Attachment D Switchgear Ex post Review of Ergon Energy 2018-2023 Capital Expenditure

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ERGON ENERGY NETWORK
Part of Energy Queensland

Note

This attachment forms part of Ergon Energy's justification of the ex post review of its 2018-2023 capital expenditure. It forms part of the 2025-30 Regulatory Proposal submission to the AER.

It should be read in conjunction the main document and the following attachments:

Ex-post Review of Ergon Energy 2018-2023 Capital Expenditure

Attachment A	Pole Replacements
Attachment B	Overhead Conductor Replacements
Attachment C	Pole Top Structure Replacements
Attachment D	Switchgear Replacements
Attachment E	Transformer Replacements
Attachment F	Underground Cable Replacements
Attachment G	Service Replacements
Attachment H	SCADA Replacements
Attachment I	Other Replacements
Attachment J	ICT Capex

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1 INTRODUCTION

The switchgear asset class includes circuit breakers, fuses, and switches across various voltage levels.

Our expenditure on switchgear replacements over the review period[1] was above the AER's forecast by $265.7 million ($2024-25). We have conducted a Post Implementation Review (PIR) on distribution lines switches replacements to evaluate the outcomes and benefits of this expenditure.

This paper provides the background and analysis of Ergon Energy's expenditure on pole top replacements to identify the causes and drivers behind the increase in expenditure. The PIR on switches replacements is set out in supporting document 5.3.15.

2 ASSET MANAGEMENT PRACTICE

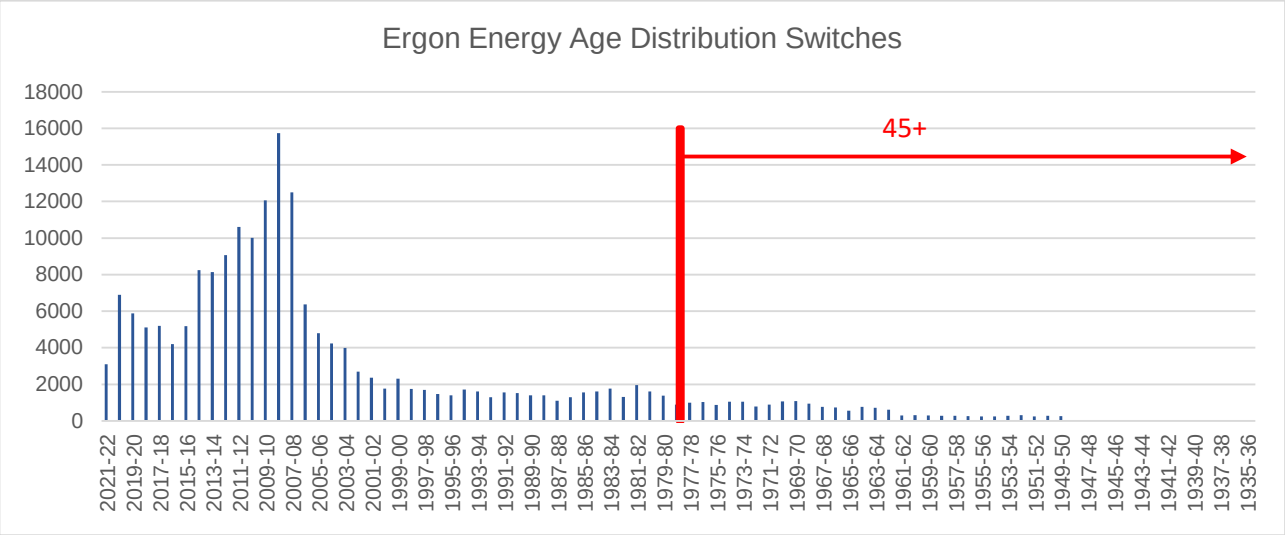
The asset management practice of switchgear is set out in the Asset Management Plan for Switches and is consistent with the ISO55000 asset management framework. In addition, a concise overview of these practices can be found in Section 8.3.7 of the Ergon Energy Distribution Annual Planning Report (DAPR) for 2023.

