Attachment F Underground Cables 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 for submission to the AER as part of its 2025-30 Regulatory Proposal. It should be read in conjunction the main document.

The ex post review submission includes the following documents.

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

Contents

List of Tables

List of Figures

1 INTRODUCTION

Ergon Energy owns and maintains approximately 9,400 km[1] of underground cable. Approximately 94% of underground cable assets are installed at distribution voltages less than or equal to 11kV.

Our expenditure on cable replacements over the review period was above the AER's forecast by $27.3 million ($2024-25).

This paper provides the background and analysis of Ergon Energy's expenditure on underground cables to identify the causes and drivers behind the increase in expenditure.

2 ASSET MANAGEMENT PRACTICE

The asset management practice for underground cables is set out in our *Asset Management Plan Underground Cables* and is consistent with the ISO55000 asset management framework. In addition, a concise overview of these practices can be found in Section 8.3.4 of the Ergon Energy Distribution Annual Planning Report (DAPR) for 2022.

This asset class includes impregnated paper, solid dielectric and pressure assisted cable types at voltages up to 132kV, cable accessories including joints and terminations and uunderground accessories including link boxes, pits and pillars.

Ergon Energy's asset management approach towards replacement of underground cables greater than or equal to 33kV is based on our Condition-Based Risk Management (CBRM) framework. For distribution and low voltage cables, the standard approach is to replace upon the identification of a defect or in-service failure.

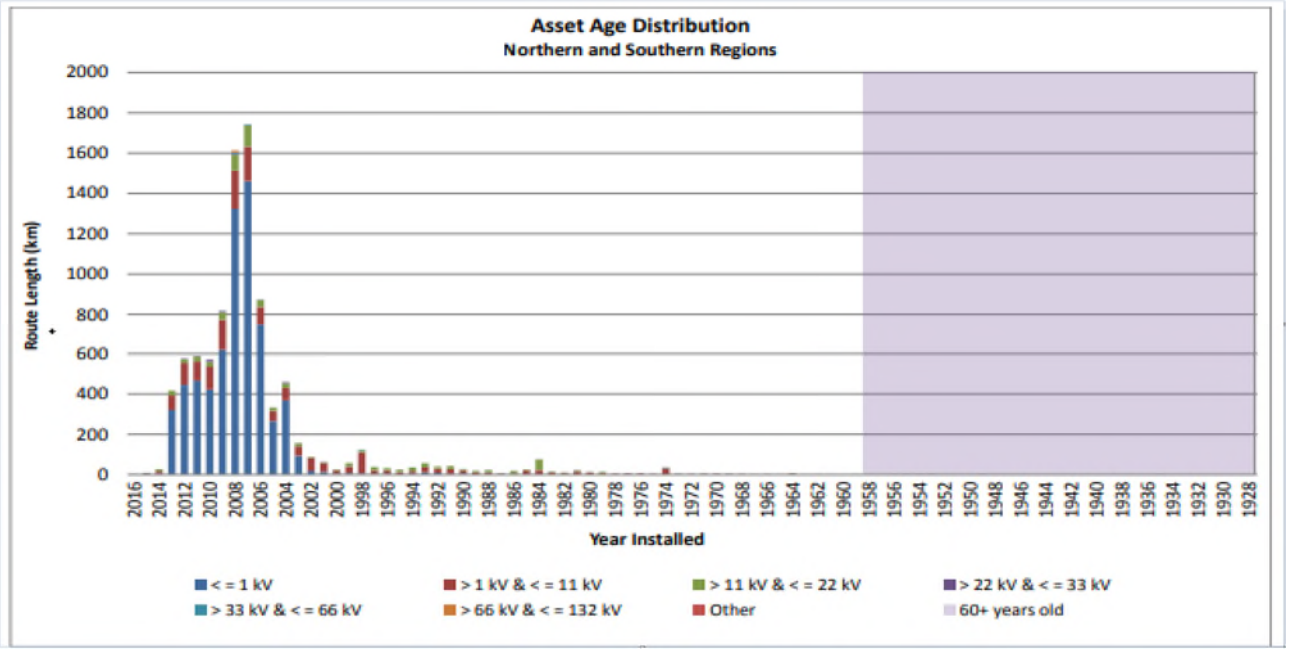
Underground cable assets are inspected periodically for transmission and sub-transmission voltages. Routine maintenance monitors the electrical condition of the cable sheaths and sheath voltage limiters, the performance of pressure feeds, the accuracy and condition of pressure gauges and alarm systems and the physical condition of the above ground structures and terminations. At distribution voltages, periodic inspections check the external condition of distribution cable systems including link pillars, link boxes and service pillars to ensure equipment remains in an acceptable condition.

