Attachment H
Scada, Control and Protection Replacements
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:

Overview - 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	Non Network Capex

Contents

List of Tables

List of Figures

1 INTRODUCTION

The SCADA, Network Control and Protection Systems asset category is a mix of system enabling technologies, split by functionality. Ergon Energy's 2022-23 RIN reported:

- 9,308 Field Devices
- 16,654 Communications Network Assets
- 114 Master Station Assets
- 2,529 Communications Site Infrastructure assets
- 4,198 Communications Linear Assets
- 173 Audio Frequency Load Control (AFLC) assets

Our expenditure on SCADA, Network Control and Protection Systems replacements over the review period[1] was above the AER's forecast by $41.8 million [2]($2024-25).

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

2 BACKGROUND

Table 1 shows the level of expenditure for the ex-post review period across the various asset categories within the SCADA, Network Control and Protection asset class.

Table 1 – Breakdown of Expenditure by Asset Category (2025 $)

Asset Category	2018-19	2019-20	2020-21	2021-22	2022-23	Total
Field Devices	8,392,388	7,537,410	14,512,731	15,625,035	21,992,030	**68,059,595**
Communications Network Assets	661,477	2,672,719	7,003,586	9,130,103	7,633,605	**27,101,490**
Master Station Assets	0	0	178,159	64,957	2,679	**245,795**
Communications Site Infrastructure	233,157	356	491,686	2,494,467	276,397	**3,496,063**
Communications Linear Assets	77,076	36,220	834,519	6,667,029	2,126,466	**9,741,310**
AFLC Assets	38,280	87,266	8,190	14,151	12,993	**160,880**

As Table 1 demonstrates, the most significant portion of expenditure in this category is attributable to Field Devices, with Communications Network Assets (networking equipment) and Communications Linear Assets (pilot and fibre optic cables) making up the top three categories contributing 96% of the total expenditure in this assets category.

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

[2] This amount is overstated. To account for escalation variations, the AER forecast has been adjusted down for the ex post analysis (see Section 0) while the actual included public lighting costs in 2018-19 and 2019-20

With the remaining assets categories being under 4% of the total expenditure, we will limit our discussion to these three key asset classes.

The replacement rate in these categories can be relatively variable across time. The uptake of new technologies, and the resulting mix of assets in these categories and the lifecycles means that there is a mixture of factors that drive this variability:

- **Basic technologies** – devices such as electromechanical and analogue protection relays and pilot cables are long-lasting assets that have reached the end-of-life in this period.
- **First-generation digital technologies** – While providing significantly more capability in the operation of our network, first-generation technologies such as fibre optic cables, networking equipment and digital relays have a shorter lifecycle than the older, simpler technologies. With a shorter lifecycle comes a higher need for replacement expenditure as these technologies either fail in-service or reach end-of-life.
- **Emerging needs** – with the pace of change in our customers energy use, and the increasing reliance on communications and technology to provide a safe and reliable network, the replacement of this technology is more important than in previous periods.
- **Safety Driven System Enabling Expenditure**: We have increased our replacement rates in our primary asset areas because of condition and risk-based approaches due to increasing failure rates. While this reduces a range of safety and reliability risks for our community, we are still seeing an increase in network failures, meaning we require a well-functioning protection system to clear faults in a safe manner. As such, replacing relays and protection enabling communications equipment is important in achieving this outcome.

Prior to 2017-18, the replacement rates two of these three main asset categories were higher than in the period 2018-19 to 2022-23. Specifically:

- **Field Devices** – 1,672 devices were replaced from 2008-09 to 2017-18, averaging around 167 devices / year. Our replacements during the last 5 years are 87.4 devices / year.
- **Communications Network Assets** – 2,380 assets were replaced, averaging 238 assets / year. Our replacements during the last 5 years have been 80.4 devices / year.
- **Communications Linear Assets** – 118.6 km of linear assets were replacement, average 11.86 assets / year. Our replacements during the last 5 years have been 35.4 assets / year. This is higher than our historical replacement rate.