Ergon's strategy for the replacement of switches is a combination of proactive replacement through identifying switches approaching the end of their life; and reactive replacements which occur in response to electrical failures or poor condition identified during inspections. This combined approach aims to maintain our customers' existing reliability by minimizing the risk of unexpected outages through proactive measures and promptly addressing issues as they arise.

3 SWITCHES PERFORMANCE

As per 2021-22 RIN data, Ergon Energy have a total of 199,100 Switches. Figure 1 and Table 1 below present the age distribution of our switches population. The majority of our switches are relatively young, with over 92% of switches being under 45 years.

Figure 1- Age Distribution



[1]The review period as defined in NER S6.2.2A(a1) is 2018-19 to 2022-23

Table 1 - Percentage of switchgears in different age categories

Age	Services	Proporton
Under 45	182,747.00	92%
45 and over	16,353.00	8%

4 2015-20 DISTRIBUTION DETERMINATION

Switchgear is a pre-defined asset group in the AER repex model that uses predictive modelling as a tool to estimate forecast replacement expenditure and volumes for DNSPs.

Unless otherwise stated, all values in this section are in are $2014-15.

Table 2 is a summary of information on switchgear replacements from the 2015-20 Regulatory Determination.

Table 2: 2015-20 Switchgear Replacements

	SWITCHGEAR 2015-2020 Determination					
$ 2014-2015 ($,000)	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
Revised Regulatory Proposal	$ 13,378	$ 15,449	$ 14,579	$ 15,123	$ 13,907	$ 72,435
Repex Model Final Decision	$ 8,224	$ 8,318	$ 8,457	$ 8,632	$ 8,836	$ 42,467
AER Final Decision Forecast	$ 8,224	$ 8,318	$ 8,457	$ 8,632	$ 8,836	$ 42,467
Volume (units)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Total**
Revised Regulatory Proposal	11,865	14,669	13,378	13,593	7,407	60,912
Repex Model Final Decision	1,782	1,676	1,592	1,526	1,476	8,052
AER Final Decision Forecast	1,782	1,676	1,592	1,526	1,476	8,052
Unit Cost ($)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Average**
Revised Regulatory Proposal	$ 1,128	$ 1,053	$ 1,090	$ 1,113	$ 1,878	$ 1,252
Repex Model Final Decision	$ 4,616	$ 4,963	$ 5,313	$ 5,656	$ 5,986	$ 5,307
AER Final Decision Forecast	$ 4,616	$ 4,963	$ 5,313	$ 5,656	$ 5,986	$ 5,307

Key points in relation to switchgear replacements are:

- In our Regulatory Proposal we forecast switchgear repex of $70 million over the regulatory control period.
- Following some adjustments, the proposed repex amount was corrected to $78 million.
- In its assessment, EMCa found evidence of the application of CBRM to switchgear but did not find sufficient analysis to support the proposed forecast[2].
- Based on EMCa's assessment, the AER adopted the outcome from its repex model for the modelled categories of underground cables, service lines, transformers and switchgears.
- In our RRP, we proposed a reduction of $6m (7%) from our RP of $78 million reducing our forecast to $72 million.

[2] Page 78, Para 405 EMCa Review of Proposed Network- Augmentation and Replacement Expenditure in Ergon's Regulatory Proposal 2015 – 2020 April 2015

- However, EMCa maintained its position regarding the insufficient analysis from Ergon to justify the level of expenditure proposed in the revised proposal[3].
- The AER's adopted its final repex model output forecast of $42.5 million for switchgear for the 2015-20 regulatory control period.

5 2020-25 DISTRIBUTION DETERMINATION

A comparison of the expenditure ($2019-20), volume and unit cost from the 2020-25 regulatory determination process is provided in Table 3 below.

Unless otherwise stated, all values in this section are in are $2019-20.