[1] 2022 CA RIN 5.2 asset age profile

3 UNDERGROUND CABLES PERFORMANCE

The age profile for the underground cable assets in Ergon Energy are shown in Figure 1. It is noted that we have a relatively young population of underground cables compared to our other asset classes.

Figure 1: Underground cables age distribution



4 2015-20 DISTRIBUTION DETERMINATION

Underground Cable is a pre-defined asset group in the AER repex model that uses predictive modelling as a tool to estimate forecast replacement expenditure and volume.

Unless otherwise stated, all values in this section are in are $2014-15 as per the 2015 Distribution Determination.

Table 1 is a summary of information on underground cable replacements from the 2015-20 Regulatory Determination.

Table 1: Summary of 2015-20 Proposals and Decisions

	UNDERGROUND CABLES 2015-2020 Determination					
$ 2014-2015 ($,000)	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
Revised Regulatory Proposal	$ 3,783	$ 4,377	$ 2,114	$ 2,826	$ 2,473	$ 15,573
Repex Model Final Decision	$ 828	$ 904	$ 1,007	$ 1,142	$ 1,318	$ 5,200
AER Final Decision Forecast	$ 828	$ 904	$ 1,007	$ 1,142	$ 1,318	$ 5,200
Volume (units)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Total**
Revised Regulatory Proposal	34	38	23	27	24	146
Repex Model Final Decision	8	9	10	12	15	53
AER Final Decision Forecast	8	9	10	12	15	53
Unit Cost ($)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Average**
Revised Regulatory Proposal	$ 111,784	$ 116,172	$ 90,326	$ 103,180	$ 103,461	$ 104,984
Repex Model Final Decision	$ 108,468	$ 105,837	$ 101,350	$ 95,380	$ 88,319	$ 99,871
AER Final Decision Forecast	$ 108,468	$ 105,837	$ 101,350	$ 95,380	$ 88,319	$ 99,871

Key points in relation to underground cable replacements are:

- In our RRP, we forecast underground cable repex of $15.6 million over the regulatory control period.
- The AER forecast was $5.2 million for underground cables for the regulatory control period based on the output of the repex model.

5 2020-25 DISTRIBUTION DETERMINATION

A comparison of the expenditure, volume and unit cost from the 2020-25 regulatory determination process is provided in Table 2 below.

Unless otherwise stated, all values in this section are in $2019-20 as per the 2020 Distribution Determination.

Table 2: Summary of 2020-25 Proposals and Decisions

UNDERGROUND CABLES 2020-2025 Determination						
$ 2019-2020 ($,000)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Revised Regulatory Proposal	$ 826	$ 827	$ 834	$ 838	$ 835	$ 4,160
Repex Model Final Decision	$ 1,437	$ 1,598	$ 1,777	$ 1,977	$ 2,200	$ 8,989
AER Final Decision Forecast	$ 1,437	$ 1,598	$ 1,777	$ 1,977	$ 2,200	$ 8,989
Volume (units)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Total**
Revised Regulatory Proposal	5	5	5	5	5	25
Repex Model Final Decision	1	1	1	1	1	6
AER Final Decision Forecast	1	1	1	1	1	6
Unit Cost ($)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Average**
Revised Regulatory Proposal	$ 165,236	$ 165,391	$ 166,843	$ 167,556	$ 167,000	$ 166,405
Repex Model Final Decision	$ 1,579,543	$ 1,575,105	$ 1,562,456	$ 1,544,902	$ 1,525,309	$ 1,557,463
AER Final Decision Forecast	$ 1,579,543	$ 1,575,105	$ 1,562,456	$ 1,544,902	$ 1,525,309	$ 1,557,463

