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Jemena Revised Regulatory Proposal 2026-31

REVIEW OF COBURG NORTH ZSS REDEVELOPMENT PROJECT

Report prepared for:

AUSTRALIAN ENERGY REGULATOR

March 2026

Preface

This report has been prepared to assist the Australian Energy Regulator (AER) with its determination of a capex allowance for Jemena for the next regulatory control period 2026-31. The AER's determination is conducted in accordance with its responsibilities under the National Electricity Rules (NER).

This report covers a particular and limited scope as defined by the AER and should not be read as a comprehensive assessment of proposed expenditure that has been conducted making use of all available assessment methods. This report relies on information provided to EMCa by Jemena. EMCa disclaims liability for any errors or omissions, for the validity of information provided to EMCa by other parties, for the use of any information in this report by any party other than the AER and for the use of this report for any purpose other than the intended purpose. In particular, this report is not intended to be used to support business cases or business investment decisions nor is this report intended to be read as a legal interpretation of the NER or other legal instruments.

EMCa's opinions in this report include considerations of materiality to the requirements of the AER and opinions stated or inferred in this report should be read in relation to this over-arching purpose.

Except where specifically noted, this report was prepared based on information provided by AER staff prior to 23 January 2026 and any information provided subsequent to this time may not have been taken into account. Some numbers in this report may differ from those shown in Jemena's revised regulatory submission or other documents due to rounding.

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Date saved
20/04/2026 4:44 PM

Version
Final v1

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ABBREVIATIONS

Term	Definition
AER	Australian Energy Regulator
CB	Circuit Breaker
CBRM	Condition-based Reliability Models
CN	Coburg North
current RCP	2021-26 Regulatory Control Period
DAPR	Distribution Annual Planning Report
DP	Degree of Polymerisation
HI	Health Index
IEEE	Institute of Electrical and Electronics Engineers
IFT	Interfacial Tension Results
IRs	Information Requests
NER	National Electricity Rules
next RCP	Next Regulatory Control Period, 2026-2031
NPV	Net Present Value
NSP	Network Service Provider
OIP	Oil Impregnated Paper
PoE	Probability of Exceedance
PoF	Probability of Failure
RCP	Regulatory Control Period
Repex	Replacement Expenditure
RIT-D	Regulatory Investment Test for Distribution
RP	Regulatory Proposal
RRP	Revised Regulatory Proposal
VCR	Value of Customer Reliability
ZSS	Zone substation

EXECUTIVE SUMMARY

Background

1. In December 2025, Jemena submitted its Revised Revenue Proposal (RRP) in response to the Australian Energy Regulator's (AER) draft decision.
2. The AER has engaged EMCa (in association with Kaihen Consulting) to review and provide advice on aspects of Jemena's proposed expenditures over the 2026-31 Regulatory Control Period (next RCP) included in its RRP.
3. We have reviewed the Coburg North (CN) zone substation (ZSS) redevelopment project included in Jemena's RRP. Our review is based on information that Jemena has provided as part of its initial Regulatory Proposal (RP) and RRP submissions to the AER and on aspects of the National Electricity Rules (NER) relevant to assessment of expenditure allowances.

Our assessment

Jemena has provided significant and relevant new information that largely addresses issues that we identified in our initial review

4. We consider that the issues that we had previously identified in our initial review of Jemena's proposed expenditure for the CN ZSS redevelopment project have been largely addressed by the new information now provided in Jemena's RRP for the CN ZSS redevelopment project.

The condition of assets at CN ZSS require intervention

5. CN ZSS was commissioned in 1967. Jemena states that most of the primary and secondary equipment has reached, or are nearing, the end of their technical lives.
6. We are satisfied of the need to consider replacement options for the assets at this site, subject to analysis of the scope and economic timing.

Jemena has considered a wider set of options including staging and refurbishment of assets

7. Jemena has expanded the list of options it has reviewed and concludes that the redevelopment of CN ZSS is the recommended selection to address the poor condition of assets at this site. Based on our review of the additional information provided by Jemena, including advice from its technical expert, this is a prudent path.

Jemena has taken steps to update its modelling of the risk-costs at CN ZSS

8. Based on our review of the RRP, we consider that Jemena has taken steps to model the costs and benefits of the CN ZSS redevelopment project in accordance with the AER asset retirement guideline[1] and industry practice.
9. This has included seeking advice from its technical expert who drew from industry reference material, approaches established by industry peers and updating its risk model and economic model.

[1] Industry practice application note | Asset replacement planning. AER.

Despite ongoing concerns with Jemena's risk modelling methods at CN ZSS, we consider that project is reasonable

10. Jemena has made a number of adjustments to its risk modelling and economic modelling in response the AER draft decision and our initial review. We reviewed Jemena's assumptions (including their expert's advice) and consider that the Probability of Failures (PoF) relied upon appear high.

11. On examination of the models, we find that the parameters applied by Jemena a not calibrated with Jemena's observed experience, but rather derived from research and industry sources and may overstate the PoFs at an asset level compared with other networks.

12. However, in accounting for the likelihood of loss of supply and calculation of its supply risk, Jemena has applied fault scenarios to its modelling and assigned a PoF to each of the respective scenarios, and not to individual assets as we had first assumed. We infer that in doing so, Jemena has determined that it is only under these fault scenarios that supply will be lost, and which it has then used to calculate the energy at risk.

13. The updated modelling assumptions, taking account of the methods that Jemena has applied in the calculation of the supply risk, support the decision to proceed with the CN ZSS redevelopment project. Notwithstanding the results, we have identified residual concerns with the application of its risk modelling, including the manner in which Jemena has applied of its fault scenarios.

14. However, we consider that a material reduction to the PoFs is required to change the preferred option and economic timing, and applying such a reduction would not be a reasonable approach, or consistent with the stated condition of the assets.

Implications to proposed expenditure

15. We consider that the project is prudent to undertake in the next RCP and the proposed cost of $45.5 million is reasonable.

1 INTRODUCTION

The Australian Energy Regulator (AER) has engaged EMCa (in association with Kaihen Consulting) to review and provide advice on aspects of Jemena's proposed expenditures over the 2026-31 Regulatory Control Period (next RCP) included in its Revised Regulatory Proposal (RRP). Our review is based on information that Jemena has provided and on aspects of the National Electricity Rules (NER) relevant to assessment of expenditure allowances.

We have reviewed the Coburg North (CN) zone substation (ZSS) redevelopment project included in Jemena's forecast replacement expenditure (repex). We have taken account of information provided in its RRP including associated reports and workings that Jemena has provided, together with Jemena's responses to information requests. As at the time of completing this report, we have shared the substance of our findings with the AER.

1.1 Purpose of this report

16. The purpose of this report is to provide the AER with a technical review of selected project expenditure that Jemena has proposed in its RRP for the next RCP.

17. The assessment contained in this report is intended to assist the AER in its own analysis of the proposed expenditure allowance as an input to its Final Determination on Jemena's revenue requirements for the next RCP.

1.2 Scope of requested work

18. The AER's definition of the scope of the required work is reproduced in Figure 1.1.

Figure 1.1: AER's definition of the scope of required work

Scope of work covered by this report

The key aspect for EMCa to assist is reviewing a number of the augmentation and replacement revised proposals from Jemena.

1. Coburg North ZSS Redevelopment

1.3 Our review approach

1.3.1 Approach overview

19. In undertaking our review, we:

- completed a desktop review of the information provided to us by the AER; and
- assisted the AER in preparing requests for information to Jemena.

20. Jemena provided the AER with responses to information requests and, where they added relevant information, these responses are referenced within this review.

