, we consider that the forecast reasonably reflects the efficient costs that a prudent operator would require to meet the capex criteria.[209] We discuss our assessment of proposed ICT capex in further detail below.

Information and communication technology capex

Endeavour has proposed capex of $91 million ($2018–19, excluding overheads) for non-network ICT for the 2019–24 regulatory control period. Endeavour's forecast is $22 million, or 20 per cent less than total actual/estimated ICT capex of the current regulatory control period. Endeavour has submitted that its forecast was developed to provide assets "that are pragmatic, efficient, scalable and re-useable to ensure the ongoing reliability, safety and security of supply to network customers."[210] Endeavour has also identified that its program seeks to improve the capability of its network.

Assessment Approach

We have assessed forecast ICT capex by each category of non-network ICT capex. This category analysis has been used to inform our view of whether forecast non-network capex is reasonable relative to historical rates of expenditure in each category, and to identify trends in the different category forecasts, which may warrant further review.[211] Endeavour has allocated its historical and forecast non-network ICT capex into the following categories:[212]

- Asset Replacement
    - The replacement of an existing ICT asset with its modern equivalent where the asset has reached the end of its economic life. This capex has a primary driver of replacement if the factor determining the expenditure is the existing ICT asset has an inability to efficiently maintain its service performance requirement.

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206 Endeavour Energy, *Response to AER Information Request 002*, June 2018.
207 Endeavour Energy, *Buildings, Property and other Non-Network Capital Expenditure Plan,* March 2018, p. 13.
208 NER, cl. 6.5.7(c).
209 NER, cl. 6.5.7(c).
210 Endeavour Energy, *10.27 ICT Investment Plan*, February 2018, p. 6.
211 NER, cl. 6.5.7(e)(5).
212 Endeavour Energy, *RIN Workbook 1 Reset - Table 2.6.4*, 30 April 2018.

- Asset Remediation
    - The correction or optimisation of the performance of existing ICT assets that are not performing to the required service performance requirement.
- Asset Extensions
    - The extension of existing ICT assets to broaden their functionality.
- Capability Growth
    - The acquisition, development and implementation of new ICT assets to meet a business purpose or capacity requirement.

In assessing Endeavour's proposed recurrent ICT expenditure (replacement and remediation) we placed significant weight on Endeavour's historical expenditure trends. Applying the CESS to capex places a strong incentive on distributors to pursue efficiencies in its recurrent expenditure practices. [213] As such, a distributor's actual expenditure under the CESS is a good indicator of the efficient expenditure the distributor requires in the future.

In assessing Endeavour's non-recurrent ICT expenditure (asset extension and capability growth), for each program we have reviewed the available individual business case assessments, benefit quantifications and NPV analysis.

For programs that are efficiency benefit driven, we sought information from Endeavour to understand how it had incorporated these benefits into its overall proposal, such that we could be satisfied that any investment would result in lower total costs. We outline this within our expenditure forecast assessment guideline:[214]

> We expect DNSPs to submit regulatory proposals that include … explanations of trade-offs between capex and opex expenditure that show that the choices chosen (for example to undertake a capex IT program to reduce opex) are prudent and efficient. Firms will also need to demonstrate these choices are fully accounted for in capex and opex forecasts.

In the absence of this information, we would not consider that the requirement for the recovery of capital funding for these programs has been justified. For any prudent investment, where the benefits outweigh the costs, the distributor will recover sufficient funding through realising efficiencies (savings) and having them returned to the distributor under the incentive frameworks we have in place (EBSS, CESS and STPIS).[215]

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[213] AER, *Capital Expenditure Incentive Guideline*, November 2013.

[214] AER, *Expenditure Forecast Assessment Guideline for Electricity Distribution*, November 2013, p. 18.

[215] See AER, *Better Regulation Factsheet - expenditure incentives guideline*, November 2013.

Our Findings

Recurrent ICT capex

Endeavour has proposed capex of $55 million for ICT replacement and remediation. Endeavour's forecast is $37 million, or 41 per cent lower than total actual/estimated ICT replacement capex of the current period. We accept Endeavour's forecast for this category of ICT capex. In coming to this view, we note the following:

- The largest component of this forecast, relates to the finalisation of the ERP and billing upgrade program, which commenced as part of the current period. Endeavour updated its ERP program in 2010–11 and implemented its metering and network billing program over 20 years ago.[216] Endeavour provided us with the business case for this program, which Endeavour's Board approved in November 2017.[217] We have reviewed this business case. Endeavour has undertaken a detailed options analysis and has considered relevant opex/capex trade-offs relevant to this project. We have also reviewed Endeavour's governance process and risk assessment. On review of this information, we are satisfied that Endeavour's forecast for this project reasonably reflects the costs of a prudent operator.
- Excluding this major program, Endeavour's forecast ICT replacement capex of $38 million is comprised of 32 various minor projects. This includes expenditure relating to the replacement of existing ICT infrastructure and applications. Trend analysis of this expenditure has found that Endeavour's forecast is approximately equal to average actual expenditure in the current period. Over this period, Endeavour operated under the CESS mechanism. Importantly, given that Endeavour has been subject to the CESS, it has had an incentive to minimise capex over the regulatory control period. This gives us some confidence that Endeavour's actual recurrent ICT capex in the 2014–19 regulatory control period may be appropriate in determining our alternative estimate.

On this basis, we are satisfied that Endeavour's forecast for these replacement projects reasonably reflects prudent and efficient costs.[218]

Non-recurrent ICT capex

Endeavour has submitted that $36 million of its ICT capex forecast relates to the extension of the functionality of ICT infrastructure, or the acquisition of new ICT assets.[219] This expenditure relates to various investments relating to cyber security, improvements to customer engagement or improved operational efficiency. Our draft decision is to accept this expenditure. In coming to this position our findings are:

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216 Endeavour Energy, *10.27 ICT Investment Plan*, Public, February 2018, p. 32.

217 Endeavour Energy, *Response to AER Information Request 002*, 06 June 2018.

218 NER, cl. 6.5.7(e)(5).

219 Endeavour Energy, *RIN Workbook 1 Reset - Table 2.6.4*, 30 April 2018.

Lack of individual project cost benefit assessment

We asked Endeavour to provide the quantified benefits of its ICT program. Endeavour submitted that it has not quantified the benefits for its ICT portfolio. Endeavour also submitted that NPV analysis would instead be undertaken for each program "closer to the time of the investment to ensure that the expenditure is prudent and efficient."[220] As such, we have concerns with the justification provided by Endeavour in support of the individual projects included within its forecast.

We do recognise however, that it is likely that if economic analysis was undertaken for some of these programs, Endeavour would be able to demonstrate that these investments are prudent and efficient. For example, on review of the information provided in support of the proposed cyber security program, while lacking benefit quantification, we consider it appears reasonable in its proposed approach. We also note in part it is, not related to improvements to security but by achieving compliance with the Network Operator Licence conditions.

Evidence of benefit incorporation into overall forecast

While we were not provided with benefit quantification for individual programs, we have had regard to extent to which Endeavour has accounted for any forecast benefits of its ICT program into its overall expenditure proposal. In doing so, we have considered any identified capex/opex trade-offs identified by Endeavour.