Key points to note are:

- In our RRP, we forecast an underground cable repex of $4.1 million over the regulatory control period.
- The AER didn't specifically mention Underground cables in its decision. The AER adopted the final repex model output with a forecast of $9.0 million for the 2020-25 regulatory control period, which was more than we had proposed in our RRP.

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 2015-20 Actual Performance

A summary of the actual expenditure of underground cable replacements over the 2015-20 regulatory control period is provided in Table 3 below.

Table 3: Underground Cables Repex 2015-20

	UNDERGROUND CABLES					
$ 2024-2025 ($,000)	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
Revised Regulatory Proposal	$ 4,991	$ 5,775	$ 2,790	$ 3,729	$ 3,263	$ 20,548
Repex Model Final Decision	$ 1,093	$ 1,193	$ 1,329	$ 1,507	$ 1,739	$ 6,862
AER Final Decision Forecast	$ 1,093	$ 1,193	$ 1,329	$ 1,507	$ 1,739	$ 6,862
Actual	$ 4,387	$ 3,090	$ 6,853	$ 2,749	$ 5,837	$ 22,917
Volume (units)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Total**
Revised Regulatory Proposal	34	38	23	27	24	146
Repex Model Final Decision	8	9	10	12	15	53
AER Final Decision Forecast	8	9	10	12	15	53
Actual	10	5	11	8	10	44
Unit Cost ($)	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**Average**
Revised Regulatory Proposal	$ 147,496	$ 153,286	$ 119,183	$ 136,144	$ 136,514	$ 138,525
Repex Model Final Decision	$ 143,122	$ 139,650	$ 133,729	$ 125,852	$ 116,535	$ 131,777
AER Final Decision Forecast	$ 143,122	$ 139,650	$ 133,729	$ 125,852	$ 116,535	$ 131,777
Actual	$ 438,736	$ 617,952	$ 623,026	$ 343,671	$ 583,738	$ 521,425

Key Observations

- We have spent above the AER's underground cables repex forecast in every year of the 2015-20 regulatory control period.
- On average the actual expenditure exceeded the AER forecast by over 231%, however was aligned with our forecast in our RRP.
- The volume of replacements we undertook was below the AER final decision forecast from the AERs repex model.

6.2 2020-25 Actual and Estimated Performance

A summary of the actual expenditure of underground cable replacements over the 2020-25 regulatory control period is provided in Table 4 below.

Table 4: Underground Repex 2020-2025

	UNDERGROUND CABLES					
$ 2024-2025 ($,000)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Revised Regulatory Proposal	$ 1,000	$ 1,001	$ 1,010	$ 1,014	$ 1,011	$ 5,036
Repex Model Final Decision	$ 1,739	$ 1,935	$ 2,151	$ 2,393	$ 2,663	$ 10,881
AER Final Decision Forecast	$ 1,739	$ 1,935	$ 2,151	$ 2,393	$ 2,663	$ 10,881
Actual	$ 12,199	$ 8,427	$ 7,186	$ 9,982	$ 10,209	$ 48,003
Volume (units)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Total**
Revised Regulatory Proposal	5	5	5	5	5	25
Repex Model Final Decision	1	1	1	1	1	6
AER Final Decision Forecast	1	1	1	1	1	6
Actual	21	21	18	19	20	99
Unit Cost ($)	**2020-2021**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**	**Average**
Revised Regulatory Proposal	$ 200,012	$ 200,200	$ 201,957	$ 202,821	$ 202,148	$ 201,428
Repex Model Final Decision	$ 1,911,983	$ 1,906,612	$ 1,891,300	$ 1,870,051	$ 1,846,335	$ 1,885,256
AER Final Decision Forecast	$ 1,911,983	$ 1,906,612	$ 1,891,300	$ 1,870,051	$ 1,846,335	$ 1,885,256
Actual	$ 580,907	$ 403,546	$ 394,519	$ 525,368	$ 510,446	$ 482,957

Key observations are:

- We have spent above the AER's underground cables repex forecast in every year of the 2020-25 regulatory control period.
- On average the actual expenditure exceeded the AER's forecast by 286%.