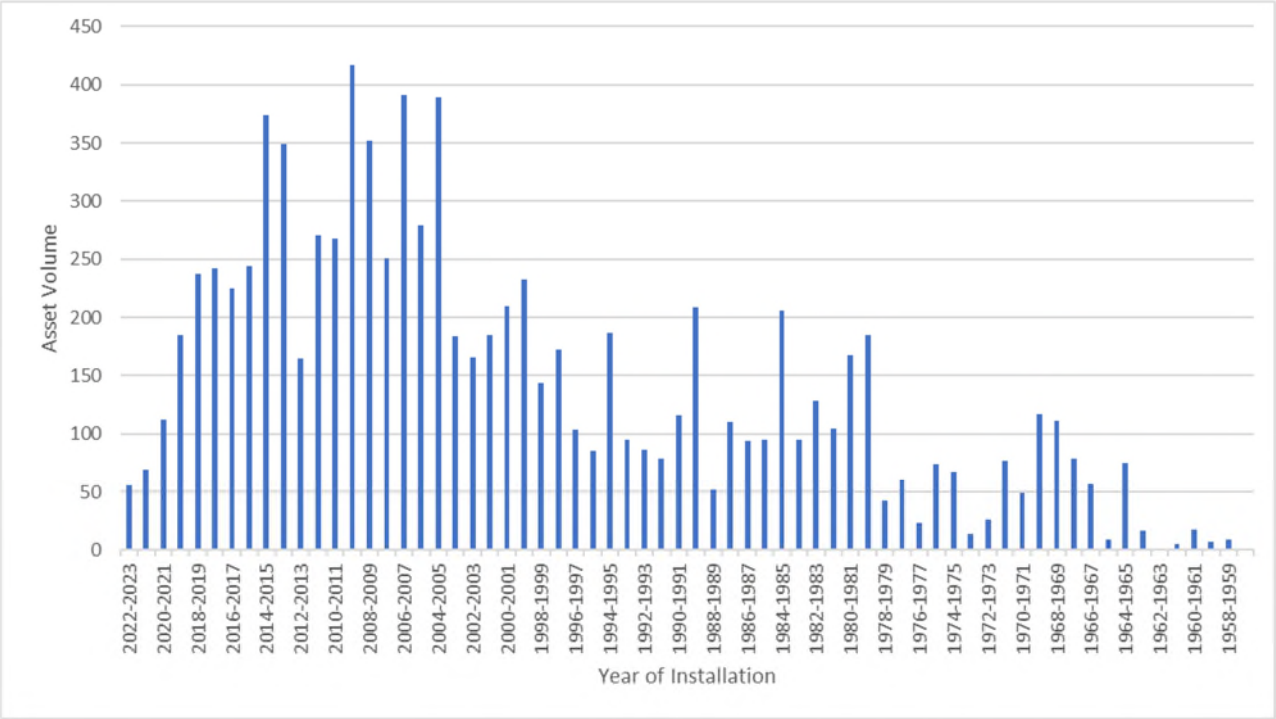
3 ASSET MANAGEMENT PRACTICE

As discussed in Section 0, most of the expenditure that we have undertaken has been in the asset categories of Field Devices, Communications Network Assets and Communications Linear Assets. Our discussion in this section will be limited to these three categories.

3.1 Field Devices

The historical approach to Field Devices has been a mixture of replacement upon failure and proactive replacement. Figure 1 below shows the age profile of our field devices assets.

Figure 1: Age Profile of Field Devices

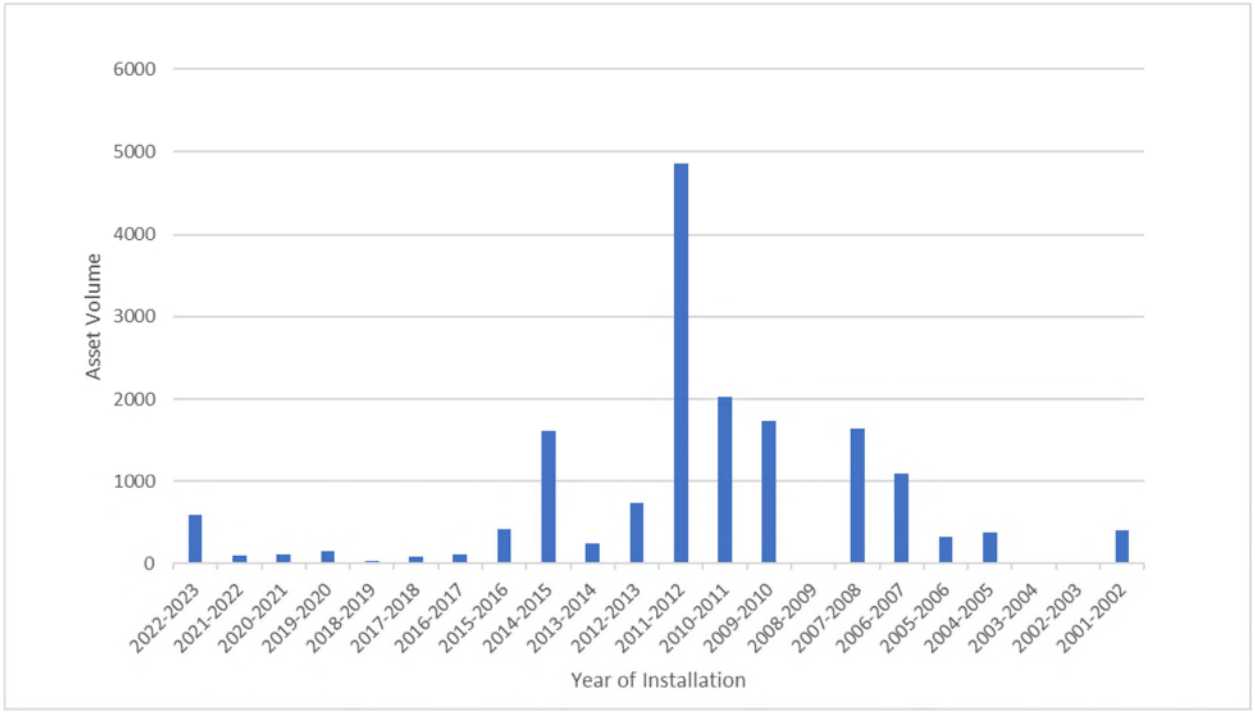


As shown in Figure 1, half of our Field Devices around assets are above 20 years old, and a third of our Field Assets above 30 years old. Field Devices are a mixture of older electromechanical protection relays, analogue protection relays and newer digital protection relays. Depending on the technology these devices have varying age expectations, with electromechanical relays 40 years or more, while digital relays could be as little as 10-15 years. With a significant variation across our network, our replacement cycle for this type of asset varies dependent on the technology.