21. We have subjected the findings presented in this report to our peer review and quality assurance processes and we presented summaries of our findings to the AER prior to finalising this report.

1.3.2 Conformance with NER requirements

22. In undertaking our review, we have been cognisant of the relevant aspects of the NER under which the AER is required to make its determination and relevant AER guidelines.[2]

1.3.3 Technical review

23. Our assessments comprise a technical review. While we are aware of stakeholder inputs on aspects of what Jemena has proposed, our technical assessment framework is based on engineering considerations and economics.

24. We have sought to assess Jemena's expenditure proposal based on Jemena's analysis and Jemena's own assessment of technical requirements and economics and the analysis that it has provided to support its proposal. Our findings are therefore based on this supporting information and, while we have sought to test Jemena's modelling and assumptions, our review does not encompass developing separate entirely bespoke modelling or assumptions.

25. We have been provided with a range of reports, internal documents, responses to information requests and modelling in support of what Jemena has proposed and our assessment takes account of this range of information provided. To the extent that we found discrepancies in this information, our default position is to revert to Jemena's RRP documents as provided on its submission date, as the 'source of record' in respect of what we have assessed.

1.4 This report

1.4.1 Report content

26. Our main findings are summarised in the Executive Summary at the beginning of this report.

27. In Section 2 we present our assessment of the CN ZSS redevelopment project included in the RRP.

1.4.2 Information sources

28. We have examined relevant documents that Jemena has published and/or provided to the AER in support of the areas of focus and projects that the AER has designated for review. This included further information at onsite meetings and further documents provided in response to our information requests. These documents are referenced directly where they are relevant to our findings.

29. Except where specifically noted, this report was prepared based on information provided by AER staff prior to 23 January 2026, and any information provided subsequent to this time may not have been taken into account.

30. Unless otherwise stated, documents that we reference in this report are Jemena documents comprising its Revised Regulatory Proposal (RRP) and including the various appendices and annexures to that proposal.

31. We also reference responses to information requests, using the format IRXX QYY being the reference numbering applied by the AER to information requests (IR) and to specific question numbers within the IR. Noting the wider scope of the AER's determination, the AER has provided us with IR documents that it considered to be relevant to our review.

[2] Including the AER's industry practice application note Asset Replacement Planning (2024).

1.4.3 Presentation of expenditure amounts

32. Expenditure is presented in this report in $2025-26 real terms as presented by Jemena in its revenue proposal and includes real cost escalation, unless stated otherwise. In some cases, we have converted to this basis from information provided by the business in other terms.

33. While we have endeavoured to reconcile expenditure amounts presented in this report to source information, in some cases there may be discrepancies in source information provided to us and minor differences due to rounding. Any such discrepancies do not affect our findings.

2 ASSESSMENT OF COBURG NORTH ZSS REDEVELOPMENT PROJECT

We consider that the issues that we had previously identified in our initial review have been largely addressed by the new information now provided in Jemena's RRP for the CN ZSS redevelopment project.

Based on our review of the RRP, we consider that Jemena has taken steps to model the costs and benefits of the CN ZSS redevelopment project in accordance with the AER asset retirement guideline and industry practice.

We have reviewed this new material, and its revised modelling approach. Whilst the updated modelling supports the decision to proceed with the CN ZSS redevelopment project, we have identified residual concerns with the application of its risk modelling, including the manner in which Jemena has applied fault scenarios.

However, we consider that a material reduction to the Probability of Failures (PoF) is required to change the preferred option and economic timing, and applying such a reduction would not be a reasonable approach, or consistent with the stated condition of the assets.

We consider that the project is prudent to undertake in the next RCP and the proposed cost of $45.5 million is reasonable.

2.1 Introduction

34. In this section, we consider the new information provided by Jemena in its RRP in relation to its expenditure requirements for the CN ZSS redevelopment project, and whether this leads us to alter the findings set out in our initial review for the CN ZSS redevelopment project.

2.2 Summary of AER draft decision

35. In its draft decision, the AER stated that Jemena had not provided sufficient information to support its proposed repex:[3]

> *'Our bottom-up review found that the majority of Jemena's forecast at the program level were not supported by robust business cases or cost benefit analysis, resulting in us being unable to adequately assess the prudency and efficiency of the proposed programs of work.'*

36. The AER did not include specific comment on its assessment of the proposed $45.5 million for the CN ZSS redevelopment project in its draft decision. However, with reference to Jemena's proposed switchgear replacement program totalling $85.8 million, of which the CN ZSS redevelopment project is a part, the AER included a placeholder subject to further information being provided by Jemena:[4]

> *'Jemena proposed $85.8 million for its switchgear replacement program. This is a 97% increase from its current period actual/estimates. Our draft decision is to not accept*

[3] Attachment 2 – Capital expenditure | Draft decision – Jemena distribution determination 2026–31. AER. Page 18.

[4] Attachment 2 – Capital expenditure | Draft decision – Jemena distribution determination 2026–31. AER. Page 18.

Jemena's forecast and to include an alternative forecast of $0 as a placeholder. We were unable to establish that any of the proposed switchgear programs were prudent and efficient. We note that there is likely to be some replacement activity over the period and we are open to Jemena providing further evidence to support this.'

37. In relation to the substation redevelopment programs more generally that Jemena has proposed in its RP, the AER encouraged Jemena to provide more information in its RRP, specifically to:[5]

'Investigate the probability of failure underpinning the cost benefit for the overall program of works. These programs represent a significant proportion of the overall unmodelled forecast repex as well as a major proportion of the reduction to Jemena's forecast. Affected asset classes include Substation transformers, Switchgear and SCADA.'

38. The AER drew from findings in our initial review of aspects of Jemena's RP,[6] including in relation to the ZSS redevelopment programs that Jemena had proposed:[7]

'Although business cases were provided for these projects, EMCa considers the risk models that support the programs to have overestimated the risk and associated costs of failure. EMCa considers the risks have not been modelled in accordance with AER guidance or industry practice.

EMCa considers that Jemena has not provided compelling information to support the identified risk at the substation sites. Jemena provided copies of the original material in response to our requests for further information regarding this program.'

39. In this report, we consider whether the new information provided by Jemena in its RRP has addressed the issues identified by the AER and ourselves, and the extent to which that leads us to alter the findings set out in our initial review.

2.3 What Jemena has proposed

2.3.1 Response to the AER's draft decision

Jemena has undertaken further analysis to support its proposed ZSS redevelopment projects

40. In response to the AER's draft decision, Jemena has undertaken further analysis of inputs proposed for redevelopment projects:[8]

'Our analysis of risks and optimal timing for these projects strongly supports the implementation of these projects in the next regulatory period. It is our expectation that having adequately addressed the AER's concerns, it will approve our proposed replacement expenditure for the ZSS redevelopments in full.'

Jemena has re-proposed the CN ZSS redevelopment project at the same cost and timing

41. Jemena has re-proposed the CN ZSS redevelopment project for the next RCP, at a total cost of $45.5 million as shown in Table 2.1, being the same cost (and timing) as proposed by Jemena in the RP.[9]

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5 Attachment 2 – Capital expenditure | Draft decision – Jemena distribution determination 2026–31. AER. Page 22.