6.3 2015-2025 Historical Trends and Performance

Figure 2 and Figure 3 provide comparisons of the expenditure and volume of underground cable replacements from the actual to the applicable RRPs, repex models and AER final decisions.

Figure 2 : Underground Cables Expenditure

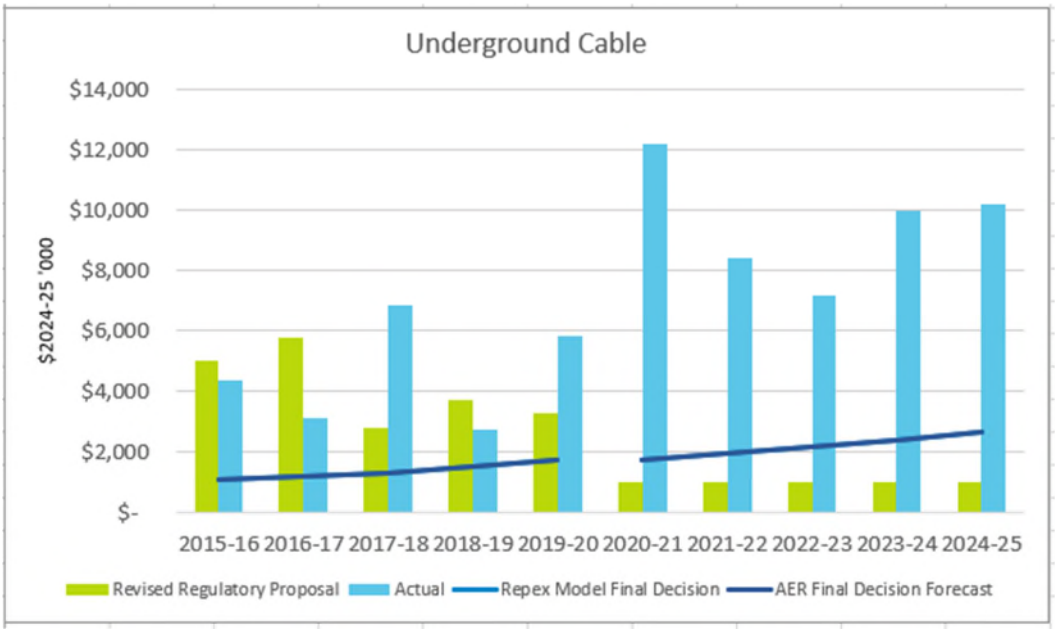
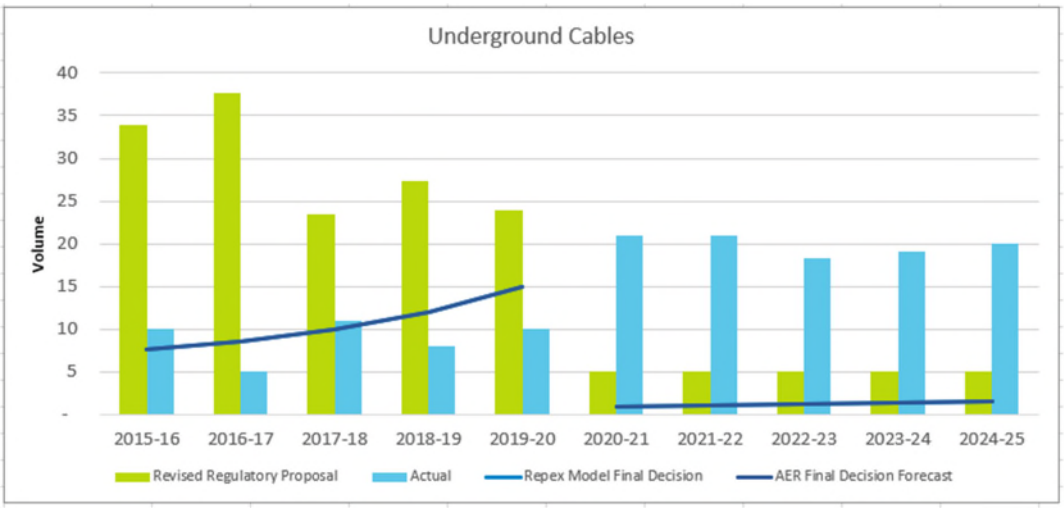