Firstly, Endeavour has submitted that the benefits of its ICT program would off-set the short-term annual increases in ICT opex costs of $2 million.[221] Secondly, Endeavour's submission to our issues paper highlighted that its updated lower forecast takes into account the expected efficiencies of its transformation of its ICT systems and capabilities.[222] In particular, Endeavour submitted that this updated forecast reflected, "more aggressive assumptions about the project delivery and asset optimisation efficiencies associated with our new delivery model and technology program."[223]

Conclusion

In consideration of this new information, Endeavour has addressed our initial concerns concerning identification of benefit into its overall proposal. Our concerns that we have with Endeavour's ICT capex proposal are immaterial and have not changed our position. Therefore, we have included Endeavour's proposed amount for non-network ICT capex in our substitute estimate for total capex. However, we expect that, as part of future resets, Endeavour will provide rigorous cost benefit analysis for its ICT forecast. Also, any forecast efficiencies achieved from its proposed ICT program are incorporated within its proposal and are clearly identified.

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220 Endeavour Energy, *Response to Information Request 002*, May 2018.

221 Endeavour Energy, *Response to AER Information Request 002*, May 2018, p. 4.

222 Endeavour Energy, *Response to AER Issues Paper*, 30 August 2018, p. 4.

223 Endeavour Energy, *Response to AER Issues Paper*, 30 August 2018, p. 4.

C Engagement and information-gathering process

Proposal

Endeavour lodged its revenue proposal on the 30 April 2018, which was an extension from the original due date of the 31 January 2018. Prior to lodgement, Endeavour requested an extension to the submission date from the 31 January 2018 to 30 April 2018.[224] Endeavour submitted that the extension would provide additional time for further engagement and consultation. Endeavour committed to a consumer engagement plan, which included a series of 'deep dives' on specific capex topics, such as the demand forecasts, changes to contributions policy, contingent projects, replacement planning and its asset management approach.

We considered Endeavour's letter and agreed to the extension, as we acknowledged that the delay would enable Endeavour to formulate a better informed proposal for the benefit of customers.[225] Endeavour lodged its capex proposal on 30 April 2018, which included the capital expenditure supporting documentation, high-level asset management strategic documentation and its regulatory information notices (RINs). However, Endeavour did not provide us with detailed business cases for specific asset replacement projects.

Information-gathering process

To gain a better understanding of Endeavour's proposal, we requested further material through our requests for information process. We sent Endeavour seventeen information requests.[226] These included three information requests, which were prepared by our consultant, EMCa.[227] Endeavour responded to all the information requests, albeit with some delay for some of those requests.

Engagemen

We engaged with CCP10 and PIAC during the review process to understand and test their views on Endeavour's proposal. We had regard to their public submissions, along with all the other submissions that we received on Endeavour's capex proposal.

In terms of engagement with Endeavour, overall we acknowledge Endeavour's constructive engagement with us, which was open and transparent. In particular, our engagement gave us the opportunity to better understand the submitted information

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224 Endeavour Energy, *Letter to AER - Extension of time for 2019-24 regulatory proposal - letter* - 8 December 2017.

225 AER, *Letter to Endeavour Energy - Revised submission date for the 2019-24 regulatory proposal, public,* 15 December 2017.

226 Each information request included multiple questions.

227 EMCa had 69 questions to Endeavour. See EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, pp.82-95.

before us. We also provided preliminary feedback where possible to give Endeavour some certainty on how we have assessed its supporting material. We are encouraged by Endeavour's efforts to respond to our issues paper, where it worked through our, and stakeholder, feedback throughout the review process. Similarly, CCP10[228] and ECA in their letter commended Endeavour on its attempt to resolve the issues ahead of the draft decision. ECA expressed its support for Endeavour's quick response to stakeholder feedback, which is apparent in its response to the Issues paper, rather than waiting for the next step in the process. We note the following specific interactions we have had with Endeavour in the lead up to draft determination:

- In the pre-proposal stage:
    - we attended the 'deep dives', which allowed us to gain a greater understanding of Endeavour's capex proposal.
    - we had multiple repex modelling meetings in February and March 2018, where we explained our latest modelling refinement, and how it is likely to affect Endeavour.
    - in March 2018, we provided Endeavour a copy of its repex modelling results, as we considered it would be an opportunity for Endeavour to understand our underlying repex modelling assumptions and the method we use to assess repex. It was also an opportunity for us to understand the results of the modelling and how it translated to Endeavour's asset replacement assumptions. Those discussions resulted in a list of information requests in the preproposal stage, where Endeavour followed up with written responses to those questions.[229]
    - we observed that the change in the reimbursement policy generated a lot of discussion at, and after, Endeavour's 'deep dives' in early 2018. We engaged with CCP10 and PIAC to understand their concerns and to gauge their perspective on the matter. We subsequently held a meeting with Endeavour to discuss these concerns and to provide Endeavour with an early assessment of our views regarding this change.
- Following the submission of the proposal we supplemented our formal information requests with face-to-face discussions:
    - In mid-June, we had an on-site discussion with Endeavour and EMCa in Sydney, where we sought further detailed information on capex issues and tested our understanding of Endeavour's augex and repex proposals. EMCa's assessment is based on its observation from the on-site meetings, together with the information supplied prior to, at, and following the on-site discussion.[230]

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[228] CCP10, *Endeavour Energy 19–24 draft revenue proposal - letter to the AER*, Public, 21 September 2018.

[229] Endeavour Energy, *Response to Information Requests 001 in the preproposal stage*, Public, 19 February 2018 and Endeavour Energy, *Response to Information Requests 002 in the preproposal stage*, Public, 15 March 2018.

[230] EMCa, *Review of aspects of Endeavour's forecast capital expenditure - Endeavour Revenue Proposal 2019-24*, August 2018, p.3.

- We also met with Endeavour and provided it with an early indication of our assessment of its capex drivers. In our discussion, we provided preliminary feedback that Endeavour's proposal was lacking justification for the observed step-up, particularly for repex and augex, which was consistent with EMCa's draft findings of Endeavour's governance, forecasting methodology and sample bottom-up assessment of its repex and augex. Endeavour took our concerns into consideration when it updated its capex forecast.
- Similarly, when we provided Endeavour an updated copy of our repex modelling results in May 2018. Endeavour sought to further understand our repex modelling and it engaged Nuttall Consulting to directly engage with us to understand, test and validate our refined approach.[231] We provided Nuttall Consulting with outputs of our working files. Endeavour noticed an anomaly with some of the input data, which prompted Endeavour to provide us with a detailed rationale for why we were observing this anomaly. We then assessed and concluded that, on balance, it was justified and took Endeavour's rationale into consideration.
- As for our concerns regarding Endeavour's reimbursement policy, which we raised in the preproposal stage, we observed that Endeavour indicated it would continue with its reimbursement policy in its proposal, but committed to further engagement on the issue. We worked closely with Endeavour, to raise our detailed concerns regarding the timing and future effect of a reversal to the reimbursement policy. We also provided feedback on its modelling. Consequently, Endeavour's updated its forecast for net connections which we have adopted as our substitute estimate.

[231] Endeavour Energy, *Response to AER Issues Paper - NSW Electricity Distribution Determinations 2019-24*, Public, 30 August 2018.

D Repex modelling approach

This section provides a guide to our repex modelling process. It sets out:

1. relevant background information
2. the data used to run the repex model
3. the key assumptions underpinning our repex modelling approach
4. the repex model outcomes under different scenarios.

D.1 Background to predictive modelling

In 2012, the AEMC published changes to the National Electricity and National Gas Rules.[232] Following these rule changes, we undertook a "Better Regulation" work program, which included publishing a series of Guidelines setting out our approach to regulation under the NER. [233]

The expenditure forecast assessment guideline describes our approach, assessment techniques and information requirements for setting efficient expenditure allowances for distribution network service providers (distributors).[234] It lists predictive modelling as one of the assessment techniques we may employ when assessing a distributor's repex. We first developed and used our repex model in our 2009–10 review of the Victorian electricity distributors' 2011–15 proposals and have also used it in subsequent electricity distribution decisions.