6 Report to AER on Jemena Network related expenditures 2026–31 RP. EMCa. August 2025.

7 Attachment 2 – Capital expenditure | Draft decision – Jemena distribution determination 2026–31. AER. Page 21.

8 JEN – RP – Att 5-01 Capital expenditure – 20251201 – Public.

9 The input cost is the same in $FY24, with minor variations in escalation assumptions.

Table 2.1: Proposed repex for CN ZSS redevelopment project ($million, June 2026)

	FY27	FY28	FY29	FY30	FY31	RCP Total
CN ZSS redevelopment project	21.6	23.9	-	-	-	**45.5**

Source: JEN - RP - Att 05-02M SCS Capex model - 20251201 - Public

Jemena has provided additional supporting information in response to the AER draft decision

42. Jemena has included additional information with its RRP, including:

- Business case
- CBA model
- Risk register
- Summary of PoF and quantified risks for the primary and secondary equipment
- Independent review of substation replacement projects by K-BIK, authored by K Williams.

2.4 Assessment of proposed expenditure

43. On the basis of the conclusions reached by the AER in its draft decision, we present our assessment against a summary of the elements required to satisfy the capex criteria and which are aligned with the Regulatory Investment Test for Distribution (RIT-D) application guideline.[10]

2.4.1 Identified need

Jemena has included further information that supports its assessment of asset condition

44. CN ZSS was commissioned in 1967. Jemena states that most of the primary and secondary equipment has reached, or are nearing, the end of their technical lives.

45. In our initial review, we found conflicting statements concerning the potential replacement options for those assets, in response to condition reports. When considered alongside the issues identified in the risk modelling, we were unable to determine whether the project was prudent to undertake in the next RCP.

46. Jemena has provided significant and relevant new information including advice from its technical expert.

The condition of the transformers is poor

47. Jemena has three transformers at CN ZSS. The No.1 and No.2 transformers were manufactured by AEI and are 59 years old and are considered by Jemena to be in poor condition. The No.3 transformer was manufactured by Wilson in 1990 and is of a newer design and is in reasonable condition.

48. We agree that the No.1 and No.2 transformers are in poor condition, as indicated by deteriorating Interfacial Tension (IFT) results as an indicator of oil aging, contamination, and oxidation, and low degree of polymerisation (DP) levels as an indicator of the insulating paper's aging, mechanical strength, and remaining useful life.

49. Jemena's technical expert considers that the transformers have limited remaining life '*With these transformers the internal condition is very poor and so over the next 5 years they are more likely to fail in service than be retired.*'[11]

[10] Application guidelines | Regulatory investment test for distribution. AER. 2024.

[11] Substation Asset Replacement Review. K-BIK. Page 13.

50. Jemena has included replacement of the No.3 transformer in its replacement project. From the information included with the RP, Jemena states:

> *'It is proposed the No.3 transformer be replaced and later relocated and installed as the No.3 transformer at zone substation Coburg South (CS) as part its future proposed redevelopment.'*[12]

51. We therefore looked closely at how Jemena had modelled the risk, given the stated fault scenario of considering the simultaneous failure of No.2 and No.3 transformers.

The condition of the circuit breaker (CB) fleet is poor, with high safety and operational risk

52. The 66kV CBs are older bulk oil style, with Oil Impregnated Paper (OIP) condenser type bushings. CBs of this type are no longer supported by the manufacturer, have a history of mechanical issues and catastrophic failure of the bushings. Based on our experience, Network Service Providers (NSP) with these CBs have established a program for replacement, prioritised by risk.

53. According to the RP, the 22kV switchgear is a combination of Email 345GC dead tank bulk oil CBs (approx. 57 years old) and Siemens 3AF CBs, which have vacuum interrupters. Jemena describes the bulk of the issues relating to the 345GC CBs, with the high duty Siemens 3AF CBs requiring replacement interrupters, operational restrictions due to not being arc fault rated, and delayed tripping – both of which increase the safety risk.

54. In its RRP, Jemena refers to advice from its technical expert which focusses on the issues associated with the 22kV metal-clad switchgear, which we infer relates to the Siemens 3AF type units. These CBs are installed in an outdoor enclosure and suffer from corrosion and present higher safety and operational risks due to their design and proximity to one another in the substation yard.

55. Jemena also describes issues associated with the switchyard design and condition, including failure of the pin and cap-type porcelain insulators used in the busbar.

Most protection systems are legacy electro-mechanical relays and exceed the design life

56. These relays are used to protect major primary plants.

57. The electro-mechanical protection relays are 50 years old, exceeding the design life of 40 years. These relays do not include monitoring to alert the operator to failure of the relay. Other relay types are similarly approaching the deign life.

58. In addition, the DC supply system and associated SCADA and communications systems are operating beyond the design life.

We are satisfied of the need to consider replacement options

59. Based on our review of this information, we are satisfied of the need for Jemena to consider replacement options for the assets at this site, subject to analysis of the scope and economic timing.

2.4.2 Options analysis

Jemena has expanded the list of options it has assessed

60. Jemena has expanded the list of options that it has assessed for the CN ZSS redevelopment project to compare against its Option 1 – the 'do nothing' base case as shown in Table 2.2.

[12] JEN - RIN - Support - CN ZSS Redevelopment - Business Case – 20250131. Table 1-1.

Table 2.2: Net economic benefits for options relative to Option 1 (the base case) ($million, 2024)

Option	Present value of gross benefits	Present value of gross costs	Net Present Value
Option 2 – transformer refurbishment, deferring the replacement of the transformers by five years	49.0	22.7	**26.3**
Option 3 – redevelopment of CN ZSS (**preferred**)	96.1	30.4	**65.7**
Option 4 – staged redevelopment of CN ZSS, prioritising transformer replacement	68.7	28.4	**40.3**
Option 5 – staged redevelopment of CN ZSS, prioritising switchgear and protection relay replacement.	95.8	31.1	**64.7**

Source: JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Table 1-1

Option analysis considers a reasonable set of options, with Option 3 the prudent selection

61. We consider that the options Jemena has assessed represent a reasonable set of options. Jemena has introduced Option 2 (based on revised scope to refurbish the transformers)[13] and Option 5 in its revised business case. Jemena also considered but did not progress non-network solutions.

62. The new information provided with the RRP also resolves the issues we identified in our initial review regarding the consideration of refurbishment and staging options. Specifically, given the stated condition of the assets, identified condition history replacement is the preferred option.

63. From our review of the options analysis:

- For Option 2, treatment is limited to the transformer risks only and therefore it does not address the source of other risks, such as failure associated with switchgear and protection relays.
- For Option 4, similarly to Option 2 whilst the primary plant risks would be treated in the next RCP, the risks associated with the switchgear and protection would not be treated until the subsequent RCP. On the basis that Option 2 and 4 do not treat all identified risks, these options were not preferred by Jemena.
- For Option 5, the net present value (NPV) is similar to the preferred Option 3. Jemena states that it has assumed the costs would be similar to Option 4. However, according to Jemena's business case, the costs are likely to be much higher due to additional complexity with the interfacing of modern protection and control equipment with legacy transformers:[14]

  'Although we have included Option 5 to ensure a robust analysis, we explain in section 5.5 that we expect the true cost of Option 5 will be significantly higher than that assumed in this analysis. These additional costs have not been captured because JEN considers it disproportionate to attempt to estimate these costs at this stage.'

64. On that basis, the net benefits for Option 5 shown in Table 2.2 are also likely to be much lower than indicated, due to the increase in cost for Option 5, and would therefore would not be preferred over Option 3.

65. Based on Jemena's analysis, the recommended Option 3 to redevelop the substation is the prudent option based on the highest net benefits and ability to treat all identified sources of risk.

66. The scope of Option 3 involves the simultaneous replacement of the transformers, switchgear, and protection relays at CN ZSS in the next RCP at an estimated cost of $45.5

[13] The original Option 2 referred to undertaking increased maintenance and monitoring only.