Table 3: Summary of 2020-25 Proposals and Decisions

	SWITCHGEAR 2020-2025 Determination					
$ 2019-2020 ($,000)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Revised Regulatory Proposal	$ 22,922	$ 18,818	$ 32,107	$ 32,698	$ 32,729	$ 139,274
Repex Model Final Decision	$ 20,086	$ 19,659	$ 19,406	$ 19,297	$ 19,308	$ 97,757
AER Final Decision Forecast	$ 20,086	$ 19,659	$ 19,406	$ 19,297	$ 19,308	$ 97,757
Volume (units)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Total**
Revised Regulatory Proposal	2,656	2,731	2,618	2,606	2,693	13,303
Repex Model Final Decision	1,744	1,628	1,537	1,467	1,414	7,790
AER Final Decision Forecast	1,744	1,628	1,537	1,467	1,414	7,790
Unit Cost ($)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Average**
Revised Regulatory Proposal	$ 8,632	$ 6,891	$ 12,264	$ 12,549	$ 12,153	$ 10,498
Repex Model Final Decision	$ 11,516	$ 12,076	$ 12,627	$ 13,157	$ 13,656	$ 12,606
AER Final Decision Forecast	$ 11,516	$ 12,076	$ 12,627	$ 13,157	$ 13,656	$ 12,606

Key points to note are:

- At the time of our RRP, we forecast switchgear repex for 2020-25 of $139 million.
- Using trend analysis, the repex model and a bottom-up assessment, the AER assessed Ergon Energy forecast was not reflective of the capex criteria and utilised their repex model output for a substitute forecast.
- The AER's final repex model output provided an allowance of $97 million for the 2020-2025 regulatory control period.

[3] Page 37, Para 177 EMCa Review of Proposed Capex in Ergon's Revised Regulatory Proposal- September 2015

6 HISTORICAL EXPENDITURE AND VOLUMES

This section presents data sourced from our proposals for 2015-20 and 2020-15 Determinations and CA RIN 2.2 Repex as submitted to the AER.

Unless otherwise stated, all values in this section have been converted to $2024-25 for comparison purposes.

6.1 Actual 2015-20 Performance

A summary of the actual expenditure of switchgear replacements over the 2015-20 regulatory control period is provided in Table 4 below.

Table 4: Switchgear Repex 2015-20

	SWITCHGEAR					
$ 2024-2025 ($,000)	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
Revised Regulatory Proposal	$ 17,652	$ 20,384	$ 19,236	$ 19,954	$ 18,350	$ 95,576
Repex Model Final Decision	$ 10,851	$ 10,975	$ 11,159	$ 11,390	$ 11,659	$ 56,034
AER Final Decision Forecast	$ 10,851	$ 10,975	$ 11,159	$ 11,390	$ 11,659	$ 56,034
Actual	$ 25,901	$ 24,092	$ 48,063	$ 57,034	$ 71,597	$ 226,687
Volume (units)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Total**
Revised Regulatory Proposal	11,865	14,669	13,378	13,593	7,407	60,912
Repex Model Final Decision	1,782	1,676	1,592	1,526	1,476	8,052
AER Final Decision Forecast	1,782	1,676	1,592	1,526	1,476	8,052
Actual	18,500	20,525	3,458	4,280	4,792	51,555
Unit Cost ($)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Average**
Revised Regulatory Proposal	$ 1,488	$ 1,390	$ 1,438	$ 1,468	$ 2,477	$ 1,652
Repex Model Final Decision	$ 6,090	$ 6,549	$ 7,010	$ 7,463	$ 7,899	$ 7,002
AER Final Decision Forecast	$ 6,090	$ 6,549	$ 7,010	$ 7,463	$ 7,899	$ 7,002
Actual	$ 1,400	$ 1,174	$ 13,899	$ 13,326	$ 14,941	$ 8,948

Key observations

- Over the 2015-2020 regulatory control period, our expenditure on switchgear replacements was above the AER's forecast by 307%.
- Our expenditure on switchgear replacement was above the AER's forecast in every year of the 2015-20 regulatory control period.
- In 2017-2018, we changed the measure of reporting our expenditure and units of replacement in our RIN reporting. This change means that the volumes and expenditure earlier than 2017-18 is not done on the same basis as after this period and makes historical comparisons difficult. These changes are outlined in our Basis of Preparation from the time of RIN submission. We historically counted all components individually rather than as a unit.
- The majority of this spend above the AERs forecast occurred in the last three years of the regulatory control period which the last two years of it fall into review period.
- In 2018-19 and 2019-20, actual expenditure exceeded the AER forecast by over 400% and 500% respectively.

6.2 2020-25 Actual and Estimated Performance

A summary of the actual expenditure of switchgear replacements over the 2020-25 regulatory control period is provided in Table 5 below.