The technical underpinnings of the repex model are discussed in detail in the replacement expenditure model handbook.[235] At a basic level, the repex model is a statistical tool used to conduct a top-down assessment of a distributor's repex forecast. Discrete asset categories within six broader asset groups are analysed using the repex model. These six asset groups are poles, overhead conductors, underground cables, service lines, transformers and switchgear.

The repex model forecasts the volume of assets in each category that a distributor would be expected to replace over a 20-year period. The model analyses the age of assets already in commission and the time at which, on average, these assets would be expected to be replaced, based on historical replacement practices. A total replacement expenditure forecast is derived by multiplying the forecast replacement volumes for each asset category by an indicative unit cost.

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232 AEMC, *Rule Determination, National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012*, 29 November 2012.

233 See AER, *Better regulation reform program* web page at https://www.aer.gov.au/networks-pipelines/better-regulation

234 AER, *Expenditure Forecast Assessment Guideline for Electricity Distribution*, November 2013; AER, *Expenditure Forecast Assessment Guideline for Electricity Transmission*, November 2013.

235 AER, *Electricity network service providers: Replacement expenditure model handbook*, November 2013.

The repex model can be used to advise and inform us and our consultants where to target a more detailed bottom-up review, and define an alternate repex forecast if necessary. The model can also be used to benchmark a distributor against other distributors in the NEM[236].

As detailed in our repex handbook, the repex model is most suitable for asset groups and categories where there is a moderate to large asset population of relatively homogenous assets. It is less suitable for assets with small populations or those that are relatively heterogeneous. For this reason, we exclude the SCADA and other asset groups from the modelling process and do not use predictive modelling to directly assess the asset categories within these groups.

Expenditure on and replacement of pole top structures is also excluded, as it is related to expenditure on overall pole replacements and modelling may result in double counting of replacement volumes. In addition, distributors do not provide asset age profile data for pole top structures in the annual category analysis RINs, so this asset group cannot be modelled using the repex model.

D.2 Data collection

The repex model requires the following input data:

- the age profile of network assets currently in commission
- expenditure and replacement volume data of network assets
- the mean and standard deviation of each asset's expected replacement life.

These data are derived from distributors' annual regulatory information notice (RIN) responses, and from the outcomes of the unit cost and expected replacement life benchmarking across all distributors in the NEM. The RIN responses relied on are:

- annual category analysis RINs – issued to all distributors in the NEM
- reset RINs – distributors are required to submit this information with their proposal.

Category analysis RINs include historical asset data and reset RINs provide data corresponding to distributors' proposed forecast repex over the upcoming regulatory control period. In both RINs, the templates relevant to repex are sheets 2.2 and 5.2.

Our current approach of adopting a standardised approach to network asset categories provides us with a dataset suitable for comparative analysis and better equips us to assess the relative prices of capital inputs as required by the capex factors.[237]

[236] This includes Power and Water Corporation.

[237] NER cl. 6.5.7(e)(7).

D.3 Scenario analysis

In this section we set out the broad assumptions used to run a series of scenarios to test the distributor's forecast modelled repex. The specific modelling assumptions applied for each distributor are outlined in each individual repex modelling workbook.

The four scenarios analysed are:

1. historical unit costs and calibrated expected replacement lives (**Historical Performance Scenario**)
2. comparative unit costs and calibrated expected replacement lives (**Cost Scenario**)
3. historical unit costs and comparative expected replacement lives (**Expected Lives Scenario**)
4. comparative unit costs and comparative expected replacement lives (**Combined Scenario**).

Comparative unit costs are defined as the minimum of a distributor's historical unit costs, its forecast unit costs and the median unit costs across the NEM. Comparative replacement lives are defined as the maximum of a distributor's calibrated expected replacement life and the median expected replacement life across the NEM.

D.4 Calibration

The calibration process estimates the average age at replacement for each asset category using the observed historical replacement practices of a distributor. The length of the historical period analysed during this process is referred to as the 'calibration period'. The inputs required to complete the calibration process are:

- the age profile of network assets currently in commission
- historical replacement volume and expenditure data for each asset category.

The calibrated expected replacement lives as derived through the repex model differ from the replacement lives that distributors report. During the calibration process, we assume the following:

- the calibration period is a historical period where a distributor's replacement practices are largely representative of its expected future replacement needs.[238]
- we do not estimate a calibrated replacement life where a distributor did not replace any assets during the calibration period, because the calibration process relies on actual historical replacement volumes to derive a mean and standard deviation
- where a calibrated replacement life is not available, we substitute the value of a similar asset category.

[238] Each distributor's specific repex modelling workbook outlines more detailed information on the calibration period chosen.

D.5 Comparative analysis

The Cost, Lives and Combined Scenarios rely on a comparative analysis technique that compares the performance of all distributors in the NEM. The technique analyses the two variable repex model inputs – unit costs and replacements lives. The aim of the Cost, Lives and Combined Scenarios is to test unit cost and expected replacement life inputs that are most representative of distributors across the NEM.

Previous distribution determinations where we have used the repex model have primarily focused on the Historical Performance Scenario. This scenario forecasts a distributor's expected repex and replacement volumes based on its historical unit costs and asset replacement practices (which are used to derive expected replacement lives).

Our refined comparative analysis repex modelling approach builds on this previous analysis and introduces the historical performances of other distributors in the NEM into the forecast period. The Cost Scenario analyses the level of repex a distributor could achieve if its historical unit costs are substituted with comparative unit costs. Expected Lives Scenario analyses the level of repex a distributor could achieve if its calibrated expected replacement lives are substituted with comparative expected replacement lives.

Unit costs

The comparative analysis technique compares a distributor's historical unit costs, forecast unit costs and median unit costs across the NEM. Historical unit costs are derived from a distributor's category analysis RIN and forecast unit costs are derived from a distributor's reset RIN, which is submitted as part of its proposal.

The median unit costs across the NEM are based on each distributor's historical unit cost for each asset category. The median unit cost is used for comparative analysis purposes because this approach effectively removes any outliers, either due to unique network characteristics or data reporting anomalies.

The United Kingdom's Office of Gas and Electricity Markets (Ofgem) has a similar approach to unit costs benchmarking, where Ofgem applies a unit cost reduction where the distributor's forecast unit cost was higher than industry median.[239]

The unit cost input used in the Cost and Lives Scenario is the minimum of a distributor's historical unit costs, its forecast unit costs and the median unit costs across the NEM.

[239] Ofgem, *Strategy decisions for the RIIO-ED1 electricity distribution price control - tools for cost assessment* - 4 March 2013.

Replacement lives

For expected replacement lives, the comparative analysis technique compares a distributor's calibrated replacement lives (based on historical replacement practices) and the median expected replacement lives across the NEM. Median expected replacement lives are based on each distributor's calibrated replacement lives for each asset category. Once again, using the median value effectively accounts for any outliers.

The expected replacement life input used in the Expected Lives and Combined Scenarios is the maximum of a distributor's calibrated replacement life and the median replacement life across the NEM.

Repex model threshold

Our repex model threshold is defined taking these results and other relevant factors into consideration. For the 2019–24 determinations, our approach is to set the repex model threshold equal to the highest result out of the Cost and Expected Lives Scenario.[240] This approach gives consideration to the inherent interrelationship between the unit cost and expected replacement life of network assets.

For example, a distributor may have higher unit costs than other distributors for particular assets, but these assets may in turn have longer expected replacement lives. In contrast, a distributor may have lower unit costs than other distributors for particular assets, but these assets may have shorter expected replacement lives.

