Grid Comms Microwave Radio Core Replacements Ergon

Justification Statement

10/ 10/ 2024

ERGON ENERGY NETWORK
Part of Energy Queensland

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DOCUMENT VERSION

Version Number	Change Detail	Date	Updated by
1.0	Approved Version	15/11/2024	General Manager Grid Technology

1 SUMMARY

Title	Grid Comms MW Radio Core
DNSP	Ergon Energy
Expenditure category	☒ Replacement ☐ Augmentation ☐ Connections ☐ Non-network
Identified need *(select all applicable)*	☐ Legislation ☐ Regulatory compliance ☒ Reliability ☐ CECV ☒ Safety ☐ Environment ☒ Financial ☐ Other An ongoing program to proactively replace aged and unsupported core microwave radio equipment. Proactive replacement ensures a reduction of time and costs associated with in-service failures as assets age beyond vendor support and experience an increased failure rate.
Expenditure	**Year** / **2025-26** / **2026-27** / **2027-28** / **2028-29** / **2029-30** / **2025-30** $m, direct 2022-23 / 0.80M / 0.80M / 0.80M / 0.80M / 0.80M / **$4.0M**
Benefits	This proactive program will reduce costs associated with managing microwave radio equipment failure in a 'fail-fix' nature. Proactive replacement provides the spare assets required to be held and reduces the extent of service outage.

2 PURPOSE AND SCOPE

This document recommends the optimal capital investment necessary for replacement of obsolete Core Microwave Radio (MW) telecommunications network assets. This business case document has been developed for the purposes of seeking funding for the required investment in coordination with the Ergon Regulatory Proposal to the Australian Energy Regulator (AER) for the 2025-30 regulatory control period. Prior to investment, further detail will be assessed in accordance with the established Energy Queensland investment governance processes. The costs presented ($4,000,279) are in (2022/23) direct dollars.

3 BACKGROUND

3.1 Asset Population / Site Summary / Capability

Ergon Energy's Telecommunications Network Assets enable mission critical real-time voice and data communications to allow automation, remote monitoring and control of the power network, enable ability to co-ordinate safe and efficient work activities as well as extend the reach of corporate information systems across a common infrastructure.

Ergon Energy utilises 473 microwave radio links to provide these communications over long distances where it is not cost effective to install fibre optic cable.

This program covers replacement of obsolete Microwave radio equipment, prioritising assets with the highest volume of business-critical services. Ergon Energy is aware of the need to effectively manage these assets, some are now approaching, have reached or have passed their original design life.

This is an ongoing risk-based replacement program that is divided into multiple projects to address differing needs, priorities and completion timings. This program is consistent with the Telecommunication Network Asset Management Plan.

3.2 Asset Management Overview

Ergon Energy has a total of 98 microwave radios assets which form part of the Core network. The vast majority being installed between 2007 and 2014 under a under a project called UbiNet. These links are installed over a combination of sites and infrastructure that is either directly owned by Ergon Energy or leased from third parties.

Asset Class / Technology Type	Core Quantity	2025-30 End of Life Quantity	Replacement Strategy
[redacted]	64	64	Proactive replace critical sites strategically – to use as spares for remaining fleet.
[redacted]	32	32	
Other Core assets	2	0	N/A

Below is the age profile for all capacity and model types of Ergon Energy's Microwave radio fleet.