[14] JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Page 11.

million. The project is planned to be delivered in FY27 and FY28 as indicated by the capex model.[15]

Jemena's modelling approach overstates the NPV,. We tested a more conservative approach but find that the NPV remains strongly positive.

67. In Table 2.2, we observe that the present value of gross costs is lower than we would have expected for the preferred Option 3. On review of Jemena's economic model, we observe that Jemena has included a terminal value at year 2044 which effectively adds a 'benefit' in that year equivalent to the depreciated value of the original capital cost.

68. To the extent that a cost benefit analysis is conducted over a given period, we consider that a reasonable default approach is to consider only the costs and benefits within that period. We consider this to be a conservative approach to such modelling.

69. There can be a case for considering terminal values, but we consider that a positive case needs to be made for doing so based on justified assumptions for the continuation of relevant costs and benefits beyond the analysis period. Jemena has not done so, but rather, its modelling approach automatically adopts a terminal value that has the effect of 'adding back' a proportion of the initial cost, and which it calculates by applying assumed 'depreciation' of that original cost. This approach mixes economic concepts in which analysis reflects economic costs and benefits, with the accounting concept of depreciation.

70. When adopted without justification, Jemena's approach understates the PV of the economic cost within the modelled period. However we tested the impact of removing the terminal value and find that, for this project, it reduces the calculated NPV from $65.7 million to $56.4 million and remains strongly positive.

2.4.3 Cost estimation

Jemena applies a standard cost estimation methodology

In our initial review, we observed that Jemena has applied a standard cost estimation methodology. We did not raise any material issues with the development of its cost estimate for this project.

Cost estimate for CN ZSS redevelopment lacks sufficient detail

71. We asked for a copy of the cost estimate relied upon for the CN ZSS redevelopment project in sufficient detail so as to understand the component costs linked to the scope, and any risk or other allowances that have been included.

72. In response, Jemena provided a cost breakdown into three components only as shown in Table 2.3 which Jemena refer to as a 'fully loaded cost'.

Table 2.3: Cost breakdown for CN ZSS redevelopment project ($million, real 2024, including OHs)

Cost breakdown	Total cost
Transformer	17.7
Switchgear	16.9
SCADA, network control and protection systems	13.0
Total	47.6

Source: JEN - IR060 - ZSS breakdown of costs - 20250121 - Public

73. In its response, Jemena states that the breakdown is an approximation only:[16]

[15] The business case refers to practical completion and commissioning in the first half of financial year FY29.

[16] Jemena's response to IR#060. Question 3.

'...the breakdown is an approximation only and were initially undertaken for the purposes of the repex modelling, that is, so we can roughly estimate the costs associated with key sub-asset class works and allocate them accordingly in the repex modelling. We have also used this proxy breakdown in the cost-benefit analysis for the different options considered for CN.'

74. Jemena also directed us to Appendix D of JEN – RIN – Support – Coburg North ZSS Redevelopment – Business Case – 20250131 which was submitted to the AER as part of the RP. Appendix D provides slightly more cost information, however not the level of detail necessary to address the focus of our question.

75. We find that this response is also at odds with statements in its business case that:[17]

'We have estimated the capital costs of the options based on the scope of works necessary, together with using a mix of current and historical information from similar projects that were adjusted to reflect the requirements of the proposed works, location and market conditions.

In line with JEN's Cost Estimation Methodology (ELE-999-PR-CE-001) a top-down technique and Project Estimation Model (PEM) tool was utilised to develop the capital cost estimate. Inputs such as scope definition, asset strategy requirements, site information, standard rates, lessons learned, vendor pricing, design considerations, delivery strategy and network asset risk assessments were considered when forming inputs into the PEM.'

We have not identified material concerns with the cost estimate

76. We had expected to see a more detailed cost estimate for this project similar to what is provided by other NSPs. However, on balance, we consider that the cost estimate is likely to be reasonable. We base this on having not identified any material concerns in the cost estimation methodology applied by Jemena in our initial review, and despite cost uplifts in the market, Jemena has not proposed to increase its cost estimate for this project.

2.4.4 Risk modelling

Jemena states that it has updated its risk modelling

77. Jemena claims that it has updated its modelling to be consistent with AER guidance and industry practice, and to respond to the concerns raised in our initial review:[18]

'To address this issue, we engaged a technical expert to advise us on an appropriate Weibull distribution and parameters for the primary equipment, that is, transformers and circuit breakers, at each ZSS proposed for replacement.'

78. We provide Jemena's response on this topic in Figure 2.1.

[17] JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Page 15.

[18] JEN – RP -Att 05-01 Capital expenditure – 20251201 – Public. Page 44.

Figure 2.1: Jemena's response to risk modelling

Probability of Failure – CN transformers

Our technical expert relied on the IEEE paper "Investigation into Modelling Australian Power Transformer Failure and Retirement Statistics" (Martin et al., IEEE Transactions on Power Delivery, Vol. 33, No. 4, August 2018). This study analysed failure and retirement data for 97% of the 6,057 utility-owned transformers in mainland Australia and Tasmania, covering 564 events between 2000 and 2015. Using locally sourced data from almost all Australian utilities, the authors applied Weibull analysis to estimate useful life and age-related failure probabilities across voltage classes. Based on these outcomes, our expert developed a Weibull curve for transformers <66 kV and identified the position of the CN units on that curve.

Probability of failure – CN, CS and NH circuit breakers

Our technical expert relied on JEN asset data and reliability statistics from CIGRE's internationally recognised surveys on high-voltage equipment. This approach, detailed in our technical expert's report supporting report underpins the analysis for our proposed ZSS redevelopments.[68]

Probability of failure – secondary equipment (protection relays)

JEN adopted a literature review approach to determine Weibull distribution parameters for protection relays due to insufficient failure data on our network, likely resulting from our proactive replacement strategy. Using limited internal data could skew statistical analysis and reduce reliability. Our review identified several studies, and for the CN, CS, and NH ZSS business cases, we adopted the Weibull parameters used in Ergon Energy's protection relay program, which was accepted by the AER.[69] Ergon operates within the Australian NEM, making it a more relevant comparator than international sources. This approach aligns with EMCa's recommendation to use Weibull functions and parameters from other DNSPs where applicable.

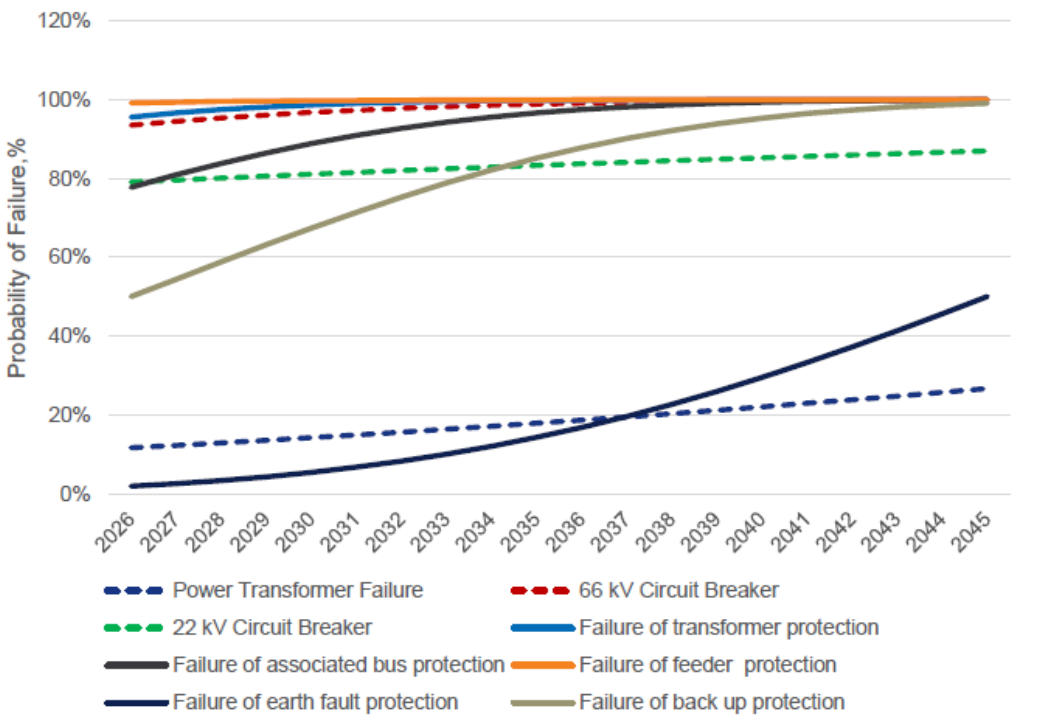
Source: JEN – RP -Att 05-01 Capital expenditure – 20251201 – Public, Page 44