D.6 Non-like-for-like replacement – the treatment of staked wooden poles

The staking of a wooden pole is the practice of attaching a metal support structure (a stake or bracket) to reinforce an aged wooden pole.[241] The practice has been adopted by distributors as a low-cost option to extend the life of a wooden pole. These assets require special consideration in the repex model because, unlike most other asset types, they are not installed or replaced on a like-for-like basis.

Replacement expenditure is normally considered to be on a like-for-like basis. When an asset is identified for replacement, it is assumed that the asset will be replaced with its modern equivalent and not a different asset.[242] The repex model forecasts the volume of old assets that need to be replaced, not the volume of new assets that need to be installed. This is simple to deal with when an asset is replaced on a like-for-like basis – the old asset is simply replaced by its modern equivalent. Where like-for-like

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[240] Our modelling approach means Historical Performance Scenario will always be higher than the Cost and Expected Lives Scenario, and the Combined Scenario will always be lower than Cost and Expected Lives Scenario.

[241] The equivalent practice for stobie poles is known as "plating", which similarly provides a low-cost life extension. SA Power Networks carries out this process. For simplicity, this section only refers to the staking process.

[242] For example, conductor rated to carry low-voltage will be replaced with conductor of the same rating, not conductor rated for high-voltage purposes.

replacement is appropriate, it follows that the number of assets that need to be replaced matches the number of new assets that need to be installed.

However, where old assets are commonly replaced with a different asset, we cannot simply assume the cost of the new asset will match the cost of the old asset's modern equivalent. As the repex model forecasts the number of old assets that need to be replaced, it is necessary to make adjustments for the asset's unit cost and calibrated expected replacement life. For modelling purposes, the only category where this is significant is wooden poles.

Staked and unstaked wooden poles

Staked wooden poles are treated as different assets to unstaked poles in the repex model. This is because staked and unstaked poles have different expected replacement lives and different unit costs.

There are two asset replacements options and two associated unit costs that may be made by a distributor – a new pole could replace the old one or the old pole could be staked to extend its life.[243] In addition, there are circumstances where an in-commission staked pole needs to be replaced. Staking is a one-off process. When a staked pole needs to be replaced, a new pole must be installed in its place. The cost of replacing an in-commission staked pole is assumed to be the same as the cost of a new pole.

Unit cost blending

We use a process of unit cost blending to account for the non-like-for-like asset categories. For unstaked wooden poles that need to be replaced, there are two appropriate unit costs – the cost of installing a new pole and the cost of staking an old pole. We use a weighted average between the unit cost of staking and the unit cost of pole replacement to arrive at a blended unit cost.[244]

For staked wooden poles, we ask distributors for additional historical data on the proportion of staked wooden poles that are replaced. The unit cost of replacing a staked wooden pole is a weighted average based on the historical proportion of staked pole types that are replaced. Where historical data is not available, we use the asset age data to determine what proportion of the network each pole category represented and use this information to weight the unit costs.

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[243] When a wooden pole needs to be replaced, it will either be staked or replaced with a new pole. The decision on which replacement type will be carried out is made by determining whether the stake will be effective in extending the pole's life and is usually based on the condition of the pole base. If the wood at the base has deteriorated significantly, staking will not be effective and the pole will need to be replaced. If there is enough sound wood to hold the stake, the life of the pole can be extended and the pole can be staked, which is a more economically efficient outcome.

[244] For example, if a distributor replaces a category of pole with a new pole 50 per cent of the time and stakes this category of the pole the other 50 per cent of the time, the blended unit cost would be a straight average of the two unit costs. If the mix was 60:40, the unit cost would be weighted accordingly.

Calibrating staked wooden poles

Special consideration also has to be given to staked wooden poles when determining their calibrated replacement lives. This is because historical replacement volumes are used in the calibration process. The RIN responses provide us with information on the volume of new assets installed over the calibration period. However, the repex model forecasts the volume of old assets being replaced. Since the replacement of staked poles is not on a like-for-like basis, we make an adjustment for the calibration process to function correctly.

We need to know the number of staked poles that reach the end of their economic life and are replaced over the calibration period, so an expected replacement life can be calibrated. The category analysis RINs currently only provide us with information on how many poles were staked each year, rather than how many staked poles were actually replaced. This additional information is provided by each of the distributors. Where this information is not available, we estimate the number of staked wooden poles replaced over the calibration period based on the data we have available.

E Demand

Maximum demand forecasts are fundamental to a distributor's forecast capex and opex, and to our assessment of that forecast expenditure. This is because we must determine whether the capex and opex forecasts reasonably reflect a realistic expectation of demand forecasts.[245] Hence accurate, or at least unbiased, demand forecasts are important inputs to ensuring efficient levels of investment in the network.

This appendix sets out our decision on Endeavour's forecast network maximum demand for the 2019–24 regulatory control period. We consider Endeavour's demand forecasts at the system level and the more local level.

System demand represents total demand in Endeavour's distribution network. System demand trends give a high-level indication of the need for expenditure on the network to meet changes in demand. Forecasts of increasing system demand generally signal an increased network utilisation that may, once any spare capacity in the network is used up, lead to a requirement for growth capex. Conversely, forecasts of stagnant or falling system demand will generally signal falling network utilisation, a more limited requirement for growth capex, and the potential for the network to be rationalised in some locations.

Localised demand growth (spatial demand) drives the requirement for specific growth projects or programs. Spatial demand growth is not uniform across the entire network: for example, future demand trends would differ between established suburbs and new residential developments.

In our consideration of Endeavour's demand forecasts, we have had regard to:

- Endeavour's proposal; and
- AEMO's independent forecasts.

These are set out in more detail in the remainder of this appendix.

E.1 Position

We consider that Endeavour's demand forecasts are justified and reflect a realistic expectation of demand over the 2019–24 regulatory control period. Our findings are that:

- Endeavour forecast a steady increase in summer peak demand growth. This is in contrast to AEMO's forecast for summer peak demand, which shows peak demand stagnating then returning to growth toward the end of the period.
- There are some minor discrepancies between AEMO's NSW peak demand forecast and those submitted by Endeavour. Endeavour's forecasts are generally lower

[245] NER, cl. 6.5.6(c)(3) and 6.5.7(c)(1)(iii).

towards the start of the forecast period, and higher towards the end, relative to AEMO's forecasts.

- Endeavour used a bottom up approach to forecast. It first takes an econometric approach that accounts for weather and calendar effects to determine peak demand, then employs a number of post modelling adjustments from the NIEIR and its network planners. We consider that Endeavour's approach to forecasting peak demand is simple relative to AEMO's approach, but remains valid.
- Endeavour's post–modelling adjustments for the effects of solar PV and energy efficiency (based on NIEIR advice) are not as aggressive as the adjustments applied by AEMO in its forecast.