Table 5: Switchgear Repex 2020-2025

	SWITCHGEAR					
$ 2024-2025 ($,000)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Revised Regulatory Proposal	$ 27,746	$ 22,778	$ 38,865	$ 39,580	$ 39,617	$ 168,586
Repex Model Final Decision	$ 24,314	$ 23,797	$ 23,490	$ 23,359	$ 23,372	$ 118,332
AER Final Decision Forecast	$ 24,314	$ 23,797	$ 23,490	$ 23,359	$ 23,372	$ 118,332
Actual	$ 73,540	$ 74,196	$ 84,038	$ 70,181	$ 72,758	$ 374,712
Volume (units)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Total**
Revised Regulatory Proposal	2,656	2,731	2,618	2,606	2,693	13,303
Repex Model Final Decision	1,744	1,628	1,537	1,467	1,414	7,790
AER Final Decision Forecast	1,744	1,628	1,537	1,467	1,414	7,790
Actual	5,036	4,901	4,541	4,292	4,337	23,107
Unit Cost ($)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Average**
Revised Regulatory Proposal	$ 10,448	$ 8,342	$ 14,845	$ 15,190	$ 14,711	$ 12,707
Repex Model Final Decision	$ 13,940	$ 14,618	$ 15,285	$ 15,926	$ 16,530	$ 15,260
AER Final Decision Forecast	$ 13,940	$ 14,618	$ 15,285	$ 15,926	$ 16,530	$ 15,260
Actual	$ 14,603	$ 15,139	$ 18,506	$ 16,352	$ 16,776	$ 16,275

Key observations:

- In the first 3 years of the 2020-25 regulatory control period, we have spent above the AER's forecast in every year.
- The actual spend in the first three years of this regulatory control period has exceeded the AER's 5-year forecast by 96%.
- The actual volume of annual replacement was almost double our RRP forecast and three times AER's forecast.

6.3 Historical Trends and Performance

Figure 2, and Figure 3 compare the actual expenditure and volume of switchgears replacements to our forecast in RRP, AER's repex model and the AER's forecast in their final decision.