79. Jemena also states that its revised analysis underpins the calculations of the risk, including by reference to the PoF charts reproduced in Figure 2.2:[19]

> *'Our revised analysis shows that the probability of failure increases over time as further asset deterioration occurs. These results underpin our calculation of risks under our updated business cases for CN, CS and NH ZSS redevelopments.'*

[19] JEN – RP -Att 05-01 Capital expenditure – 20251201 – Public. Page 45.

Figure 2.2: Coburg North - Probability of failure: transformer, circuit breakers and secondary equipment



Source: JEN – RP -Att 05-01 Capital expenditure – 20251201 – Public

We remain concerned by the elevated level of risk that Jemena has assumed

80. As shown in Figure 2.2, Jemena is assuming that the failure of transformer protection or failure of feeder protection approaches certainty from 2026, with elevated risks for many of the remaining protections systems and primary plant elements.

81. When considering the population of assets at this site, the rates applied by Jemena indicate that it should expect that an asset failure is imminent. These values would indicate to us that asset replacement at this site is urgent and is likely to have been economically viable in the 2021-26 Regulatory Control Period (current RCP), if not earlier.

82. We expressed similar concerns relating to the high PoF presented in its original risk modelling as part of our initial review, and which we found at that time was not consistent with AER guidance[20] or industry practice. Despite the claimed improvements to Jemena's risk modelling in its RRP, we remain concerned that the methods that Jemena has now applied have similarly resulted in overstated PoF assumptions.

Assumed failure probabilities are now based on advice from its technical expert

83. Jemena has included a PoF worksheet with its RRP. We were not able to review the full derivation of the Weibull parameters that Jemena has applied, as they are hardcoded in the version of the model that we have been provided. We therefore asked Jemena to explain the derivation of them.

84. In its response,[21] Jemena refers to the findings and outcome of technical advice that it had been provided in a report from its technical expert titled *'Review of Assets for Replacement of Substations within Jemena's Network'* by K. Williams. In its RRP, Jemena states that:[22]

> *'We accept our technical expert's advice on the probability of failure for primary equipment. The approach relies on a peer-reviewed IEEE study that analysed failure and retirement data for almost all utility-owned transformers in Australia, using robust*

[20] Industry practice application note | Asset replacement planning. AER.

[21] Jemena's response to IR#060. Question 2.

[22] JEN – RP -Att 05-01 Capital expenditure – 20251201 – Public. Page 44.

statistical methods such as Weibull analysis. This ensures the assessment is based on comprehensive, locally relevant data and aligns with industry best practice, providing an evidence-based estimate of failure probability for CN ZSS transformers.'

85. We have considered the basis of the risk modelling and parameters, including by reference to the advice from Jemena's technical expert. Jemena states that the failure probability for power transformers:[23]

'...have been adopted from an IEEE paper by D. Martin et al, titled 'Investigation into Modelling Australian Power Transformer Failure and Retirement Statistics' which was published in the academic journal 'IEEE Transactions on Power Delivery Volume 33 No. 4' in August 2018.'

86. Jemena has applied a combination of the Weibull parameters from this paper for failures and retirements as shown in Table 2.4 to produce a composite PoF for transformers No.1 and No.2, which is shown in Figure 2.3.

Table 2.4: Weibull parameters for transformer failure distribution

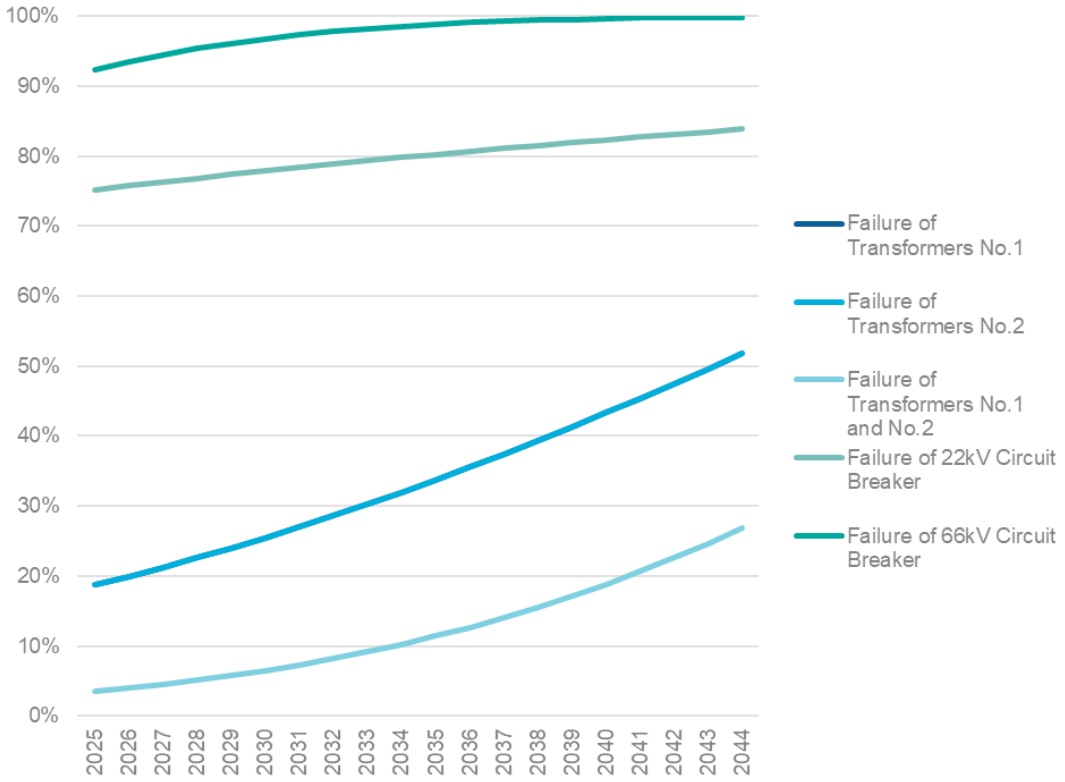
Distribution		β	η
Failures	Early / random failures	0.96	5,930
	Age related failures	3.49	112
Retirements due to poor condition	Early / random failures	0.57	467,000
	Age related failures	5.86	90.3

Source: JEN - RP - Support - Coburg North ZSS - PoF and Quantified Risks - Primary equipment- 20251201 - Public ; and IEEE Paper - Investigation into Modelling Australian Power Transformer Failure and Retirement Statistics – Confidential, Table 1.