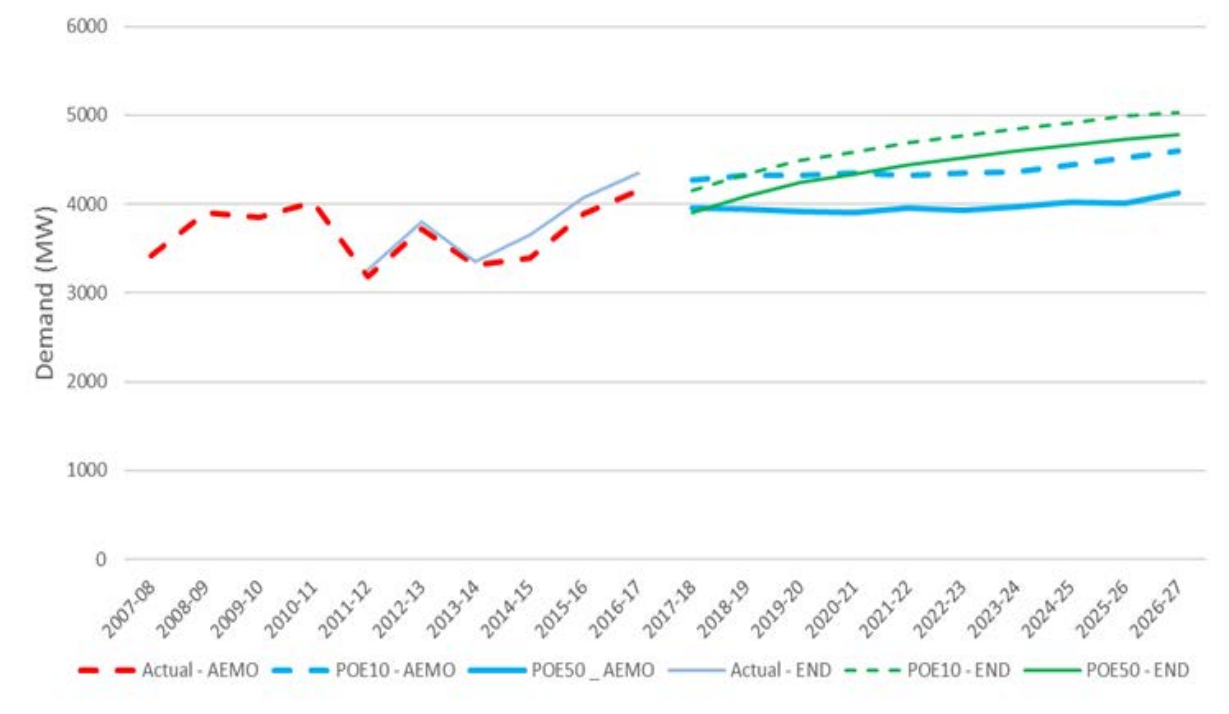
Comparison between the AEMO forecasts and Endeavour forecasts

We compared AEMO's and Endeavour's non-coincident summer peak demand for the Endeavour network region, as shown in Figure 5.22, Endeavour's network peaked in 2017 at 4,353MW, partially due to high temperatures (with a weather adjusted demand of 3,798MW). At the beginning of the forecast period, Endeavour's forecasts are below those of AEMO, but Endeavour forecasts peak demand to grow strongly, rising to 4,243MW in 2019-20 and 4,595MW in 2023-24 as a result of new connections and increased industrial activity.

In comparison, AEMO forecasts peak demand to fall from 3,959MW in 2017–18 to 3,902MW in 2020-21 before some recovery to 3,965MW in 2023–24. Towards the end of the forecast period, AEMO forecasts are marginally lower at POE10 per cent level, and clearly lower at the POE 50 per cent level.

In percentage terms, Endeavour forecast a 2.4 per cent annual increase in summer peak demand between 2018 and 2024, whilst AEMO forecast peak demand to be flat over the same period.

Figure 5.21 - Comparison of non-coincident summer peak demand forecasts by AEMO and Endeavour



Source: Endeavour Energy, Attachment 7.01, Table 4.1 Endeavour Energy Total; AEMO, 2017 NSW-ACT Dynamic Interface.

Forecasts for individual transmission connection points differ between Endeavour and AEMO to varying degrees, as shown in Table 5.10. The higher overall growth rate forecast by Endeavour appears to be the result of its higher growth rates forecast for the two larger connections points, Western Sydney Region and Dapto (which accounts for about 80 per cent and 15 per cent of aggregated peak demand respectively). In particular, Endeavour submitted that the majority of the Priority Growth Areas and Precincts designated by the NSW Government Department of Planning and Environment fall within the Endeavour network area.[246]

[246] Endeavour Energy, *Regulatory Proposal 1 July 2019 to 30 June 2024*, April 2018, p. 64.

Table 5.10 Summary of Endeavour and AEMO regional non-coincident summer peak demand - average growth rate

	Endeavour[247]		AEMO	
	2012-2017	2017-2027	2012-2017	2017-2027
Dapto	1.2%	0.0%	2.0%	-0.5%
Ilford	-4.9%	15.5%	-4.3%	12.4%
Marulan	2.0%	-0.8%	1.8%	0.4%
Mt Piper	-1.8%	-0.8%	-2.2%	-2.3%
Sydney North 132kV	3.6%	-0.4%	3.6%	0.6%
Wallerawang 66kV and 132kV	1.5%	-2.6%	2.5%	-0.5%
Western Sydney Region	7.3%	3.0%	6.5%	1.1%
Non-coincident total	5.9%	2.3%	5.4%	0.8%

Source: AER calculation using data from: Endeavour Energy, Attachment 7.01, Table 4.1 Endeavour Energy Total; AEMO, 2017 NSW-ACT Dynamic Interface.

Review of Endeavour's peak demand forecasting methodology

Figure 5.22 shows that Endeavour's forecasts differ somewhat from AEMO's forecasts. To further understand the differences, we have reviewed Endeavour's peak demand forecasting methodology and its assumptions regarding long-term trends and recent industry developments.

Comparison of forecasting method

AEMO uses a combination of a bottom-up approach to forecast peak demand at the transmission connection point (TCP) level and a top-down approach to forecast state-based system level peak demand. The bottom-up TCP forecasts are reconciled to state-based system level forecasts by applying individual diversity factors[248] and allocating remaining differences with the top-down forecasts to growth connection points on a proportional basis.

Endeavour uses its own bottom-up approach to forecasting summer peak demand at the zone substation level. Endeavour's approach is a combination of econometric modelling to account for weather and calendar effects to derive the weather-corrected

[247] Peak demand at the bulk supply points for the Western Sydney region is assumed to peak at the same time. Peak demand for Wallerawang 66kV and Wallerawang 132kV bulk supply points is assumed to peak at the same time.

[248] Diversity factor is the ratio between the demand at a location at the time of system peak demand (coincident?) to the maximum demand occurring at that location (whenever that maximum may occur).

peak demand in 2016-17 as the starting point, and post-modelling adjustments that account for two further sources of inputs:

- NIEIR's estimated demand effects from different state and national energy policies and programs (mainly the NSW Energy Savings Scheme), as well as the emerging technologies such as PV, solar battery storage and electric vehicles;
- planned load transfers, spot loads, land releases (sourced from the NSW Department of Planning) and redevelopments within the zone substation load catchment area (local knowledge of the network planners).

Compared to AEMO's approach, Endeavour directly accounts for a more limited range of demand drivers in its econometric modelling, and assumes away the historical weather trend and time trend in forecasting peak demand. Instead of making above-trend adjustments (as AEMO does), it makes direct adjustments to the baseline level (the 2016-17 weather-corrected peak demand) through the post-modelling process.

To the extent that Endeavour forecasts higher growth rates for its network relative to the AEMO forecasts appears to be driven by:

- AEMO's more aggressive post-modelling adjustments for the effects of PV and energy efficiencies:
    - On solar PV systems, AEMO projects the PV share of underlying maximum demand to grow over time, from 2.8 per cent in 2016-17 to about 5 per cent by 2023-24.[249] In contrast, NIEIR's forecasts that Endeavour uses estimate that PV share will grow more gradually, from 1.8 per cent in 2016-17 to 3.3 per cent in 2023-24.
    - On energy efficiency, AEMO projects a continuing reduction in consumption by 4.6 per cent in 2023-24 relative to 2015-16. In contrast, the NIEIR's forecasts show incremental effect of energy efficiencies by 1.9 per cent for the same period.
- different thresholds to spot load adjustments - AEMO's threshold for spot load adjustments is five per cent of the connection point maximum demand (anywhere from 0.2 to 170MW), whereas Endeavour makes an adjustment for any future spot loads expected to be larger than 0.2MW. The lower threshold utilised by Endeavour means its adjustment for future spot loads is likely to be larger.
- planning knowledge, including information on land releases and housing starts from the NSW Department of Planning and from developers. For example, Endeavour has revised dwelling completion forecasts upward in Catherine Park, after firm connection applications indicated that the development would be completed in seven years rather than the 20 years that was assumed.[250]

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[249] AER analysis of AEMO's data from National Electricity Forecasting reports 2017.