3.2 Communications Network Assets

The historical approach to technology replacement in Ergon has been a mixture of replacement upon failure and proactive replacement. Figure 2 below shows the age profile of our Communications Network Assets.

Figure 2: Age Profile of Communications Network Assets

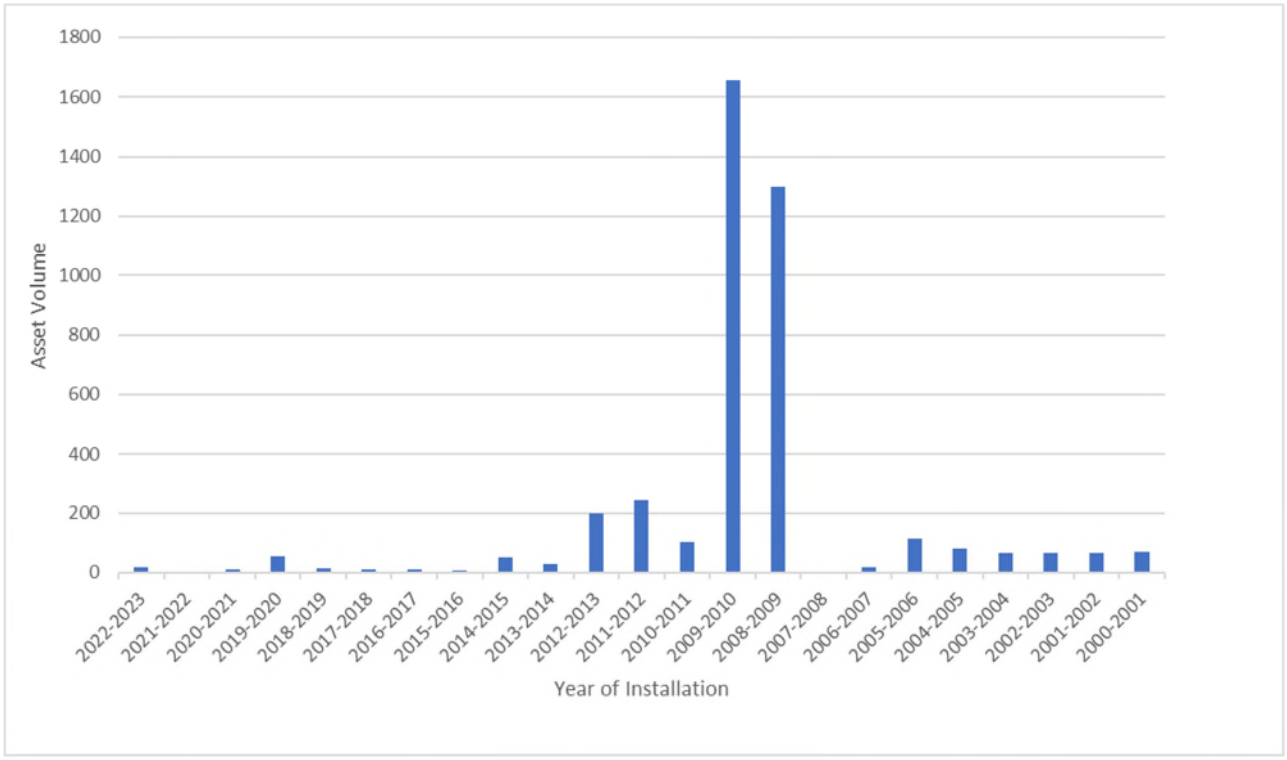


As Figure 2 outlines, our Communications Network Assets are relatively young when compared to our primary asset categories. However, these are short-lived assets with a typical life of 15 years. Around half of our Communications network assets are above 12 years old, with a quarter above 15 years old. With a typical life expectation of 10 – 15 years, many our assets have approached, or are approaching the end of their serviceable lives.

3.3 Communications Linear Assets

The historical approach to these replacements in Ergon has been a mixture of replacement upon failure and proactive replacement.

Figure 3: Age Profile of Communications Linear Assets



As Figure 3 outlines, we have a consistent installed asset base, apart from some significant length of assets around 15 years old, with a relatively large proportion of assets installed after this period. As with other assets in this asset class, our assets have a differing level of expected life. Our copper pilot cables are expected to last around 25 years, with our first-generation optic fibre cables also approaching the end of their serviceable lives at 15 years.

4 2015-20 DISTRIBUTION DETERMINATION

A high-level review of the 2015-20 Regulatory Determination process was undertaken to determine the basis and reasons of the AER decision on the forecasts provided for SCADA, Control and Protection asset classes. Unless otherwise stated, all values in this section are provided in $2014-15 as used in the 2015-20 Distribution Determination.