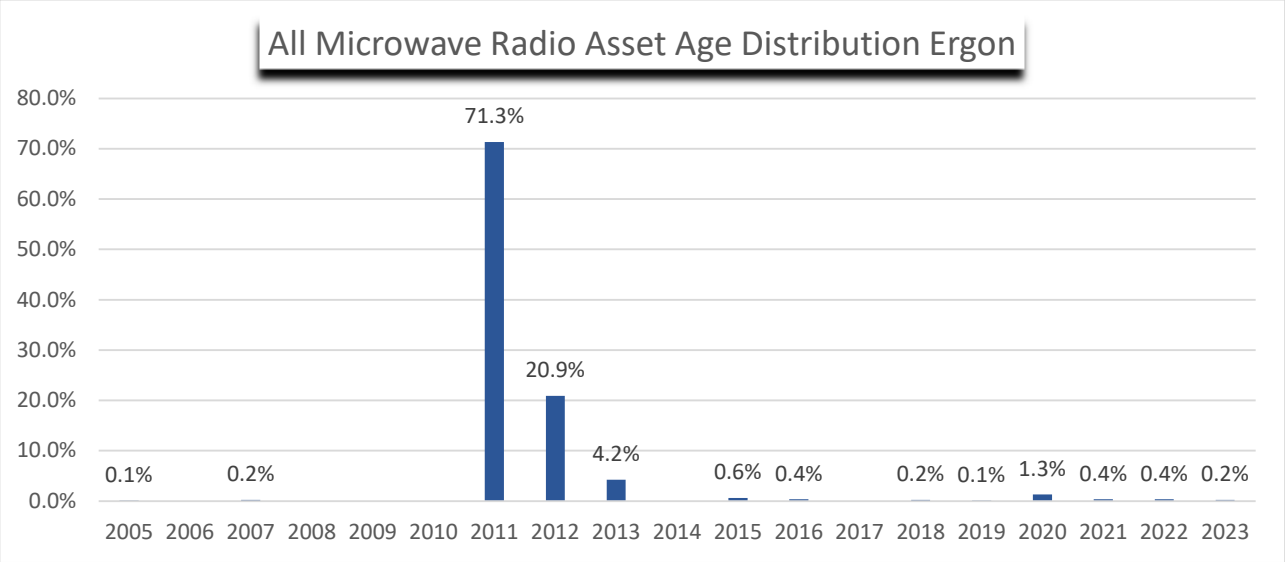


Figure 1 Microwave Radio Age Profile all assets (Core and Edge)

3.3 Asset Failure Rates

Asset performance considerations for the Microwave radio fleet is as follows:

- The MW Radio components comprise of both Indoor and Outdoor electronic components installed in rugged environments that deteriorate with age.
- The MW Radio components which have gone End of Life, manufacturers have ceased support and very limited options exist for equipment repairs and refurbishment.
- Large portion of the fleet 88.9% went End of Sale in 2015 with End of Support occurring in 2025-2026.
- Like for like replacements do not exist for both Indoor and Outdoor MW radio equipment resulting in increased complexities associated with upgrading to current contracted equipment from legacy equipment.
- Combined average failure rate during the 5 year period between 2019 and 2023 has been ~4% and is anticipated to increase as the electronic components age.