[250] Endeavour Energy, *Response to information request 014*, July 2018, p.22.

Assessment of Endeavour's approach

We consider that Endeavour's approach to forecasting is relatively simple, but remains valid. The approach has some limitations, such as only directly modelling weather and calendar effects. It also does not directly model key demand drivers such as economic growth, population/household growth, price of electricity and other energy sources, technological changes and government policies.

However, these drivers are partially captured in the year variable or by the post-modelling adjustments:

- NIEIR's post-modelling adjustments consider the likely effect from technical changes and evolving government policies.
- The network planners' inputs consider the likely effect from economic and demographic developments using their local knowledge of dwelling development planning and load applications for the relevant network areas.

Whilst there are some differences between AEMO's and Endeavour's forecasts, we consider that Endeavour's peak demand forecast is reasonable. In deriving its forecast, Endeavour used independent sources of information for demand drivers such as the NSW Department of Planning estimates on housing starts.

F Ex post statement of efficiency and prudency

We are required to provide a statement on whether the roll forward of the regulatory asset base from the previous period contributes to the achievement of the capital expenditure incentive objective.[251] The capital expenditure incentive objective is to ensure that where the regulatory asset base is subject to adjustment in accordance with the NER, only expenditure that reasonably reflects the capex criteria is included in any increase in the value of the regulatory asset base.[252]

The NER require that the last two years of the previous regulatory control period (for the purposes of this decision, the 2017–18 and 2018–19 regulatory years) are excluded from the ex-post assessment of past capex. Further, the NER prescribe that the review period does not include the regulatory year in which the first Capital Expenditure Incentive Guideline was published (2013–14) or any regulatory year that precedes that regulatory year.[253] In addition, under the transitional rules, in making this distribution determination, the review of past capex does not apply to Endeavour prior to 1 July 2015.[254] Accordingly, our ex-post assessment only applies to the 2015–17 regulatory years.

We may exclude capex from being rolled into the RAB in three circumstances:[255]

1. Where the distributor has spent more than its capex allowance;
2. Where the distributor has incurred capex that represents a margin paid by the distributor, where the margin refers to arrangements that do not reflect arm's length terms; or
3. Where the distributor's capex includes expenditure that should have been classified as opex as part of a distributor's capitalisation policy.

F.1 Position

We are satisfied that Endeavour's capital expenditure in the 2015-16 and 2016-17 regulatory years should be rolled into the RAB.

F.2 AER approach

We have conducted our assessment of past capex consistent with the approach set out in our capital expenditure incentive Guideline. In the Guideline, we outlined a two-stage process for undertaking an ex-post assessment of capital expenditure:[256]

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251 NER, cl. 6.12.2(b).
252 NER, cl. 6.4A(a).
253 NER, cl.11.60.5.
254 NER, cl. 11.56.5(a).
255 NER, cl. S6.2.2A(b).

- Stage one - initial consideration of actual capex performance
- Stage two - detailed assessment of drivers of capex and management and planning tools and practices.

The first stage considers whether the distributor has overspent against its allowance and past capex performance. In accordance with our Guideline, we would only proceed to a more detailed assessment (stage two) if:

- a distributor had overspent against its allowance
- the overspend was significant; and
- capex in the period of our ex-post assessment suggests that levels of capex may not be efficient or do not compare favourably to other distributors.

F.3 AER assessment

We have reviewed Endeavour's capex performance for the 2015-16 and 2016-17 regulatory years. This assessment has considered Endeavour's out-turn capex relative to the regulatory allowance given the incentive properties of the regulatory regime for a distributor to minimise costs.

Endeavour incurred total capex below its forecast regulatory allowance in these regulatory years. Therefore, the overspending requirement for an efficiency review of past capex is not satisfied.[257] We also consider that the 'margin' and 'capitalisation' RAB adjustments are not satisfied.

We have also had regard to some measures of input cost efficiency as published in our latest annual benchmarking report.[258] We recognise that there is no perfect benchmarking model, however we consider that our benchmarking models are the most robust measures of economic efficiency available and we can use this measure to assess a distributor's efficiency over time and compared with other distributors.

The results from our most recent benchmarking report suggest that Endeavour's overall efficiency has declined in 2016 and in 2015. Endeavour was ranked eighth of thirteen on our multilateral total factor productivity score, it has had a reduction in its productivity from 2015 to 2016.[259] While this provides relevant context, we have not used our benchmarking results in a determinative way for this capex draft decision, including in relation to this ex-post efficiency and prudency review.

In assessing the prudency and efficiency of Endeavour's capex in the ex-post review period, we may only take into account information and analysis that Endeavour could reasonably be expected to have considered or undertaken at the time that it undertook

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256 AER, *Capital Expenditure Incentive Guideline*, November 2013, pp. 19-22.

257 NER, cl. S6.2.2A(c).

258 AER, *Annual benchmarking report: Electricity distribution network service providers*, November 2017.

259 AER, *Annual benchmarking report: Electricity distribution network service providers*, November 2017, p. 8.

the relevant capex.[260] We have therefore not taken into account the information and analysis relied upon in other areas of this draft decision, for example EMCa's analysis and advice on aspects of Endeavour's forecast capex, for this ex-post efficiency and prudency review.

For the reasons set out above, we are satisfied that Endeavour's capex in the 2015-16 and 2016-17 regulatory years should be rolled into the RAB.

[260] NER, cl. S6.2.2A(h)(2).

G Contingent project

Endeavour proposed $61.2 million ($2018–19) for a contingent project to service the Western Sydney Airport growth area for the 2019–24 regulatory control period.[261]

Generally, contingent projects are significant network augmentation projects, the timing of which is uncertain. Expenditure for such projects does not form a part of our assessment of the total forecast capex that we approve in this determination. Contingent projects are linked to unique investment drivers (rather than general investment drivers such as expectations of load growth in a region) and are triggered by a defined 'trigger event'. The occurrence of the trigger event must be probable during the relevant regulatory control period.[262]

If, during the regulatory control period, Endeavour considers that the trigger event has occurred, then it may apply to us for additional revenues. At that time, we will assess whether the trigger event has occurred and whether the project meets the threshold of $30 million or 5 per cent of the annual revenue requirement in the first year of the 2019–24 regulatory control period. If satisfied of both, we will determine the efficient incremental revenue that is likely to be required in each remaining year(s) of the regulatory control period as a result of the contingent project, and amend the revenue determination accordingly.[263]

G.1 Position

Endeavour has not demonstrated that its proposed contingent project is reasonably required to achieve the capex objectives.

We consider Endeavour's proposed trigger events are appropriate and are likely to generate increased costs for Endeavour. However, we do not consider Endeavour's proposed capex meets the capex criteria:

- It does not reflect a realistic expectation of the demand forecasts and cost inputs required to achieve any of the capital expenditure objectives.
- It does not reflect the efficient costs of achieving the capital expenditure objectives.