Figure 3 : Underground Cables Volume



Key observations are:

- Expenditure fluctuated in the 2015-2020 regulatory period. However, after an increase in 2021, we have had a downward trend for the remainder of 2020-2025.
- In the 2015-2020 regulatory period our replacement volumes aligned with the AER forecast.
- In the 2020-2025 regulatory period, our expenditure increased and was above the AER's forecast for this period.

7 ANALYSIS OF UNDERGROUND CABLE REPLACEMENT

Ergon Energy uses the Condition-Based Risk Management (CBRM) method to manage the replacement of underground cables greater than or equal to 33kV. For distribution and low voltage cables, the standard approach is to replace them upon the identification of a defect or when they experience ultimate failure.

Distribution underground cable replacement expenditure accounts for 99% of the total replacement expenditure for both regulatory periods. Around 75% of our expenditure on underground cable replacement has been driven by consequential replacements with other projects and programs. In particular, our replacement of poles, transformers, Clearance to Ground/Structure and some of our substation refurbishment projects have replaced underground cables to enable the replacement of the primary assets.

Of the remaining 25% of replacements, failure-related underground replacements account for around 10% of total replacement expenditure, while proactive replacements account for around 15% of total replacement expenditure.

In this expenditure category we have not undertaken any significant individual projects, with no single project being higher than $1 million across the ex-post review period.

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

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

Actual and performance against the forecasts set by the AER over the review period is provided in Table 5 below. Unless otherwise stated, all values have been converted to $2024-25.

Table 5 : Review Period Performance- Underground Replacements

	UNDERGROUND CABLES					
$ 2024-2025 ($,000)	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	Total
Revised Regulatory Proposal	$ 3,729	$ 3,263	$ 1,000	$ 1,001	$ 1,010	$ 10,003
Repex Model Final Decision	$ 1,507	$ 1,739	$ 1,739	$ 1,935	$ 2,151	$ 9,072
AER Final Decision Forecast	$ 1,507	$ 1,739	$ 1,739	$ 1,935	$ 2,151	$ 9,072
Actual	$ 2,749	$ 5,837	$ 12,199	$ 8,427	$ 7,186	$ 36,399
Volume (units)	**2018-2019**	**2019-2020**	**2020-2021**	**2021-2022**	**2022-2023**	**Total**
Revised Regulatory Proposal	27	24	5	5	5	66
Repex Model Final Decision	12	15	1	1	1	30
AER Final Decision Forecast	12	15	1	1	1	30
Actual	8	10	21	21	18	78
Unit Cost ($)	**2018-2019**	**2019-2020**	**2020-2021**	**2021-2022**	**2022-2023**	**Average**
Revised Regulatory Proposal	$ 136,144	$ 136,514	$ 200,012	$ 200,200	$ 201,957	$ 174,966
Repex Model Final Decision	$ 125,852	$ 116,535	$ 1,911,983	$ 1,906,612	$ 1,891,300	$ 1,190,456
AER Final Decision Forecast	$ 125,852	$ 116,535	$ 1,911,983	$ 1,906,612	$ 1,891,300	$ 1,190,456
Actual	$ 343,671	$ 583,738	$ 580,907	$ 403,546	$ 394,519	$ 461,276

Key observations:

- Ergon exceeded the AER's forecast over the review period by $27.3 million for underground cables.
- The actual volume was below the AER's and our forecasts for the first two years of the review period and then exceeded the AER's and our forecast for the last three years of the review period.