These asset categories are a mixture of types of equipment with differing lifecycles and drivers for expenditure. As such, the Repex Model is not easily utilised for these asset classes. Table 2 is a summary of information on SCADA, Control and Protection replacements from the 2015-20 regulatory determination.

Table 2: 2015-20 SCADA, Control and Protection Replacements

	SCADA, NETWORK CONTROL AND PROTECTION					
	2015-2020 Determination					
$ 2014-2015 ($,000)	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
Revised Regulatory Proposal	$25,547	$29,486	$19,761	$19,479	$15,189	$ 109,461
AER Final Decision Forecast	$34,425	$20,013	$10,535	$12,567	$ 9,163	$ 86,704

Key points to note:

- AER's alternative estimate of repex by asset categories is $786.6 million. The final repex forecast after adjusting for escalations is $740.2 million. For the purpose of this ex-post review, the forecast for unmodelled categories was pro-rated to align with the final total repex forecast of $740 million. Hence total repex for SCADA, Network Control and Protection is $86.7 million instead of $109.4 million.
- We submitted its forecast expenditure for SCADA, Network Control and Protection in the reset RIN.
- On page 6-100 of the AER Final Decision, Attachment 6 – Capital Expenditure Ergon Energy Determination 2015-20 (footnote 203) the AER also stated the following:

  ".. we have included Ergon Energy's revised proposal of $109 million for replacement of SCADA, network control and protection (collectively referred to as SCADA) in its alternative estimate of capex."

- The AER noted that the proposed expenditure in the Revised Regulatory Proposal was around 15% less than in the previous regulatory period.

5 2020-25 DISTRIBUTION DETERMINATION

Details of the expenditure and volume from the 2020-25 regulatory determination process is provided in Table 3 below. Unless otherwise stated, all values in this section are in $2019-20 as used in the 2020-25 Distribution Determination.

Table 3: 2020-25 SCADA, Network Control and Protection Replacements[3]

	SCADA, NETWORK CONTROL AND PROTECTION					
$ 2019-2020 ($,000)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Regulatory Proposal	$13,312	$12,347	$ 9,274	$11,288	$15,513	$ 61,734
Revised Regulatory Proposal	$15,018	$13,933	$10,525	$12,820	$17,498	$ 69,793
AER Final Decision Forecast	$10,500	$10,500	$10,500	$10,500	$10,600	$ 52,600

Summary of key points on pole replacements from the 2020-25 regulatory determination are:

- In our RP submitted to the AER in January 2019, the forecast program was based on an assessment of condition and risk for the SCADA, Network Control and Protection asset category.
- The level of forecast expenditure was lower than that proposed in the 2015-2020 period for this category.
- The AER's Draft and Final Determinations did not discuss this area of expenditure.

[3] The regulatory process does not require a submission of a revised reset RIN with an RRP. In lieu of Reset RIN, a selection of updated RIN templates with detailed information of the forecast volumes and costs was provided to the AER. Data is sourced from this file. To align with the AER's FD, CTG/CTS cost are re-allocated from Others to the modelled and unmodelled asset categories as per the Regulatory Proposal

6 HISTORICAL EXPENDITURE AND VOLUMES OF SCADA, NETWORK CONTROL AND PROTECTION REPLACEMENTS

This section presents data from various sources including our RRPs, AER's Final Decisions, our CA RIN 2.2 Repex and CA RIN 5.2 Asset age profile as submitted to the AER.

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

6.1 Actual 2015-20 Performance

A summary of the actual expenditure of SCADA, Network Control and Protection replacements over the 2015-20 regulatory control period is provided in Table 4 below.

Table 4: SCADA, Control and Protection Repex 2015-2020

	SCADA, NETWORK CONTROL AND PROTECTION					
$ 2024-2025 ($,000)	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Total
AER Final Decision Forecast	$45,423	$26,407	$13,900	$16,582	$12,091	$ 114,403
Actual	$24,445	$17,811	$ 9,741	$ 9,389	$10,319	$ 71,705

Key observations:

- Repex in all five years of the 2015-20 regulatory control period was below the Final Decision Forecast.
- Over the 2015-2020 period there was a downward trend of expenditure.
- The actual expenditure for 2018-19 of $9.4 million is $7.2 million below the Final Decision Forecast, and the expenditure in 2019-20 of $10.3 million is 1.8 million below the Final Decision Forecast.

6.2 2020-25 Actual and Estimated Performance

A summary of the actual expenditure of SCADA, Network Control and Protection replacements over the 2020-25 regulatory control period is provided in Table 5 below.