Figure 2: Switchgear Replacement – Expenditure

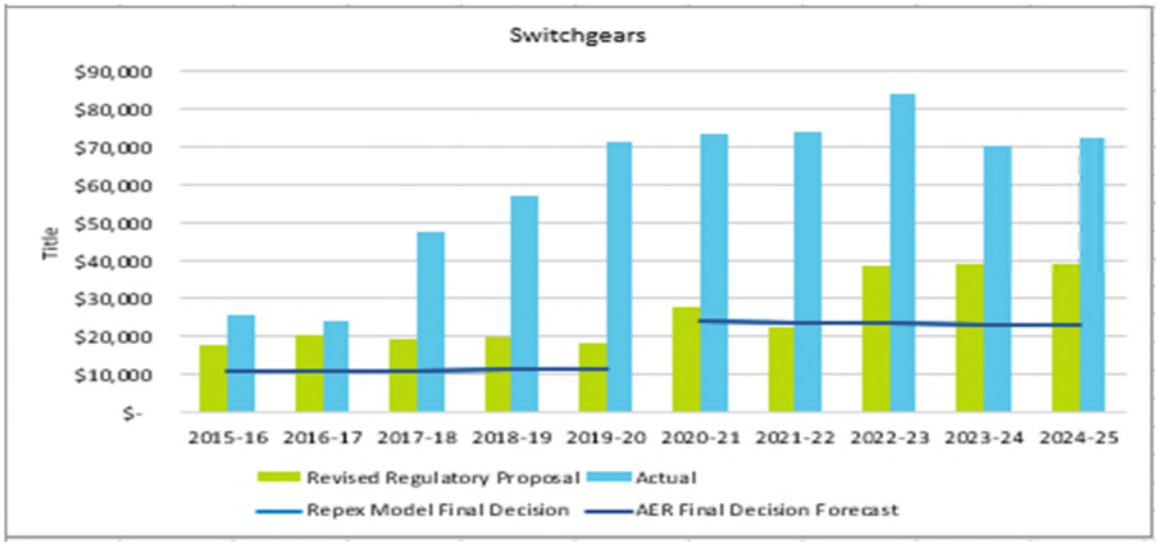
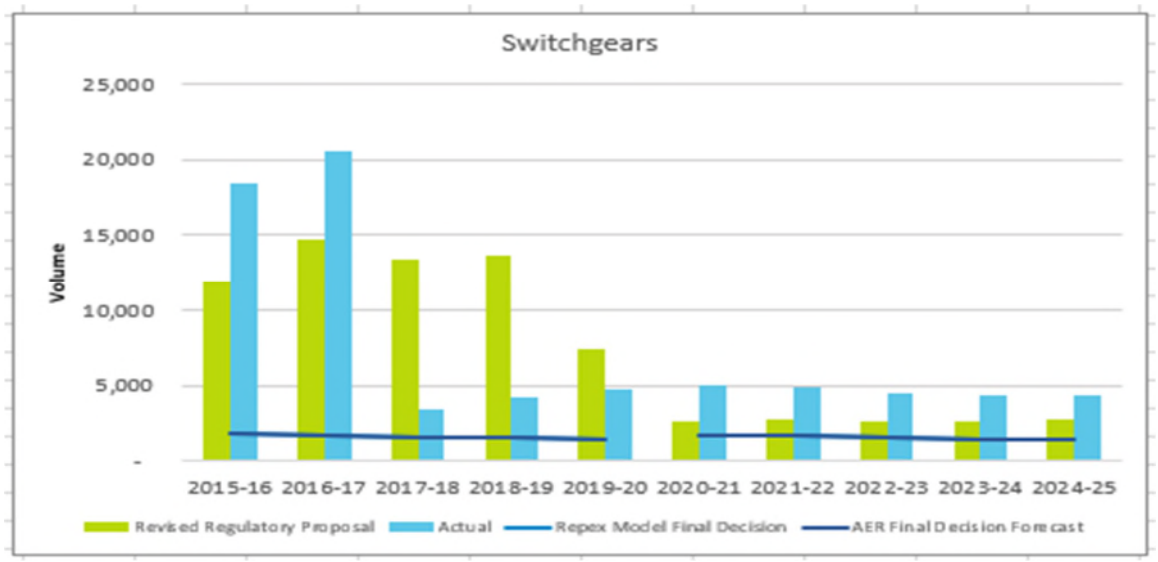


Figure 3: Switchgear Replacement – Volume



Key observations:

- As mentioned above, we changed the method of reporting in 2017-18
- Data for 2015-16 and 2016-17 is not comparable and is disregarded in our trend analysis.
- From 2017-18 onwards, there has been an upward trend in our actual expenditure.
- Volume of replacements have remained relatively stable averaging around 4,500 units per year.

7 SWITCHGEAR ANALYSIS

Ergon's switch replacement expenditure can be split into two distinct types of assets – substation and lines. In general switches greater than 22kV are assets within a substation, switches between 11kV and 22kV are a mixture of substation and lines, while switches below 11kV are typically all lines. There is a significant difference in our asset management approach and unit costs of replacement between these types of switches. As such, we have split these categories in our analysis to give better context of our expenditure over the ex-post review period. All values in this section are in are $2024-25.

7.1 Line switches

A summary of breakdown of expenditure of switches in Line for the 2015-20 and 2020-25 regulatory control periods are presented in Table 6 and Table 7.

Table 6: Distribution Line expenditure 2015-2020

Line	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total/Average
2024-25 ($,000)	$ 13,123	$ 13,329	$ 31,096	$ 39,941	$ 51,889	$ 149,377
Volume	18,401	20,440	3,303	4,094	4,686	50,930
Unit Rate	$ 713	$ 652	$ 9,414	$ 9,756	$ 11,073	$ 6,322

Table 7: Distribution Line expenditure 2020-2025

Line	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total/Average
2024-25 ($,000)	$ 61,450	$ 56,207	$ 63,774	$ 63,774	$ 63,774	$ 308,980
Volume	4,888	4,711	4,400	4,400	4,400	22,799
Unit Rate	$ 12,572	$ 11,931	$ 14,494	$ 14,494	$ 14,494	$ 13,597

Ergon Energy lines switches replacement strategy is to replace on failure or identified defect. However, when we are replacing equipment that switches are attached to, we consider their replacement where efficient to do so, in line with good industry practise of bundling works for efficiency.