87. Figure 2.3 also shows the PoF for a 22kV CB and 66kV CB, for comparison purposes and which we review separately.

[23] Jemena's response to IR#060. Question 2

Figure 2.3: Asset probability of failure 2025 - 2044[24]



Source: EMCa analysis of JEN - RP - Support - Coburg North ZSS Redevelopment - CBA Model - 20251201 - Public

88. The findings of the Institute of Electrical and Electronics Engineers (IEEE) paper are based on power transformers from utilities (generators, transmission, and distribution) operating in Australia between the 1960's and 2015 and have been used in determining the PoF values that Jemena has subsequently relied upon. The resulting PoF for the CN ZSS transformers, whilst following a Weibull function, are higher than a typical PoF for a transformer that we have observed.

Assumed failure distributions do not appear to have been calibrated with observed experience

89. Whilst we accept that it is often necessary to gather data from other networks and published materials to establish a failure distribution,[25] in doing so, it is common practice to take into account differences in transformer specifications, operating conditions and asset condition. This is often done by establishing a relationship between the failure distribution and the assessed condition of the assets.

90. We asked Jemena to explain the relationship between the selected Weibull parameters for its transformers and CBs and the condition-based health index (HI) included in the Condition-Based Reliability Models (CBRM) that were provided with the RP. Jemena stated there was no such relationship:[26]

> *'There is no mathematical relationship between the condition-based health index included in the CBRM models and the selected Weibull parameters to determine the probabilities of failure for the power transformers at Coburg North (CN). The CBRM health index reflects the observed condition of the CN power transformers and circuit*

[24] The data for the failure of transformers No.1 and No.2 is the same and therefore overlap in this figure.

[25] For example, in instances where there is in sufficient information to establish a failure distribution within its own network, including a small population of assets.

[26] Jemena's response to IR#060. Question 2.

breakers, incorporating factors such as operational history of the asset and results from key asset maintenance tests such as insulation condition and dissolved gas analysis. In contrast, the Weibull-based probability-of-failure (PoF) assessment draws upon empirically derived age-related failure and retirement statistics sourced from the Australian or international sources. They are unrelated concepts.'

91. We understand that the method of determining a failure distribution that Jemena has adopted is based on published material, and not its own population. However, we find that Jemena's response is not consistent with accepted industry practice in this case, where a relationship is typically established between the failure distribution and condition assessment. Such a relationship typically ensures that a failure distribution adopted by the NSP more accurately reflects the assets in its network and does not overstate the PoF and risk of its assets.

For CBs, Jemena has similarly relied upon advice from its technical expert

92. Similar to power transformers, Jemena has relied on advice from its technical expert who has sourced failure data from CIGRE Technical Brochure 509 for 22kV CBs, and which is based on surveys conducted in 2004 and 2014 respectively. Jemena states that a similar 'statistical method' has been applied to that undertaken for power transformers.

93. However, for 66kV CBs, Jemena has relied upon a standard set of Weibull parameters of β = 3.5 and η = 45 years based on values adopted by AusNet Services, which Jemena considers to be similar:[27]

'IT [sic] is noted that AusNet distribution substations are at 66kV and therefore can be considered as aligning closely to those 66kV breakers in the Jemena network. This alignment and AusNet verified data can be applied to the Jemena PoF.'

The proposed Weibull parameters for primary equipment are similar to the standard parameters adopted for other networks

94. On the basis of Jemena's own comparison, we reviewed AusNet's standard Weibull parameters that it states apply to asset renewal planning as shown in Table 2.5.

Table 2.5: AusNet Weibull parameters for power transformers and circuit breakers

Asset	AusNet Weibull parameters
Power transformers	η = 50, β = 3.5
Circuit breakers[28]	HV: η = 55, β = 3.6 MV: η = 65, β = 3.6

Source: ASD - Ausnet - AMS 01-09 Asset Risk Assessment Methodology -31 Jan 2025 - PUBLIC (1).pdf and AusNet Services - TRR 2027-32 AMS 01-09 Asset Risk Assessment Overview - 10 Nov 2025 - PUBLIC.pdf

95. We consider that the assumptions adopted by Jemena approximate the assumptions adopted by AusNet before making adjustments for condition (as relevant). We reviewed the impact of changing the Weibull parameters adopted by Jemena[29] and consider the outcome of this analysis as a part of our sensitivity analysis of the project.

[27] Substation Asset Replacement Review. K-BIK. Page 17.

[28] For ASD, a single set of parameters was provided of η = 45, β = 3.5.

[29] We refined our view, as the shape of the curves will differ based on the parameters adopted, with the values and shape of the curve over the assessment period being of most significance to the analysis.

Jemena has adopted Weibull parameters for its secondary equipment based on work developed by Ergon Energy

96. Jemena states that it has based its PoF analysis on the protection relay program business case submitted by Ergon Energy for its 2025-30 RCP:[30]

> *'We consider use of Ergon Energy's Weibull distribution appropriate because Ergon Energy also operates in the Australian National Electricity Market (NEM) and is therefore likely to be a closer comparator to JEN's assets relative to international evidence.'*

97. We reviewed the Ergon Energy business case and find that Ergon Energy's replacement program was determined[31] '*after conducting the risk evaluation, optimal timing and NPV analysis for individual projects to optimise the cost/benefits for the community,*' and not reliant solely on its Weibull failure modelling.

98. The parameters adopted by Jemena are shown in Table 2.6.

Table 2.6: Jemena Weibull parameters based on Ergon parameters

Asset	Weibull parameters
Digital	η = 14, β = 1.9
Analogue	η = 37, β = 4.3
Electromechanical	η = 47, β = 5.0

Source: JEN - RP - Support - CN CS and NH ZSS - PoF and quantified risks - Secondary equipment - 20251201 - Confidential

99. We also note that the electromechanical and digital protection relays installed at CN ZSS have been in service for longer than their technical asset lives. Jemena has limited its assessment of risk to the protection relays, and not included risks associated with other secondary equipment, such as DC systems and communication systems.

100. As a result of the advanced age of the protection relays, and the predominance of electro-mechanical relays, the PoF after application of the above Weibull parameters results in an elevated level of risk. We consider that establishing a failure relationship for protection equipment is complex due to the nature of the failure modes, and may not align with a Weibull distribution. However, these values provide an approximation of the risk values for the purpose of its economic modelling.

101. Due to the high contribution of the secondary systems to the level of overall supply risk, as we have done for primary assets, we also considered changes to the Weibull parameters (and associated risk) as a part of our sensitivity analysis for the project.

Modelling the likelihood of loss of supply due to substation configuration

102. In a sub-transmission or transmission system, the network typically includes a level of redundancy, such that loss of a single element (such as a transformer or CB) will not result in the loss of supply to connected customers. However, even in these scenarios, there is a small risk that the failure triggers another failure (due to fault stressors, damage, fire or other factor) which results in loss of supply, or the network is running at higher risk levels due to maintenance or assets being out of service.

103. It is therefore important to consider the specific items of plant, condition of the assets and risks including catastrophic failure, configuration of the site, physical separation and protection systems.

104. For sub-transmission systems, the consequences are typically considered for N-1 scenarios, where a network element is unavailable (planned or unplanned), as a better indicator of the likely level or risk.

30 JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Page 4.

31 Protection relay replacements business case. Ergon Energy. 25 January 2024. Page 17.

105. In determining the supply risk arising from the failure of an asset, the NSP needs to take account of the likelihood of the consequence occurring in addition to the consequence of the fault occurring. In our experience, NSPs take into account the factors outlined above through the use of joint and conditional probability methods.