Table 5: Scada, Network Control and Protection Repex 2020-2025

	SCADA, NETWORK CONTROL AND PROTECTION					
$ 2024-2025 ($,000)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
AER Final Decision Forecast	$12,710	$12,710	$12,710	$12,710	$12,831	$ 63,671
Actual	$22,996	$33,947	$31,998	$30,201	$29,124	$ 148,266

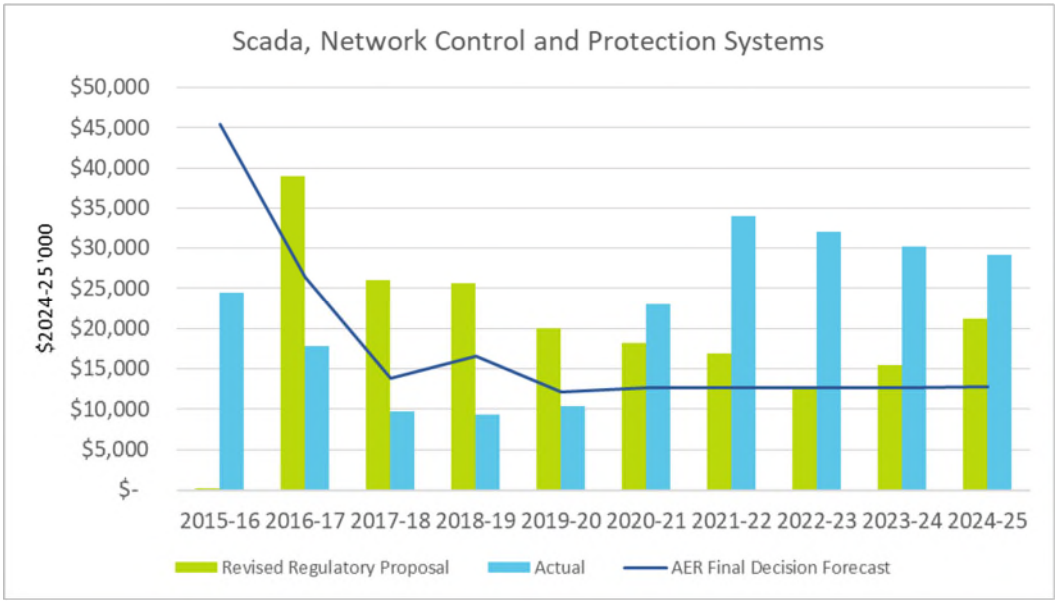
Key observations:

- We begin to increase our expenditure in the SCADA asset class in the 2020-2021 financial year.
- Our expenditure for the 2020-2025 regulatory control period has been consistently around $30m, with most of the expenditure occurring in the Field Devices, Communications Network Assets and Communication Linear Assets, which account for around 95% of the total expenditure.

6.3 Historical Trends and Performance

The chart in Figure 4 compares the actual expenditure to Ergon Energy's forecast in Revised Regulatory Proposal, AER's repex model and the forecast provided in AER's final decision.

Figure 4: Historical SCADA, Network Control and Protection Systems replacement expenditure



As shown in Figure 4, our actual expenditure for the 2015-2020 period was below the AER's final decision forecast. For the 2020-2025 period, our expenditure has been above the AERs Final Decision Forecast and our Revised Regulatory Proposal.

7 ANALYSIS OF EXPENDITURE FOR SCADA, NETWORK CONTROL AND PROTECTION

As shown in Table 1, most of our expenditure in this asset class is in the Field Devices, Communications Network Assets and Communication Linear Assets category.

The expenditure in these asset categories is a mixture of three different types of projects or programs:

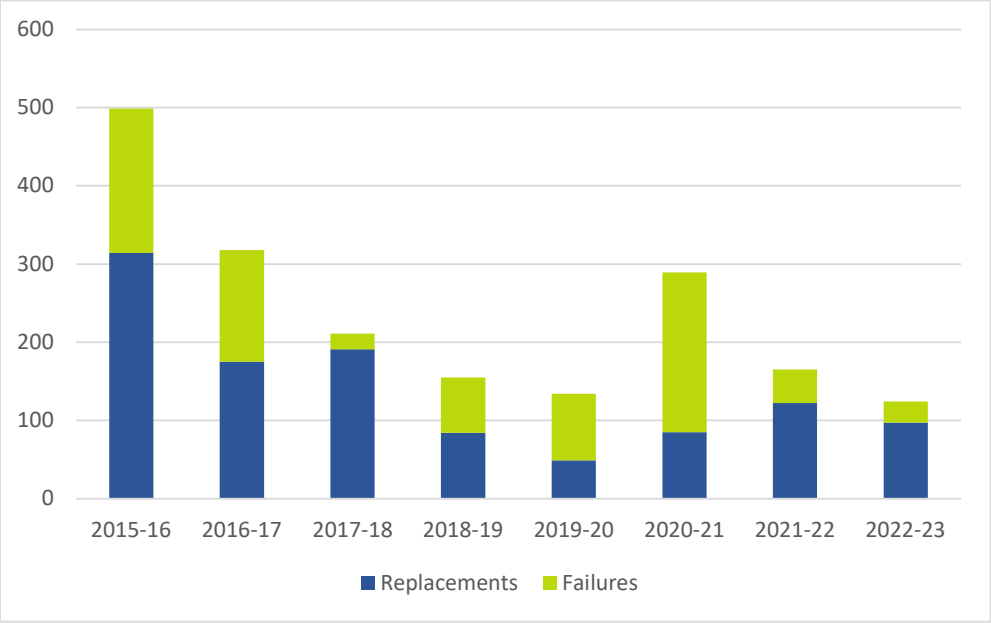
- **Proactive replacements** – projects and programs created specifically for the purpose of replacing the assets in this asset category.
- **Consequential replacements** – a large proportion of the expenditure in this category are replacements that occur because of another type of replacement or refurbishment project. Devices are identified for replacement where efficient to do so and included in a larger substation or lines project. Around 25% of the expenditure in the ex-post period has been undertaken as part of the substation-type replacement project, while around 10% has occurred with large lines projects.