Over 90% of the switch category repex was for distribution lines switches. Of this, approximately 70% is related to the replacement of fuse holder, housings and other fuse related equipment. Most of this expenditure is consequential replacements, typically with distribution transformers, poles and conductor. Even of the remaining distribution lines repex, the majority of this expenditure is also consequential replacements with poles and conductor. A small portion of this is in response to failures and defects. In this way, the main driver of our line's switches expenditure is the replacement of fuses and is consequential in nature. Our PIR for switches outlines the level of consequential replacement involved with our distribution lines switchgear.

7.2 Substation switches

A summary of breakdown of expenditure of switches in Substation for the 2015-20 and 2020-25 regulatory control periods are presented in Table 8 and Table 9.

Table 8: Substation Switches expenditure 2015-2020

Substation	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total/Average
2024-25 ($,000)	$ 12,816	$ 10,797	$ 17,037	$ 17,175	$ 19,811	$ 77,637
Volume	99	85	149	186	106	625
Unit Rate	$ 129,458	$ 127,026	$ 114,345	$ 92,339	$ 186,898	$ 130,013

Table 9: Substation Switches expenditure 2020-2025

Substation	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total/Average
2024-25 ($,000)	$ 12,196	$ 18,096	$ 20,385	$ 20,385	$ 20,385	$ 91,446
Volume	148	190	141	141	141	761
Unit Rate	$ 82,402	$ 95,242	$ 144,572	$ 144,572	$ 144,572	$ 122,272

Our substation switches replacement strategy involves a mixture of proactive replacement based on condition, typically identified utilising Condition Based Risk Management (CBRM), with a small portion of expenditure involved in replacing switches upon failure or defect. Around 10% of the total replacement of switches is associated with substation switches replacement, conducted following CBRM assessments.

8 POST IMPLEMENTATION REVIEW

We have undertaken a post implementation review (PIR) of our distribution lines switchgear replacement expenditure over the review period and compared with possible alternative options. The PIR on distribution line replacement is set out in supporting document 5.3.15.

The basis and assumptions used in the PIR are:

- A cost benefit analysis over a twenty-year time horizon as a period
- The options analysis is based on the different volume of replacements.
- The actual delivery or selected option expenditure and unit cost over the 5 years review period is used as the starting point.
- The base case or counterfactual is based on the implied volume using the AER forecast and the actual delivery unit cost.
- The actual unit cost is applied across all other options.
- Only cost associated with switchgear defects are included in the cost benefit analysis.
- Costs associated with replacements because of other projects or programs (e.g pole replacements, reconductoring, CTG/CTS) are excluded from this cost benefit analysis. They are included in the PIR of the respective asset classes.

Table 10 sets out the basis of the PIR for switches and reconciliation to the annual CA RIN 2.2

Table 10: PIR / RIN Reconciliation

Switchgears ($ millions nominal)	2018-19	2019-20	2020-21	2021-22	2022-23	Total
RIN total ($million)	$ 45.9	$ 58.6	$ 61.0	$ 62.9	$ 75.3	$ 303.6
Non - substation switches	$ 32.1	$ 42.4	$ 50.8	$ 47.4	$ 57.0	$ 229.7
Switches Defects	**$ 8.6**	**$ 7.9**	**$ 8.4**	**$ 7.1**	**$ 12.1**	**$ 44.1**
Fuses Defects	**$ 5.4**	**$ 7.8**	**$ 10.6**	**$ 10.2**	**$ 18.2**	**$ 52.2**
Non Defects / Added to other PIRs						
Switches to Poles	$ 3.7	$ 3.2	$ 3.0	$ 2.7	$ 1.8	$ 14.4
Switches to Conductors	$ 0.5	$ 2.0	$ 3.4	$ 5.2	$ 4.2	$ 15.3
Fuses to Dist Transformers	$ 10.6	$ 12.3	$ 14.2	$ 13.9	$ 13.9	$ 64.9
Fuses to Clearance	$ 0.8	$ 1.8	$ 3.7	$ 0.3	$ -	$ 6.6
Fuses to Poles	$ 2.1	$ 6.1	$ 5.1	$ 5.2	$ 3.7	$ 22.2
Fuses to Conductors	$ 0.3	$ 1.3	$ 2.4	$ 2.7	$ 3.1	$ 9.8
Total PIR for Switches	**$ 14.0**	**$ 15.7**	**$ 19.0**	**$ 17.3**	**$ 30.3**	**$ 96.3**

The cost benefits analysis from the post implementation review confirms that the pole top structure replacements undertaken over the review period delivered a net benefit of $114 million compared to the AER forecast option.