Endeavour has proposed a 132kV upgrade to service the Western Sydney Airport growth area, which will not be fully utilised until 2063 under current demand projections. We do not consider that the option to invest in a connection to meet 2063 capacity is required in the 2019–24 regulatory control period. Instead, we consider that it is more prudent to provide a less capital intensive solution, as part of standard control capex rather than a contingent project, with further augmentation in future if demand forecasts materialise.

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261 Endeavour Energy, *Regulatory proposal 1 July 2019 to 30 June 2024*, Public, April 2018, p. 153.

262 NER, cl. 6.6A.1 (5).

263 NER, cl. 6.6A.2.

Leading up to the revised proposal, we will continue to engage with Endeavour and other stakeholders to ensure that the proposed connection meet the long term interests of consumers.

G.2 Assessment approach

We reviewed Endeavour's proposed contingent project against the NER requirements.[264] We considered whether:

- the proposed contingent project is reasonably required in order to achieve any of the capex objectives.[265]
- the proposed contingent project capital expenditure is provided for elsewhere in the capex proposal.[266] (Most relevantly, a distributor must include forecast capex in its revenue proposal which it considers is required in order to meet or manage expected demand for standard control services over the regulatory control period.[267])
- the proposed contingent project reasonably reflects the capex criteria, taking into account the capex factors.[268] Importantly this requires the expenditure to be efficient.
- the proposed contingent project capital expenditure exceeds the defined threshold.[269]
- the trigger events are appropriate. This includes having regard to the need for the trigger event:
    - to be reasonably specific and capable of objective verification.[270]
    - to be a condition or event which, if it occurs, make the project reasonably necessary in order to achieve any of the capex objectives.[271]
    - to be a condition or event that generates increased costs or categories of costs that relate to a specific location rather than a condition or event that affects the distribution network as a whole.[272]
    - is described in such terms that it all that is required for the revenue determination to be amended.[273]

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264 NER, cl. 6.6A.1.
265 NER, cl. 6.6A.1.
266 NER, cl. 6.6A.1(b)(2)(i)
267 NER, cl. 6.5.7(a)(1).
268 NER, cl. 6.6A.1(b)(2)(ii)
269 NER, cl. 6.6A.1(b)(2)(iii).
270 NER, cl. 6.6A.1(c)(1).
271 NER, cl. 6.6A.1(c)(2).
272 NER, cl. 6.6A.1(c)(3)
273 NER, cl. 6.6A.1(c)(4).

- is probable during the 2014–19 regulatory control period but the inclusion of the project in the total forecast capex is not appropriate because either it is not sufficiently certain that the event or condition will occur during the regulatory control period; or the costs associated with the event or condition are not sufficiently certain.[274]

We also considered the interaction between the total forecast capex included in our revenue determination and projects proposed as contingent projects. Where a project is included in total forecast capex it cannot also be included as a contingent project.[275] Further, the case for a contingent project needs to take into account the extent to which the forecast capex in included in our revenue determination already caters for increased demand across the network.

G.3 Endeavour's proposal

Endeavour proposed a contingent project to service the Western Sydney Airport Growth Area. Western Sydney Airport Corporation (WSACo) has expressed a desire to establish a connection from the airport to Endeavour's network prior to 2024.[276]

To provide the connection to the airport, Endeavour proposed 132kV feeders and associated substation works at an estimated cost of $61 million ($2018–19) subject to the following triggers:

1) A formal request from WSACo (or other entity responsible for the Wester Sydney Airport construction) requiring connection within a timeframe that necessitates investment within the 2019–24 regulatory control period.

2) Confirmation that the proposed network solution maximises the net market benefits following completion of the RIT-D process.

Endeavour also noted that this area forms the basis for the Greater Sydney Commission's plan for a 'third city' for Sydney, which will include development of residential and supporting infrastructure and services around the planned Western Sydney Airport - this is referred to as the Western Sydney Priority Growth area.[277] A single runway airport is expected to be operational by 2026 (stage 1) and a second runway proposed for 2050 (stage 2). This forms part of an anticipated ultimate load required of 850 MVA over a 40 year period for the whole growth area.

As construction of the airport is initiated, Endeavour expects load forecasts to increase. Existing infrastructure for the area has been mainly used for agriculture production with low density electrical load and no existing 132kV assets in the area. The existing 33kV

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274 NER, cl. 6.6A.1(c)(5).

275 NER, cl. 6.6A.1(b)(2)(i).

276 Endeavour Energy, *Attachment 10.32 Western Sydney Airport Growth Area - Contingent Project Business Case*, April 2018, p. 1.

277 Endeavour Energy, *Western Sydney Airport Growth Area - contingent project business case*, April 2018, p. 1.

network has approximately 21MVA capacity available at 'N supply security and backup capacity of 7 MVA under an 'N-1' scenario.[278]

Subject to the project triggers being satisfied, Endeavour proposed two options to meet airport demand:

- $61 million 132kV option to provide capacity for stage 1 and stage 2 of the airport development. With stage 2 commencing in 2050 this option provides for expected long term capacity in 2063.
- $91 million 32kV option to provide for stage 1 capacity up to 2042.[279]

Endeavour considers the 132kV option is the preferred option. This will require the installation of three 132kV feeders. With the third feeder to provide for 'N-1' contingency.

Endeavour considered the value of customer reliability benefits of this project are high at $779.6 million, as connection capacity will be exceeded in 2024 and if no action is taken development will not be able to proceed.[280]

In response to an information request, Endeavour provided data on forecast passenger volumes and confidential data on electricity demand for the airport.[281]

G.4 Reasons for preliminary decision

We do not accept Endeavour's proposed contingent project is a contingent project in accordance with the NER.[282] Although we consider the trigger events are appropriate,[283] we do not consider that Endeavour has justified the expenditure for the following reasons:

- It is not reasonably required in order to achieve the capital expenditure objectives as the proposed project is not required to meet or manage expected demand over the 2019–24 regulatory control period.[284]
- It does not reflect the capital expenditure criteria.[285]

We consider the purpose of the trigger event is to provide a connection upon request by WSACo. However, the request for connection does not necessarily mean Endeavour must provide a connection to meet indicative 2063 demand forecasts. We

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278 Endeavour Energy, *Western Sydney Airport Growth Area - contingent project business case*, April 2018, p. 5–6.

279 Endeavour Energy, *10.32 Western Sydney Airport Growth Area - Contingent project business case*, Public, April 2018, pp. 6–7.

280 Endeavour Energy, *10.32 Western Sydney Airport Growth Area - Contingent project business case*, Public, April 2018, p. 8.

281 Endeavour Energy, *Response to Information Request 008*, Public, June 2018, pp. 2–3.

282 NER, cl. 6.6A.1(b).

283 NER, cl. 6.6A.1(4).

284 NER, cl. 6.6A.1(b)(1).

285 NER, cl. 6.5.7(c).

consider Endeavour can meet the connection requirement with a less capital intensive solution and further augmentation in future if demand forecasts materialise.

We note that although timing is uncertain, we consider that Endeavour will be required to undertake augmentation in the 2019–24 regulatory control period to provide a timely connection to the airport.

We will continue to engage with Endeavour and other stakeholders to ensure that the proposed connection meet the long term interests of consumers.

Demand forecasts

We do not consider the demand forecasts reflects a realistic expectation of the demand Endeavour is required to provide if WSACo requires an airport connection in the 2019–24 regulatory control period. This is because the demand forecasts:

- are indicative only and plan for potential expansion of the airport in 2050.
- do not include the detailed electricity needs of the airport as these are only required once the application process begins.
- do not account for the potential for distributed energy resources (DER) and other non-network alternatives.
- do not account for the uncertainty around long term forecasting beyond 40 years into the future.