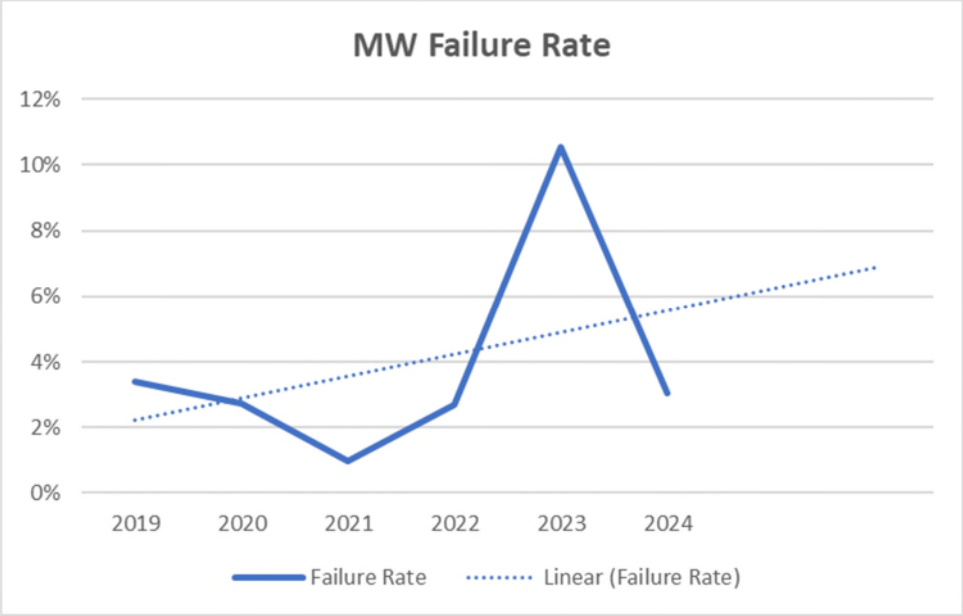


Figure 2: Microwave Core Radio Asset Failure rate

4 IDENTIFIED NEED

4.1 Summary

This program seeks to manage risks and costs associated with provision of comms equipment by replacing equipment ahead of in service failure to generate spares to extend the life of the remaining fleet. Not proceeding with the program will require expensive reactive replacement when units fail in service and no spares are available.

Ergon's fleet of microwave radio links provide the underlying bearer capacity for provision of telecommunications services and connectivity to multiple substations, depots and P25 sites, in addition to this it provides duplicate and diverse communications capacity for Teleprotection services required for protection systems to adhere to the NER (National Electricity Rules).

These assets experience conditional issues which can impact their expected operational life or result in in-service asset failure and outages. Failure to address these known conditional issues with appropriate asset management practices could result in the loss of critical services that are provisioned for safety and the support of basic services for the efficient completion of operational and supervisory activities.

Some of the potential consequences which can occur because of microwave radio system outage include:

- Loss of control and visibility of substation(s).
- Increased outage duration due to lack of SCADA functionality.
- Loss of interrogation/control of protection relays.
- Loss of operational voice communications using substation phones and P25 radios.
- Increased outage duration due to limited communications capacity.

- Reduction of network reliability and loss of contingency communications resulting in cascading network outages.
- Loss of diverse high-speed telecommunications for NER governed protection systems requiring de-energisation or abnormal network configurations.

4.2 Options Analysis

Ergon Energy evaluated multiple options as follows to determine the most prudent asset management approach for the MW radio based assets. These options are summarised in the table below and detailed further in each subsequent section.

Option	Qty Proactive	Total Proactive Cost	Qty Reactive	Total Reactive Cost	Total Cost	NPV
Option 1 - Spares mine 4% *Mine spares in alignment with failure rate projections ~4%*	18	$4.00M	0	$0	$4.00M	$0.68M
Option 2 – Hybrid proactive and reactive replacement *Accept AER proposed 37% reduction. Resulting in 10 x proactive and ~8 x reactive replacements.*	10	$2.48M	8	$3.57M	$6.05M	-$1.04M
Option 3 - Wholesale replace *Proactive replacement of all obsolete assets*	96	$12.8M	0	$0	$12.8M	-$6.73M
Option 4 – Counterfactual *No proactive replacement in place*	0	$0	18	$8.53M	$8.53M	-$7.19M

4.2.1 Option 1 (Proposed) – Spares mining aligned with projected failure rates.

This proposed option is based on allowing for a failure rate of equipment to not increase from the current observed 4%. This option will allow the existing MW radio fleet to continue to remain in service without significant change to ultimately extend the life of the existing infrastructure.

To achieve this Ergon intends to continue the existing practice of strategic spares mining which involves proactive replacement and recovery of operational MW radio assets for the likely amount required to support failure in service.

The approach to prioritise assets for recovery has strong focus on alleviating deliverability issues through targeted selection of assets that are simple to recover have reduced complexity based on where it is located and services it provides. The key methodology is as follows:

- Assets where design and construction can be aligned with other planned works, such as those assets interfacing to SDH based equipment.
- Sites that have existing modern IP/MPLS based assets and the radios are not providing Protection based services are generally the simplest to recover.

It is proposed that Ergon proactively replace **18** unsupported and aged core microwave radio links with the current contract equipment and utilise the recovered equipment as spares to support the remaining fleet.