- **Reactive replacements** – where an asset fails in service, we are typically required to replace the asset with a short turn-around as these devices are critical in providing a safe network for our community.

7.1 Field Devices

Field Devices represent 63% of the expenditure in this asset class. Figure 5 outlines the level of replacements and asset failures that we have undertaken on our network over the last 8 years.

Figure 5: Replacements and Failure of Field Devices



As shown in Figure 5, the volume of replacements and failures that we have seen on our network is below historic levels. There is a high number of failures (204) that occurred in 2020-21. We are not able to avoid the replacement of assets that have failed in service, and these typically need to be done quickly to restore our network to it normal operating state. This mean that most of the expenditure that occurred in replacing field devices in the 2020-21 period was unavoidable.

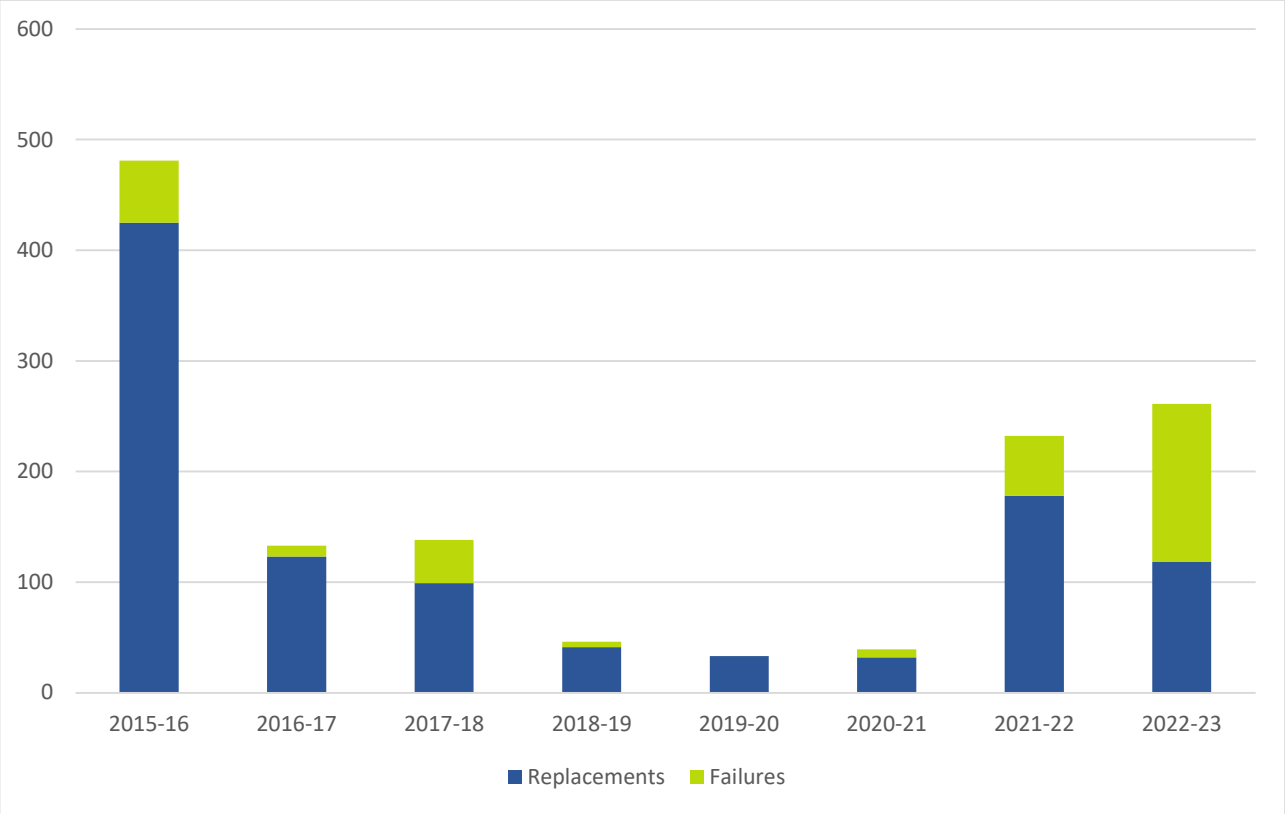
This level of asset failures also demonstrates the need for replacement of these assets to enable us to avoid the high level of reactive replacements in this asset class. Proactive projects targeting relays that are in poor condition and present high risk to our network make up close to 30% of the expenditure in the overall asset category. It should be noted that the replacement of a protection relay will also require the consequential replacement of other network control and SCADA type equipment.

Our Revised Regulatory Proposal underestimated our requirements for Field Devices in the first three years of the 2020-2025 regulatory period. However, we did forecast an increase from 2023-24 in expenditure requirements, with the final year of this period forecasting an expenditure of around $11m (2020 $). Because of our increased failures rates in the 2019-20 and 2020-21 period, we began to undertake a more proactive replacement program for Field Devices (need to check this).