For the reasons above, the 2063 demand forecasts are not a reasonable basis for the capacity of the connection that Endeavour may be required to provide in the 2019–24 regulatory control period.

This is not an assessment of WSACo's airport forecasts. Rather, this is an assessment of whether a 2063 demand forecast reasonably reflects a realistic expectation of the energy needs of the connection the contingent project is expected to provide.

In response to our information request for more detailed demand forecasts, Endeavour noted that it has yet to receive a formal application for the connection of load for the airport. The application process will give Endeavour more detailed estimates of future electricity needs in the area, allowing Endeavour to assess the veracity of estimates and then assess the effect on upstream infrastructure.[286]

We note the proposed demand forecasts are indicative only and the Western Sydney Airport plan acknowledged that it is difficult to predict long-term future outcomes for 2063.[287] The airport plan also noted that initial passenger demand is forecast to be modest with 10 million annual passengers (MAP) at stage 1, increasing to 37 MAP in 2050 and 82 MAP in 2063.[288]

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[286] Endeavour Energy, *Response to information request 008*, Public, June 2018, p. 1.

[287] Australian Government, *Western Sydney Airport plan*, December 2016, p. 25

[288] Australian Government, *Western Sydney Airport plan*, December 2016, p. 24.

Table 5.11 below shows the expected annual passenger numbers and original forecast airport demand and an updated 2018 forecast airport demand.

Table 5.11 – Forecast passenger and electricity demand for Western Sydney Airport

	Stage 1 (2030)	First runway at capacity 2050	Long term 2063
Annual passengers (million)	10	37	82
Forecast Maximum demand November 2016 (MVA)	16.7	59.9	106.9
Forecast maximum demand updated June 2018 (MVA)	33.2	122.9	177.3

Source: Endeavour Energy, *Response to information request 008*, Public, June 2018, p. 3.

Endeavour noted that comparisons with other similar sized airports are less relevant due to the inclusion of a business park at the airport.

Although passenger volume is not the sole driver of an airport's energy usage, it does provide an indicator of energy usage. We note that Sydney Airport serviced 43 MAP in 2017[289] with 2017 forecast feeder capacity of 43 million MVA.[290] This energy usage is significantly below the energy per customer used to forecast the Western Sydney Airport's energy needs.

We also note that Western Sydney Airport will be able to use the latest airport designs and technologies with the potential to adopt energy storage and other DER, which will provide the airport with greater ability to manage its demand and energy use than existing airports. Further, there may be other non-network alternatives for the stage 2 development of the airport in 2050. This is acknowledged in the airport plan, which noted that as the airport develops beyond stage 1, it will maintain similar or better levels of sustainability and is also expected to take account of developments and innovations in the area of sustainability.[291]

Further, uncertainty in demand forecasts has not been taken into account. Endeavour has not considered the real option value in deferring the investment for uncertain forecasts or the underutilisation of the assets. This indicates that the proposed works are planned to meet a specific long-term demand scenario (stage 2 and beyond) that has not taken into account other demand scenarios.

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289 Airport traffic data available at the Department of Infrastructure, Regional Development and Cities website at: https://bitre.gov.au/publications/ongoing/airport_traffic_data.aspx

290 Ausgrid forecast feeder capacity can be accessed at: https://www.ausgrid.com.au/Common/Industry/Regulation/Network-Planning/DTAPR.aspx

291 Australian Government, *Western Sydney Airport plan*, December 2016, p. 23.

We acknowledge that Endeavour is likely to be required to connect the airport before the airport becomes fully operational. For this reason, we consider Endeavour may require localised network augmentation in the next regulatory control period. This is consistent with our TransGrid determination, which included capex for Western Sydney development for additional dwellings and the airport.[292]

Prudent and efficient costs

We consider Endeavour has not established that its proposed contingent project is reasonably required in order to achieve the capex objectives.

We consider Endeavour has not explored other potential augmentation to enable its existing network to meet the initial stages of demand up to 2030. For example, Endeavour has not included an option to extend its existing 33kV network to meet initial demand. This could defer the proposed 132kV investment option until there is greater certainty about forecast demand for the airport and surrounding area.

As noted above, given the uncertainty in forecasts, we do not consider constructing assets to meet forecast 2063 demand is prudent and efficient.

Due to the proximity of the planned airport site to existing network infrastructure at Kemps Creek, Luddenham and Bringelly zone substations, we consider Endeavour will be able to augment its existing network in conjunction with proposed 2019–24 capex augmentation to meet the additional 16.7MVA airport operational load and network demand projected for 2030. Due to the uncertainty in demand forecasting, any additional demand past 2030 should be considered as part of our assessment for the 2024–2029 regulatory control period.

In response to an information request, Endeavour reviewed the scope for the 33kV network to supply stage 1 loads. Endeavour noted that by 2026, given significant development is proposed outside the airport, the 33kV option is not sufficient to meet the airport and surrounding development area demand. [293]

We note that Endeavour's forecast capex already includes augmentation for the Western Sydney Growth Area. We consider Endeavour can further augment its network in conjunction with works already commencing in the 2019–24 regulatory control period in the surrounding area to provide a connection to the airport.

We also note that Endeavour's proposed approach for this contingent project is different to its general augex approach. Endeavour stated that a key component of its investment approach is to incrementally stage augex to service growth and defer significant network investment until it is self-evidently necessary.[294]

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[292] AER, *Draft decision TransGrid transmission determination 2018 to 2023, Attachment 6 – Capital expenditure*, Public, September 2017, p. 134.

[293] Endeavour Energy, *Response to information request 029*, August 2018, Public, p. 2.

[294] Endeavour Energy, *Regulatory proposal 1 July 2019 to 30 June 2024*, Public, April 2018, p. 122.

We consider Endeavour's proposed approach in installing a significant network asset is contrary to its general augex approach, particularly in light of the uncertain demand information currently available to Endeavour.

Triggers

We consider the trigger events proposed by Endeavour are appropriate.

Endeavour proposed trigger involves an application by WSACo and the successful completion of the RIT-D. We consider these triggers are reasonably specific and capable of objective verification. [295] We are also satisfied that these triggers will generate increased costs for Endeavour in order to achieve the capex objectives.

We also consider the triggers meet the remaining criteria set out in our assessment approach above.

Other considerations

We consider Endeavour's proposed contingent project meets the materiality threshold and that it is not otherwise provided for in the capex proposal.

The materiality threshold for a contingent project is either $30 million or 5 per cent of the value of the annual revenue requirement for the first year of the relevant regulatory control period, whichever is the larger amount.[296]

As the proposed project is $61 million ($2018–19) and 5 per cent of Endeavour's proposed revenue requirement for 2019–20 is $43.9 million. Therefore, this contingent project meets the materiality threshold. If Endeavour revises its proposed contingent project, then we will assess any changes in the final decision.

We also consider Endeavour's proposed contingent project is not otherwise provided for in the capex proposal. Although, the capex forecast for the 2019–24 regulatory control period includes augex for the Western Sydney Growth area surrounding Western Sydney Airport, we consider the proposed capex relates only to the connection of the airport to Endeavour's network.

However, we note that Endeavour's updated 33kV option analysis may include additional augmentation not relating to the airport connection. This is because the analysis takes into account growing demand in areas surrounding the airport.[297]

Given Endeavour is expecting to augment for increased demand in the area immediately surrounding the airport, we consider any costs associated with providing a connection to the airport to be incremental to already planned augmentation works in the area.

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[295] NER, cl. 6.6A.1(c)(1).

[296] NER, cl. 6.6A.1 (2)(iii).

[297] Endeavour Energy, Response to information request #029, August 2018, p. 3.