When considering alternative options that considered an increase in failure rates and subsequently proactively recovering higher volumes of equipment; the NPV analysis is comparable given the proportion increase in expenditure required.

Should Ergon not proceed with a proactive replacement program aligned with projected failure rates than equipment will be having to be replaced not Like for Like in a reactive 'fault-fix' basis. This approach would likely need significantly higher costs and extended outages given an increased likelihood of failure of an aged asset and nature of the microwave radio equipment.

Total cost of this program $4,000,279.

4.2.2 Option 2 – Hybrid proactive and reactive replacements

This option is accepting the AERs 37% reduction in the program ($2.48M) and only replacing 10 assets. For this option we would be likely performing some reactive replacements of between 6 and 12 units. If we assume 8 units would be replaced the actual expenditure that would be required would be the proactive program and the reactive program to cover the fail-fix where spares would not be available.

Simply scaling the counter factual case costs based on the percentage of the program that would be done reactively suggest that the total costs for this program likely to cost $2.48M (proactive component) + $3.57M (reactive component) = $6.05M (total).

4.2.3 Option 3 - Wholesale replacement

Ergon considered performing wholesale proactive replacement of all obsolete MW Radio assets based on age, condition and vendor support removal as an alternate to the proposed multi-faceted approach that replaces a smaller subset however the program was grossly ($12.8M) more expensive than the proposed program and was rejected.

4.2.4 Option 4 - Counterfactual – Reactive replacement only

The counterfactual considers the continued use of the current infrastructure platform without a proactive program to generate spares ahead of failure. This means that once we have depleted all spares on failure the radio equipment will need to be replaced with new non-compatible equipment.

Should failure rates continue at 4%, this would result in approximately 18 failures over the 5 year period requiring reactive return to service initiatives which is estimated to cost at least 2 times to restore services. There are several factors that can lead to these significantly higher costs:

- Reactively replacing microwave equipment will cost twice as much as proactive replacement and fail then fix process due to:-
    - Proactive programs can be scheduled to occur at times when staff were performing other works at the site resulting in lower expenditure.
    - Significant amounts of overtime is always required to bring the services back on line in a suitable time frame for these reactive replacements, that in the most part can be avoided for a proactive program.
    - Inefficiencies that are caused to the work that Staff have been taken off of, as they demobilise to perform the emergency works and then move back to normal operations.

- current contracted equipment is not a like for like replacement. It involves replacing both indoor and outdoor equipment located on tower/structures, at minimum both ends of the links and often multiple sites along the string require replacement of legacy assets due to differences in protocols used to manage equipment.

- Reactively replacing MW radio's can result in longer network downtime, which adds indirect costs due to service outages, business impacts and the urgency of securing specialised resources and equipment to implement the migration. Pole or tower mounted equipment may not be repairable or replaceable for several days due to safety concerns or accessibility associated with inclement weather.
- The absence of proactive capital investment in the 2025-30 regulatory period would mean that over time the current infrastructure would no longer be fit-for-purpose and may become incompatible with new and emerging systems and technologies used by Ergon and third parties.

The total estimated cost of the counterfactual case over the period is $8,533,929.