7.2 Communications Network Assets

Communications Network Assets represent 25% of the expenditure in this asset class. Figure 6 outlines the level of replacements and asset failures that we have undertaken on our network over the last 8 years.

Figure 6: Replacements and Failure of Communications Network Assets



As shown in Figure 6, the volume of replacements and failures that we have seen on our network is below historic levels. However, our level of replacements has increased in the 2021-22 and 2022-23 period. This has occurred at the same time as we have experienced higher levels of asset failures in this category.

The level of asset failures and our volume of replacements demonstrate that our fleet of first-generation Communications Network Assets have reached the end of their serviceable lives. 2021-22 saw us being our work replacing several technology areas. Proactive Replacement programs have included:

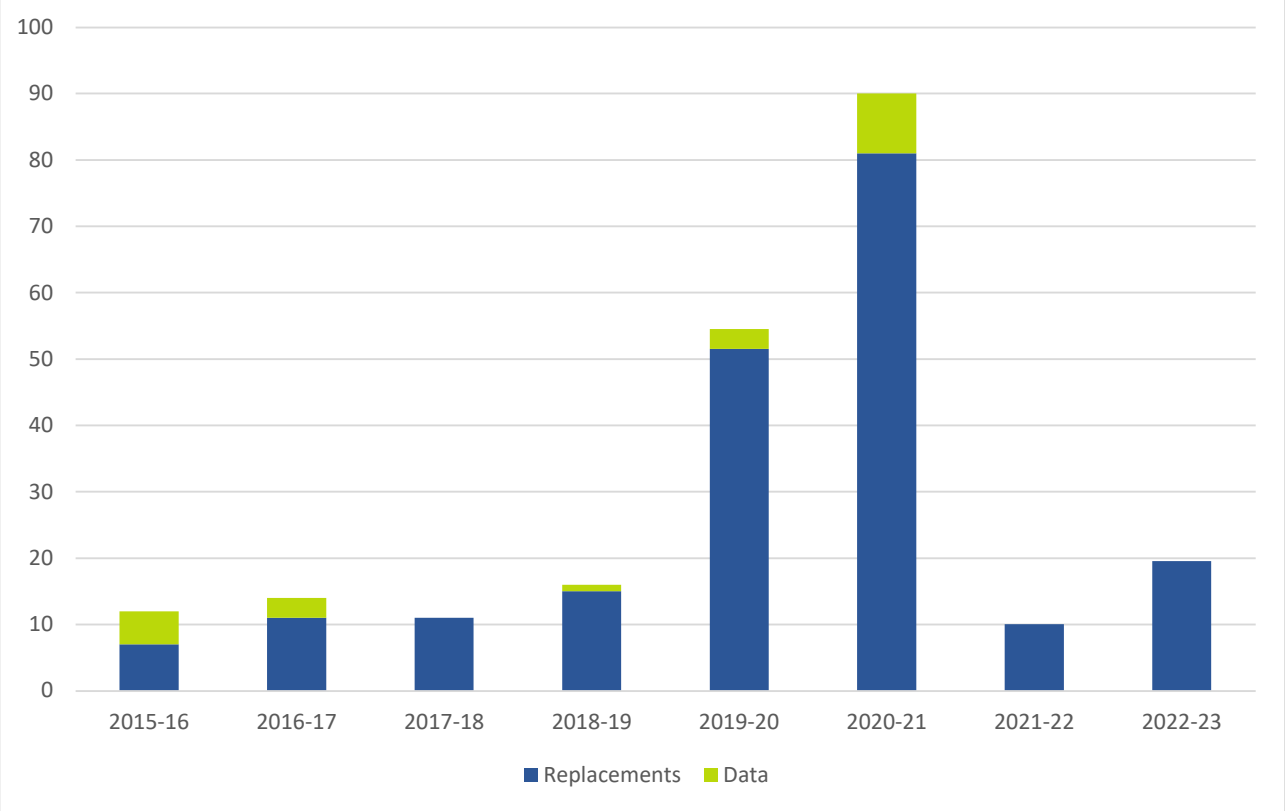
- Ethernet replacement
- Operational Technology Proxy Appliances
- Microwave Radio
- Lower Class Equipment
- Circuit Emulation

With our failure rates increasing in the last two financial years, our expenditure in this category was prudent to ensure that in-service failures don't continue to increase and cause reliability and safety issues for our customers.

7.3 Communications Linear Assets

Communications Linear Assets represent 9% of the expenditure in this asset class. Figure 7 outlines the level of replacements and asset failures that we have undertaken on our network over the last 8 years.

Figure 7: Replacements and Failure of Communications Linear Assets



As shown in Figure 7, the volume of replacements and failures that we have seen on our network is higher than historic levels, particularly in 2019-20 and 2020-21. While Communications Linear Assets are one of the major contributors to the expenditure in this overall expenditure category, this is driven by a single project; the Childers to Gayndah 66kV feeder replacement. The driver for this project is the condition of the feeder. Expenditure attributable to Linear Assets are due to the inclusion of an OPGW cable located on the feeder. Without this expenditure, the contribution of Linear Assets to the overall expenditure is much smaller, and not a significant contributor to the overall expenditure in this asset category.