Figure 4 and Figure 5 compare the actual expenditure, volume and unit rate of underground cable replacements to Ergon Energy's forecast in RRP, AER's repex model and the AER's forecast provided in AER's final decision.

Figure 4: Underground Cables Replacement – Expenditure

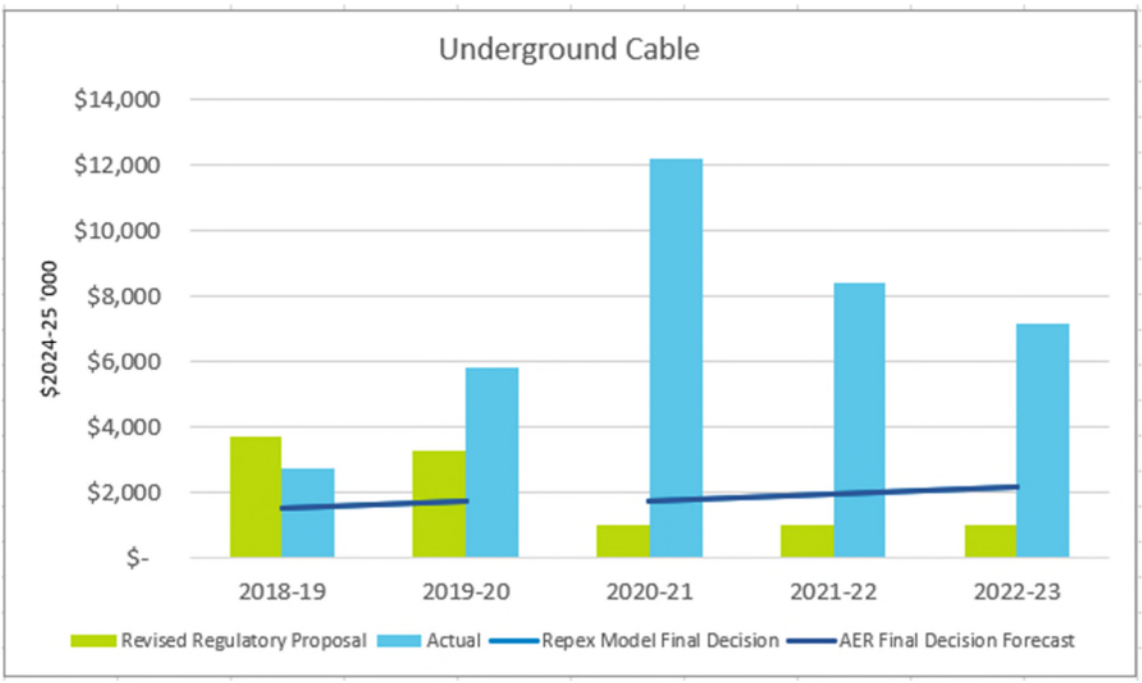
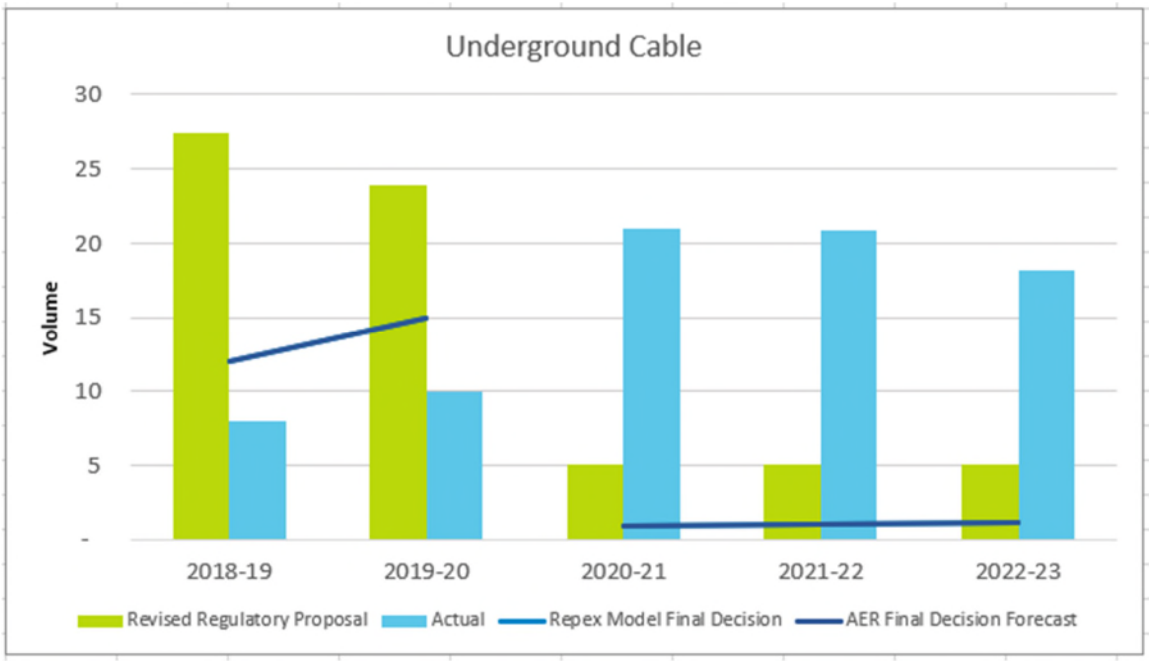