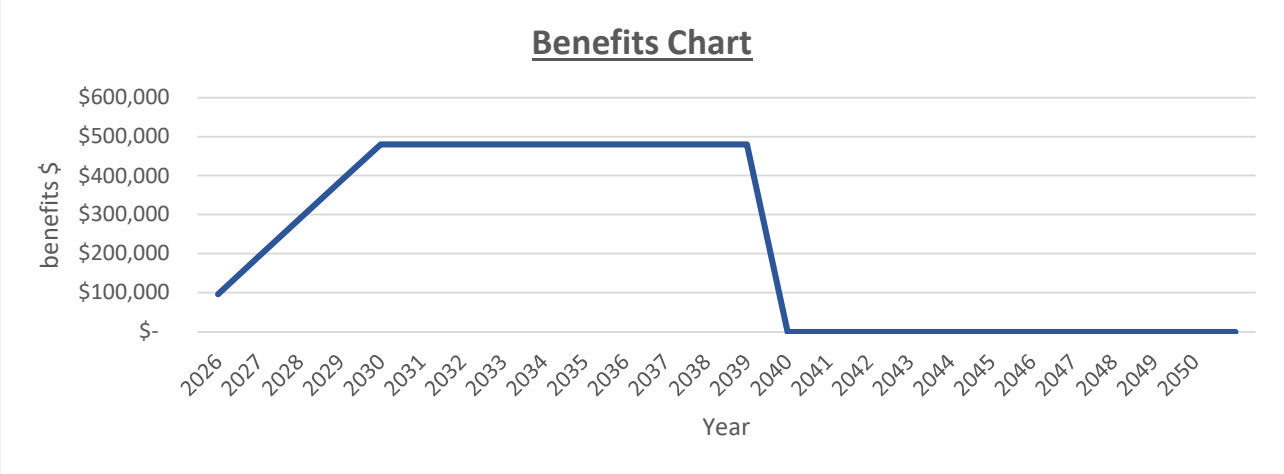
4.3 Risks

Table below outlines the risk assessment for the counterfactual scenario with no proactive program in place to address conditional and age issues (i.e. all work is done as reactive):

Risk Scenarios	Description of Risk
MW Radio hardware or software defects occur on aged unsupported equipment results in loss of protection, SCADA or other operational service for an extended period of time.	With the continued use of unsupported and aged microwave radio equipment services reliant on this equipment for diversity or primary connectivity (i.e. spurred substations) will be out of service for extended periods of time in the event of an asset failure. There is an estimated likelihood that on a yearly basis 5% of the at-risk assets will experience either hardware or software defects that will result in extended network outages that require an emergency response costing twice as much to fix compared to resolving as part of planned proactive work due to complexities associated with upgrading to current contracted equipment from legacy equipment.
Failure of unsupported MW Radio equipment causing extended SCADA outages resulting in delays to both planned and unplanned restoration works.	Hardware or software failure on obsolete MW radio asset hinders ability to remotely manage the power network resulting increased labour costs and delays in service restoration impacting customer reliability totalling 2 hours of an average 22kV feeder (2000kW) with an assumed VCR of $52 per kWh with a likelihood of 1% p.a.
Failure of microwave radio assets providing primary connectivity to Ergon depot with no available spares results in extended periods of	Ergon is reliant on microwave radio for connectivity to remote Depot locations; should these microwave radios fail, employees would experience a reduce capacity to access corporate and operational systems for the duration of the outage. Delays in service restoration totalling 40 hours for 20 staff resulting in a 20% reduced efficacy for this period with a likelihood of 1.8%

reduced operational capacity.	

The table below outlines the cost benefits for the preferred option which has only been modelled over the estimated asset life of ~12 years.



5 ECONOMIC ANALYSIS

5.1 Cost Summary 2025-30

Table 1 Cost summary 2025-30

Option	2025-26	2026-27	2027-28	2028-29	2029-30	Total 2025-30
Option 1 – Spares mining	$0.80M	$0.80M	$0.80M	$0.80M	$0.80M	$4.00M
Option 2 – Hybrid replace	$1.21M	$1.21M	$1.21M	$1.21M	$1.21M	$6.05M
Option 3 – Wholesale replace	$2.56M	$2.56M	$2.56M	$2.56M	$2.56M	$12.80M
Option 4 – Reactive replace	$1.70M	$1.70M	$1.70M	$1.70M	$1.70M	$8.53M

We have modelled the costs and benefits in our NPV in the way we would deliver the program absent of any deliverability constraints. The investments have been phased for deliverability in the capex model, and so there will be some differences in the capital cost phasing. This phasing does not change the preferred option for this investment.

5.2 NPV Analysis

The NPV calculations have been modelled as a complete program, with benefits realised through proactive program delivery calculated.