9 REVIEW PERIOD PERFORMANCE (2018-19 TO 2022-23)

The *review period* for ex post review spans across two regulatory control period and two separate Distribution Determinations.

Actual and performance against the allowances set by the AER over the review period is provided in Table 11 below.

Unless otherwise stated, all values have been converted to $2024-25.

Table 11: Review Period Performance - Switchgear Replacements

	SWITCHGEAR					
$ 2024-2025 ($,000)	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	Total
Revised Regulatory Proposal	$ 19,954	$ 18,350	$ 27,746	$ 22,778	$ 38,865	$ 127,693
Repex Model Final Decision	$ 11,390	$ 11,659	$ 24,314	$ 23,797	$ 23,490	$ 94,650
AER Final Decision Forecast	$ 11,390	$ 11,659	$ 24,314	$ 23,797	$ 23,490	$ 94,650
Actual	$ 57,034	$ 71,597	$ 73,540	$ 74,196	$ 84,038	$ 360,404
Volume (units)	**2018-2019**	**2019-2020**	**2020-2021**	**2021-2022**	**2022-2023**	**Total**
Revised Regulatory Proposal	13,593	7,407	2,656	2,731	2,618	29,004
Repex Model Final Decision	1,526	1,476	1,744	1,628	1,537	7,911
AER Final Decision Forecast	1,526	1,476	1,744	1,628	1,537	7,911
Actual	4,280	4,792	5,036	4,901	4,541	23,550
Unit Cost ($)	**2018-2019**	**2019-2020**	**2020-2021**	**2021-2022**	**2022-2023**	**Average**
Revised Regulatory Proposal	$ 1,468	$ 2,477	$ 10,448	$ 8,342	$ 14,845	$ 7,516
Repex Model Final Decision	$ 7,463	$ 7,899	$ 13,940	$ 14,618	$ 15,285	$ 11,841
AER Final Decision Forecast	$ 7,463	$ 7,899	$ 13,940	$ 14,618	$ 15,285	$ 11,841
Actual	$ 13,326	$ 14,941	$ 14,603	$ 15,139	$ 18,506	$ 15,303

Key observations:

- Ergon exceeded the allowance provided by the AER over 2018-23 by 281% for switchgears.
- Ergon Energy has overspent its switchgear repex allowance in every year of the review period.
- The actual volume of 23,550 is just under Ergon RRP forecast of 29,000 switchgear.

Figure 4 and

Figure 5 compare the actual expenditure and replacement volumes of switchgear replacements to Ergon Energy's forecast in RRP, AER's repex model and the allowance provided in AER's final decision.