Figure 5: Underground Cable Replacement – Volume



8.1 Adjustments for CTG/CTS

As discussed in supporting document 5.3.01 – Capex ex-post Justification, the clearance program was reclassified from a repex program to an augex program to better align with the driver of this type of expenditure.

Table 6 present a summary of the AER's forecast with and without the CTG/CTS where:

- The AER Final Decision Forecast is the forecast with notional amount of CTG/CTS included.
- Actual as reported in RIN with CTG/CTS in repex from 2018-19, 2019-20 and 2020-21
- Adjusted AER forecast is the forecast without the notional amount of CTG/CTS
- Adjusted actual shows repex with expenditure for CTG/CTS in 2018-19, 2019-20 and 2020-21 removed from the pole replacement category.

It is noted that the assumptions used in allocating CTG/CTS costs to asset categories did not include costs to underground cables.

Table 6: Review Period Performance – excluding CTG/CTS

$ 2024-2025 ($,000)	UNDERGROUND CABLES					
	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	Total
AER Final Decision Forecast	$ 1,507	$ 1,739	$ 1,739	$ 1,935	$ 2,151	$ 9,072
Actual (as reported in RIN)	$ 2,749	$ 5,837	$ 12,199	$ 8,427	$ 7,186	$ 36,399
Adjusted AER Forecast (without CTG/CTS)	$ 1,507	$ 1,739	$ 1,739	$ 1,935	$ 2,151	$ 9,072
Adjusted Actual (CTG/CTS removed in 18-19,19-20 and 20-21)	$ 2,157	$ 4,650	$ 11,627	$ 8,427	$ 7,186	$ 34,048

9 JUSTIFICATION STATEMENTS AND CONCLUSION

We submit that the expenditure for replacement of just over 78 km of underground cables over the *review period* is prudent and efficient as demonstrated by the fact that:

- Around three-quarters of our expenditure on underground cable replacement has been driven by consequential replacements with other projects and programs.
- 10% of our expenditure is related to failures.
- There has not been any major project associated with underground cable expenditure which indicates the majority of the expenditure is driven by defects and consequential. replacement.

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