106. This is described in the AER asset replacement guideline as being undertaken as part of risk cost analysis to '*ensure that any proposed risk assessment method includes treatment of joint and conditional probability (as appropriate). This is critical to getting reasonable and meaningfully results, and to ensuring that the risk cost is not overestimated.*'[32]

Jemena has modelled fault scenarios as a proxy for the likelihood of loss of supply

107. Jemena has included the following fault scenarios for its primary plant, each with an assigned PoF used to calculate the supply risk:

- Failure of Transformer No.1 and No.2
- Failure of Feeder Circuit Breaker
- Failure of Transformer Incomer Circuit Breakers
- Failure of 22kV Bus Tie Circuit Breakers
- Failure of 66kV Bus Tie Circuit Breakers.

108. We observe that, other than accounting for the coincidental failure of transformers No 1 and No 2, the PoF and fault scenarios are based on a group of assets, where the PoF accounts for a number of assets at the substation. This differs from what we typically see, where NSPs assign a PoF to individual assets, as shown in the AER's Asset replacement guideline.[33]

109. Jemena has then calculated the energy at risk based on its assessment of the loss of supply at the substation, taking into account the configuration of the substation and network more generally. Jemena has assumed that:

- where two transformers (No.2 and No.3) fail simultaneously, two of the three buses will lose supply, equating to two-thirds of the average load,[34] and
- for a single transformer failure, switchgear failure, or protection failure only one of the three buses will lose supply.

110. Jemena refers to these cases as fault scenarios and assigned the PoF calculated above to each of the respective scenario. We infer that in doing so, Jemena has determined that it is only under these fault scenarios that supply will be lost, and which it has then used to calculate the energy at risk.

111. Whilst Jemena has not modelled the joint and conditional probability of asset failure, from our assessment of the modelling undertaken by Jemena, it has firstly assumed that restoring supply to customers would take 90 minutes for each of the fault scenarios, and which we consider is the time to restore supply from other sources and not the time to replace an asset following failure, as this would typically be much longer.

112. Jemena states that:

> *'[o]ur experience with the time it takes to undertake the onsite inspection and investigate the cause of an outage, which is a combination of remote and manual switching and transferring load to the adjacent network, suggests that restoring supply would take considerably longer for some failure modes. However, we have adopted this conservative approach to mitigate concerns that the benefits of replacing CN ZSS are overstated.'*[35]

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32 Industry practice application note | Asset replacement planning. AER. Page 62.

33 Industry practice application note | Asset replacement planning. AER.

34 At CN ZSS, the No. 2 and No. 3 22 kV buses are tied together, while the No. 1 22 kV bus operates independently. Failure of No.1 transformer would only result in a momentary outage.

35 JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Page 5.

Application to transformer failure modelling

113. Jemena modelling has determined the PoF for each of the No.1 and No.2 transformers based on advice from its technical expert as 18.7% in 2025 and then determined the simultaneous failure as being the PoF (No.1) x PoF (No.2) for the transformer fault scenario. However, Jemena states that it is the No.2 and No.3 buses (and which we assume are connected to the No.2 and No.3 transformers) that are tied together, and to which a calculation such as this would apply rather than the No.1 and No.2 transformers which are on a separate bus.

114. This suggests to us that Jemena has overstated the PoF based on the assumed consequence of losing two thirds of the load. The PoF would in fact be lower than Jemena has assumed, being the multiple of PoF (No.2) and PoF (No.3) where the PoF (No.3) would be much lower.

115. As stated earlier, Jemena has used data based on the 'whole of fleet statistics across Australia' and does not account for Jemena's fleet of transformers or the specific condition of transformers at CN ZSS. We accept that the No.1 and No.2 transformers would have a higher PoF than the No.3 transformer, and also that the No.1 and No.2 transformers are in an advanced state of deterioration, and that may indicate a higher PoF for these transformers than Jemena has assumed.

116. We therefore considered how sensitive the economic analysis was to changes to the assumed PoF and energy at risk, as explained in Section 2.4.5.

Application to 22kV CB failure modelling

117. By adopting fault scenarios for the 22kV CB assets, we infer that Jemena has modelled the 22kV CB assets as an integrated system, whereby the failure of any 22kV CB would likely result in failure or loss of the adjacent 22kV CBs or otherwise prevent their safe repair and continued operation. We often see this when considering an oil-insulated CB in MV switchboards, where failure may be catastrophic to the switchboard and/or render the switchboard otherwise inoperable as a result of the failure and require replacement.

118. In Jemena's case, the 22kV CB are indoor CBs enclosed in an outdoor structure, and present higher safety and operational risks due to their design. Jemena's technical expert states that:[36]

> *'For the purposes of this report and assessments the 22kV circuit breakers will be considered as 22kV switchgear. This is because the arrangements for the breakers being in service requires a similar set up as would be required for an indoor panel type switchboard. The only difference is that these breakers are individual panels and the busbar is external rather than enclosed with the switchgear.'*

119. We agree that the current 22kV CB design arrangement represents a high safety and operational risk, and if there is a fault that leads to catastrophic failure then there is a high likelihood that other CBs and the busbar would be affected. If not, an extended outage would be required to make changes to the switchyard to allow access to the damaged assets.

120. Based on our review of the information provided by Jemena, we consider that the modelled risk represents a conservative assumption for the 22kV CB assets.

Application to 66kV CB failure modelling

121. Rather than consider the PoF for each 66kV CB, Jemena has similarly considered these as part of a system and assigned a single PoF for the fault scenario of failure of 66kV CBs. Whilst there is a high likelihood, but less than 100%, that the bulk-oil type CBs fail catastrophically, the rationale for including the 66kV CB assets as a system is not explained by Jemena. By modelling these as a system, Jemena is essentially assuming that failure of any 66kV CB will result in the loss of supply, assuming one third of the average load is unsupplied.

[36] Substation Asset Replacement Review. K-BIK. Page 18.

122. Jemena states that:[37]

> *'.. in the event of a switchgear failure, only one of the three buses at CN ZSS will lose supply. It follows that we assume a switchgear failure would result in one-third of the average load being lost for each hour of the outage.'*

123. Based on our review of the information provided by Jemena in its RP and RRP, including the stated condition of these assets, we consider that the modelled risk represents a conservative assumption for the 66kV CB assets. We arrive at this view, also considering that Jemena has not included the contribution from other instrument transformers, which are likely to be of similar age and condition.

Application to protection systems failure modelling

124. For its secondary plant, Jemena has included failure, referred to as maloperation, of individual relays rather than a group of relays which result in loss of supply of the bus corresponding with the upstream protection zone.

125. Jemena states that:[38]

> *'A protection relay failure may result in one or two buses losing supply. To be conservative, we assume the energy at risk for protection relay failures is one-third of the average load being lost for each hour of the outage.'*

126. Based on our reading of the business case, we understand that Jemena has applied a moderating factor (between 0.25 and 0.5) to reflect that an outage associated with a protection relay failure occurs only during a network fault, given the high unmoderated PoF. We consider this is a reasonable approach.

2.4.5 Economic assessment

A new economic model was provided

127. In addition to updates to Jemena's risk modelling, we observe the following changes to the economic model:

- Adoption of a load duration curve for estimation of the load at risk
- Calculation of unserved energy, making use of a ratio of 70:30 PoE50 and PoE10 summer and winter demand forecasts at the substation
- A load-weighted value of customer reliability (VCR) based on the 2024 AER VCR study
- Assessment of optimal timing, through a comparison of the annualised benefits with the annualised costs.