Figure 4: Switchgear Repex – Review Period

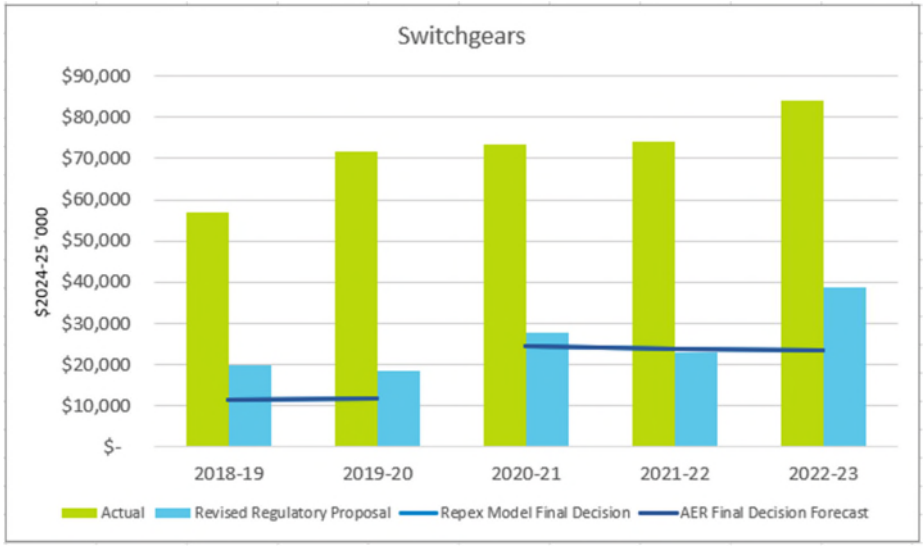
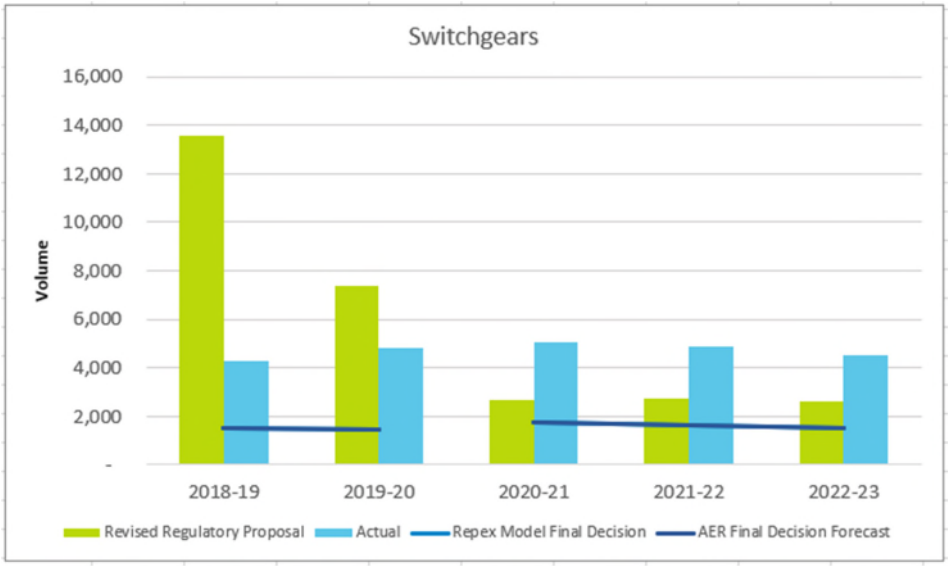


Figure 5: Switchgear Replacement Volume – Review Period



9.1 Adjustments for CTG/CTS

CTG/CTS programs are treated as augex in Energex. From 2021-22 onwards and to align with Energex approach in categorising its clearance programs, CTG/CTS are categorised as augex. Going forward, Ergon Energy will be reporting costs associated with the clearance programs as augex instead of repex.

To provide a comparable trend, adjustments to the AER allowance and Actual to remove CTS/CTG from repex from 2018-19 to 2020-21 is provided in Table 12 below.

Table 12: Review Period Performance – excluding CTG/CTS

$ 2024-2025 ($,000)	SWITCHGEAR					
	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	Total
AER Final Decision Forecast	$ 11,390	$ 11,659	$ 24,314	$ 23,797	$ 23,490	$ 94,650
Actual (as reported in RIN)	$ 57,034	$ 71,597	$ 73,540	$ 74,196	$ 84,038	$ 360,404
Adjusted AER Forecast (without CTG/CTS)	$ 11,390	$ 11,659	$ 23,496	$ 23,797	$ 23,490	$ 93,832
Adjusted Actual (CTG/CTS removed in 18-19,19-20 and 20-21)	$ 54,878	$ 69,285	$ 68,335	$ 74,196	$ 84,038	$ 350,733

10 JUSTIFICATION STATEMENTS AND CONCLUSION

We submit that the expenditure for replacement of switches over the *review period* is prudent and efficient as demonstrated by

- The PIR which shows that the replacement distribution lines switches is prudent and delivered a net benefit of $114 million compared to the AER's forecast option.
- The remaining switches (including fuses) were replaced as part of other works such as transformer replacement, pole replacement, conductor replacement and clearance and they have been separately cost justified.

We therefore submit that all the repex on pole top structure incurred over the review period are required and should be rolled into our RAB.