The resulting NPV value calculated for the proposed program was $684,131.

Table 2 NPV analysis

Option	NPV	Discount rate		Benefits	
		2.5%	4.5%	125%	75%
Option 1 – Spares mining	$684,131	$933,441	$471,404	$1,698,193	-$329,930
Option 2 – Hybrid replace	-$1,046,888	-$882,640	-$1,179,605	-$32,826	-$2,060,949
Option 3 – Wholesale replace	-$6,733,769	-$6,848,973	-$6,603,630	-$5,719,707	-$7,747,830
Option 4 – Reactive replace	-$7,193,846	-$7,547,350	-$6,861,336	-$7,193,846	-$7,193,846

APPENDICES

Appendix 1: Alignment with the National Electricity Rules

Table 3 Recommended Option's Alignment with the National Electricity Rules

NER capital expenditure objectives	Rationale
A building block proposal must include the total forecast capital expenditure which the DNSP considers is required in order to achieve each of the following (the capital expenditure objectives):	
6.5.7 (a) (1) meet or manage the expected demand for standard control services over that period	
6.5.7 (a) (2) comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;	As indicated in section 4, this proposal ensures that safety obligations, reliability obligations and protection requirements are met by providing an appropriate, economically efficient program of works to prevent in-service failure of microwave infrastructure. Without this program, these obligations would be at significant risk of being breached.
6.5.7 (a) (3) to the extent that there is no applicable regulatory obligation or requirement in relation to: (i) the quality, reliability or security of supply of standard control services; or (ii) the reliability or security of the distribution system through the supply of standard control services, to the relevant extent: (iii) maintain the quality, reliability and security of supply of standard control services; and (iv) maintain the reliability and security of the distribution system through the supply of standard control services	This program of work ensures the integrity of communications functions that support SCADA, protection, voice and data communications systems. They are critical in the provision of network reliability in support of MSS and safety net security and reliability targets.
6.5.7 (a) (4) maintain the safety of the distribution system through the supply of standard control services.	This program of work ensures the integrity of communications functions that support SCADA, protection, voice, and data communications systems. They are critical in ensuring safety through correct protection operation, and through the availability of voice and data communications.
NER capital expenditure criteria	**Rationale**
The AER must be satisfied that the forecast capital expenditure reflects each of the following:	
6.5.7 (c) (1) (i) the efficient costs of achieving the capital expenditure objectives	The options considered in this proposal take into account the need for efficiency in delivery. The preferred option has utilised a delivery approach that provides for bundling of work in terms of both timing and geography to enable a lower cost delivery compared to other options. It generally avoids emergency replacements that incur higher costs by enabling efficient use of labour resources in the delivery of the work programs. Specialised contractors are utilised as appropriate to ensure that costs are efficiently managed through market testing. Cost performance of the program will be monitored to ensure that cost efficiency is maintained.

NER capital expenditure objectives	Rationale
	The unit costs that underpin our forecast have also been independently reviewed to ensure that they are efficient (Attachments 7.004 and 7.005 of our initial Regulatory Proposal).
6.5.7 (c) (1) (ii) the costs that a prudent operator would require to achieve the capital expenditure objectives	The prudency of this proposal is demonstrated through the options analysis conducted. The prudency of our CAPEX forecast is demonstrated through the application of our common frameworks put in place to effectively manage investment, risk, optimisation and governance of the Network Program of Work. An overview of these frameworks is set out in our Asset Management Overview, Risk and Optimisation Strategy (Attachment 7.026 of our initial Regulatory Proposal).
6.5.7 (c) (1) (iii) a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives	NA

Appendix 2: Reconciliation Table

Table 4 Reconciliation

Expenditure	DNSP	2025-26	2026-27	2027-28	2028-29	2029-30	2025-30
GRID COMMS MW Radio Core REPEX ($ Direct)	Ergon	0.80M	0.80M	0.80M	0.80M	0.80M	**$4.0M**