Key observations:

- The step increase in expenditure in this category is largely due to Field Device and Communications Network Assets expenditure.
- Both asset classes have experienced increased in-service failures during this period, which requires replacement expenditure to rectify the issues. These failures are also indicative of

asset issues requiring a balance of proactive replacement to avoid the extra costs associated with emergency rectifications. We have undertaken a mixture of proactive and reactive replacements in this asset category.

- In the last 2 years of the 2015-2020 regulatory control period our expenditure was lower than the AER final decision forecast. However, we have increased our expenditure in first three years of the 2020-2025 regulatory control period in line with our increased failure rate of the key assets in this category. Our increasing Field Devices failure rate caused us to bring forward investment in this area two years earlier than forecast in our Revised Regulatory Proposal.

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

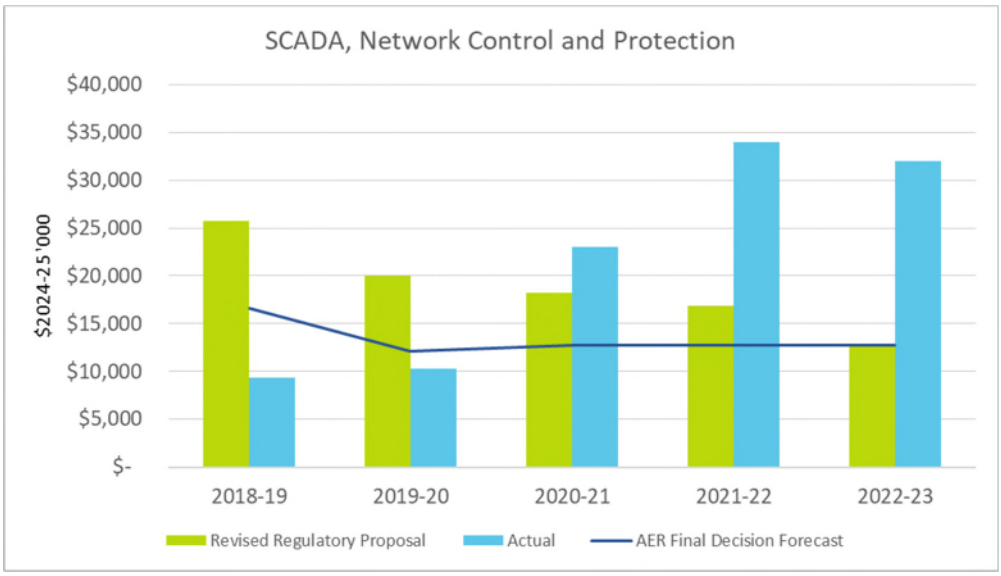
The *review period* for ex post review spans across two regulatory control period and two separate Distribution Determinations.

Actual and estimated performance against the forecasts set by the AER over the *review period* is provided in Table 6 below. Unless otherwise stated, all values have been converted to $2024-25 for comparison purposes.

Table 6: Review Period Performance – SCADA, Network Control and Protection

	SCADA, NETWORK CONTROL AND PROTECTION					
$ 2024-2025 ($,000)	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	Total
AER Final Decision Forecast	$16,582	$12,091	$12,710	$12,710	$12,710	$ 66,802
Actual	$ 9,389	$10,319	$22,996	$33,947	$31,998	$ 108,649

Figure 8: SCADA, Network Control and Protection Repex – Review Period



Reasons and drivers of overspend on SCADA, Network Control and Protection replacements are:

- Most expenditure in this asset category is the replacement of Field Devices, which is largely driven by the condition of our protection relay fleet. We have seen a high level of in-service failures of protection relays which have required rectification, with our proactive programs making up the remaining expenditure in this category.
- Communications Network Assets make up a large portion of the remaining expenditure. Like protection relays, these short life assets require active management as we had an increasing failure rate through this period, and our proactive replacements were increased to ensure we continued to operate a safe and reliable network.
- Communications Linear Assets also has a significant portion of expenditure in this period. This expenditure was largely driven by a single project, Childers to Gayndah, which included OPGW in its design. This project forms part of our Conductor Post Implementation Review (PIR). Without this project, the expenditure in this category is not a significant portion of our expenditure in this category.

9 JUSTIFICATION STATEMENTS AND CONCLUSIONS

We submit that the expenditure for replacement of our SCADA, Network Control and Protection assets over the *review period* is prudent and efficient as demonstrated by

- Our assets in this category have had a higher level of in-service failure during this period, requiring us to remediate this under emergency conditions.
- These in-service failures also demonstrate the need for a proactive replacement strategy in these categories to reduce the risk to reliability and safety from in-service failures of this crucial system enabling equipment.
- A significant portion of our expenditure (around 25%) is related to consequential replacement as part of other programs. Our substation refurbishment projects typically replace protection relays and communications equipment and there is little choice over this expenditure.
- We therefore submit that all the repex on transformers incurred over the review period are required and should be rolled into our RAB.