The new model had provision to include other sources of risks, however these were not populated by Jemena instead relying on the supply risk.

128. The economic model includes assessment of options, NPV and sensitivity analysis. We consider that the economic model is appropriate to assess the project.

The proposed project timing of FY29 is reasonable

129. From Figure 2.4 we observe that the supply risk assumed by Jemena is approximately $7 million ($real 2024) in 2025 and increasing. This exceeds the annuitised cost of the proposed redevelopment calculated by Jemena of $3 million, and on the assumption that the proposed solution rescues all of the supply risk, the project is already economic to undertake. In reality a residual level of risk continues after Option 3.

130. Jemena has indicated the economic timing as 2029, and proposed expenditure in FY27 and FY28. Based on our review of the model, the economic timing is determined as the year

[37] JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Page 16.

[38] JEN - RP - Support - Coburg North ZSS Redevelopment - Business Case - 20251201 – Public. Page 16.

when the benefits arising from the timing of its preferred Option 3 exceed the annuitised cost, and which we consider is circular logic on the basis the benefits occur after the cost.

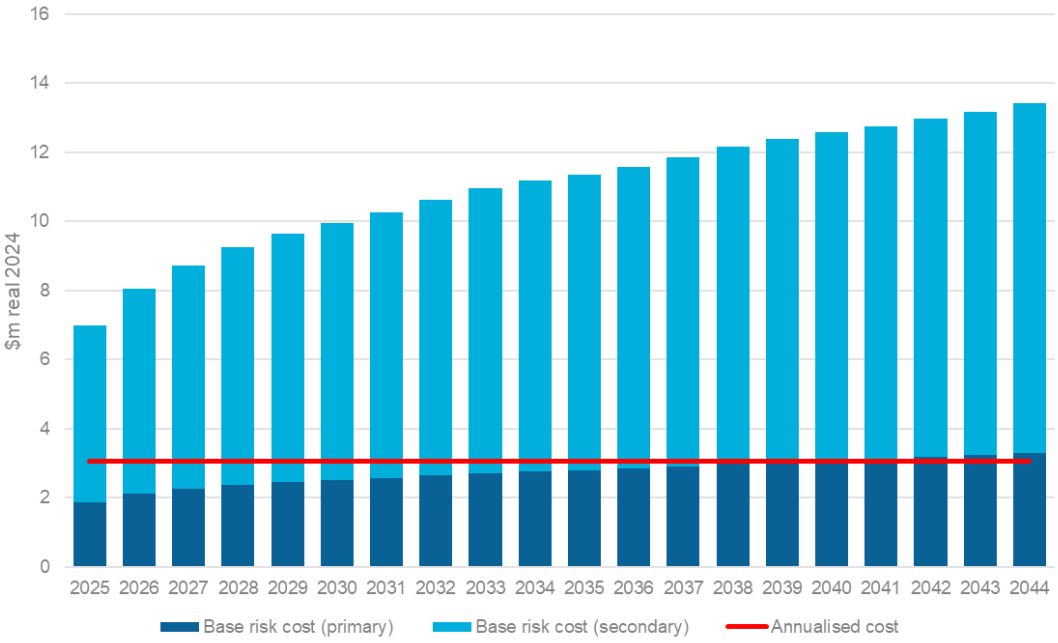
131. A more accurate representation of the economic timing is FY25, being the commencement of the assessment period. The project timing is as proposed in the RP as FY29, without change.

132. We also noted Jemena's comment that it had previously identified a project relating to the switchgear and relay condition at CN ZSS as part of the current RCP. We reviewed the 2023 Distribution Annual Planning Report (DAPR)[39] being around the time of the commencement of the current RCP. We found reference to asset replacement plans for the year 2027, with RIT-Ds proposed for 2025 for:

- CN 66 kV CB asset condition - Replace 66 kV 1-2 bus-tie and 66 kV line CB at CN ZSS: and
- CN switchgear and relay asset condition - Replace 22 kV switchgear and relays at CN ZSS.

133. Jemena is now also proposing to replace the transformers at this site as a part of the ZSS redevelopment project.

Figure 2.4: Base case supply risk ($million, real 2024)



Source: EMCa analysis of JEN - RP - Support - Coburg North ZSS Redevelopment - CBA Model - 20251201 – Public

Sensitivity analysis confirms the selected option of substation redevelopment and project delivery timing of FY29

134. As shown in Table 2.2, Jemena's preferred Option 3 has the highest NPV and when accounting for the additional costs of Option 5 that Jemena has not included, is likely to be much higher than the remaining options.

135. Jemena states that Option 3 is the preferred option under each of the sensitivities that it has applied. We confirm that the selection of Option 3 from application of Jemena's sensitivity analysis is robust and would require material changes in assumptions to change the preferred option.

[39] 2023 Distribution Annual Planning Report. Jemena. Table 5-9.

136. We undertook further sensitivity analysis to determine if, after adjusting for the observations we made regarding the calculated PoF distributions, the proposed delivery timing would be altered:

- We first adjusted the Weibull parameters that Jemena had proposed, as the shape of the curves will differ based on the parameters adopted, with the values and shape of the curve over the assessment period being of most significance to the analysis. For example, we considered a higher characteristic life, as a way to account for the apparent lower failure rates and longer asset lives being observed by Jemena, and variations to the beta value, and
- As a simplified sensitivity, we also applied an overall reduction factor of 50% to the modelled PoF for both primary and secondary assets, as a way to test how sensitive the analysis was to the assumed PoF.

137. In both cases, we found that the adjustments did not change the delivery timing of the project. This is not surprising given the large supply risk as shown in Figure 2.4.

2.5 Summary and implications

2.5.1 Summary of findings

Jemena has provided significant and relevant new information that largely addresses issues that we identified in our initial review

138. The issues that we had previously identified in our initial review have been largely addressed by the new information now provided in Jemena's RRP for the CN ZSS redevelopment project.

139. Based on our review of the RRP, we consider that Jemena has taken steps to model the costs and benefits of the CN ZSS redevelopment project in accordance with the AER asset retirement guideline[40] and industry practice.

The additional supporting information has addressed the majority of our concerns in relation to the originally proposed repex

140. Jemena has made a number of adjustments to its risk modelling and economic modelling in response the AER draft decision and our initial review.

141. However, on examination of the modelling we found that the parameters applied by Jemena for calculation of its asset failure distributions were not calibrated with Jemena's observed experience, but rather derived from research and industry sources and may overstate the PoFs at an asset level compared with other networks.

142. In accounting for the likelihood of loss of supply, and calculation of its supply risk, Jemena has applied fault scenarios to its modelling and assigned a PoF to each of the respective scenarios, and not to individual assets as we had first assumed. We infer that in doing so, Jemena has determined that it is only under these fault scenarios that supply will be lost, and which it has then used to calculate the energy at risk.

143. Whilst the updated modelling supports the decision to proceed with the CN ZSS redevelopment project, we have identified residual concerns with the application of its risk modelling, including the manner in which Jemena has applied of its fault scenarios.

144. However, we consider that a material reduction to the PoFs is required to change the preferred option and economic timing, and applying such a reduction would not be a reasonable approach, or consistent with the stated condition of the assets.

[40] Industry practice application note | Asset replacement planning. AER.

The CN ZSS redevelopment project remains subject to RIT-D

145. We note that this investment will be subject to a RIT-D prior to being initiated, ensuring transparency and providing an opportunity for further stakeholder consultation.

2.5.2 Implications for forecast capex

146. We consider that the project is prudent to undertake in the next RCP and the proposed cost of $45.5 million is reasonable.