# Grid Comms AC Systems Replacement REPEX Ergon Energy

## Justification Statement

11/ 11/ 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 AC Systems Replacement |
|---|---|
| DNSP | Ergon Energy |
| Expenditure category | ☒ Replacement ☐ Augmentation ☐ Connections ☐ Non-network |
| Identified need<br>*(select all applicable)* | ☐ Legislation ☒ Regulatory compliance<br>☒ Reliability ☐ CECV ☒ Safety ☐ Environment ☐ Financial<br>☐ Other<br>This ongoing program to replace Site Generation addresses the need to ensure costs and risk remain manageable by replacing higher risk component of the asset base in a timely fashion before the cost of in service failures and associated issues escalate to unmanageable levels in terms of costs and risk |
| Expenditure | See nested table below |
| Benefits | This proactive program will reduce costs associated with moving to a reactive program, it will reduce risks associated with increased outages of in service equipment and has a range of other advantages compared to the a fail fix asset strategy |

| Year | 2025-26 | 2026-27 | 2027-28 | 2028-29 | 2029-30 | 2025-30 |
|---|---|---|---|---|---|---|
| direct 2022-23 | $0.701M | $0.879M | $0.880M | $0.881M | $1.058M | **$4.4M** |

# 2 PURPOSE AND SCOPE

This document recommends the optimal capital investment necessary for Grid Comms AC Systems such as Generator and Solar Regulator replacements. This is a preliminary 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 ($4.4M) are in (2022/23) direct dollars.

# 3 BACKGROUND

## 3.1 Asset Population / Site Summary / Capability

Ergon Energy currently operates a large number of communication sites to meet legislative requirements for operation of the electricity network. These sites provide the backbone of the communication systems that support protection communication and SCADA, while catering for number of other services such corporate computing, substation voice, in field mobile voice comms and a range of miscellaneous network related services.

The majority of these site are in rural and remote locations with significant travel from the closest support locations and many without all weather access.

The Site Generation assets are separated into two categories below based on function:

- **Solar Regulator** - Provide regulation of Solar Generation that supply power to Ergon Energy telecommunication sites that are not mains connected.
- **Generators** - Deployed to sites deemed to be of significant criticality to provide AC power in the event of mains outage. As the majority of telecommunications sites are in remote locations site autonomy is critical.

At the end of the current 2020-25 AER period, it is estimated that Ergon will have the below distribution of assets:

| Asset Class / Technology Type | Total Quantity |
|---|---|
| Generators | 100 |
| Solar Regulators | 54 |

**Table 1: Asset Summary**

## 3.2 Asset Management Overview

Ergon Energy typically replaces assets based on age, condition or a combination of both, below shows a table detailing the category of assets, install base and number of assets expected to exceed their design and/or operational life at 2030. Ergon Energy is proposing that the assets exceeding their life or have condition based issues (as per Table 2: Asset Summary below) will either be replaced or assessed and appropriate action taken to extend their life to ensure reliable operation of the telecommunications network.

| Asset Class / Technology Type | Total Quantity | 2025-30 End of Life Quantity | Driver |
|---|---|---|---|
| Generators | 100 | 33 | **Age/Condition Based Replacement** |
| Solar Regulators | 54 | 13 | **Age/Condition Based Replacement** |

**Table 2: Asset Summary**

EQL monitors the condition of the Site Generation through field assessments and programmed inspections. The information provided can identify the deterioration or degraded state of the assets. This information is used to inform proactive replacement programs.

The deterioration of the solar regulators and generators has been reported and identified by field and telecommunication groups. However, the required asset refurbishment activities are outside the scope of standard maintenance programs. These deteriorating assets are experiencing increasing reliability issues and require refurbishment or replacement in order to improve asset condition and network resilience.
This proposal addresses the approaching need to replace or refurbish a number of deteriorating Site Generation Systems within the next regulatory period.

## 3.3 Asset Types & Age Distribution

A number of programs have been implemented over the period 2001 to 2023 which have deployed varying standard power generation infrastructure (AC Generator & Solar generation) to support the underlying telecommunication network for Ergon Energy. These have included programs such as Ubinet from 2010 to 2014, P25 program from 2013 to 2021 all of which implemented new generation assets into the Ergon network.

In addition to these programs, a number of 3rd party site acquisitions have occurred since 2020, of these sites the generation assets have been non-standard for Ergon Energy which meant they were not able to be monitored by our management system and the ages and condition of these units varied significantly.

Due to the age distribution and program rollout of these assets a number of variations have been deployed. This variation in standard generation deployments does not enable a “like for like” drop in replacement. This means that replacement on assets failure will require significant down time on the generation / solar system whilst designs are developed and installation works planned to deploy the replacement device. These outages are mitigated with a planned replacement program prior to failure.

The graphs below highlights the age distribution of the different generator types:

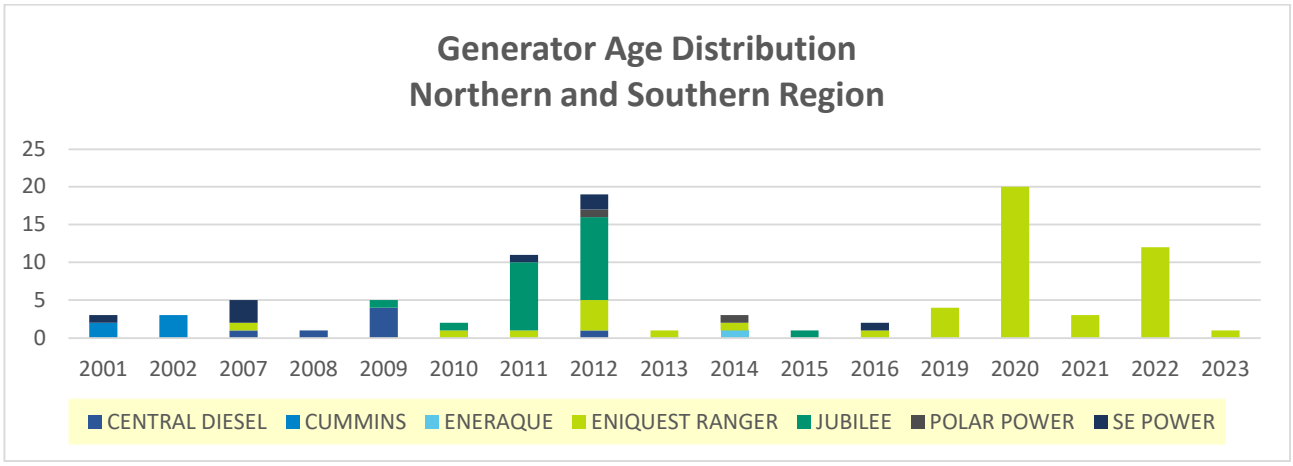



**Figure 1: Age Distribution Generators**

The majority of the solar regulator assets were installed between 2007 and 2021. The graphs below highlights the age distribution of the different solar regulator types:

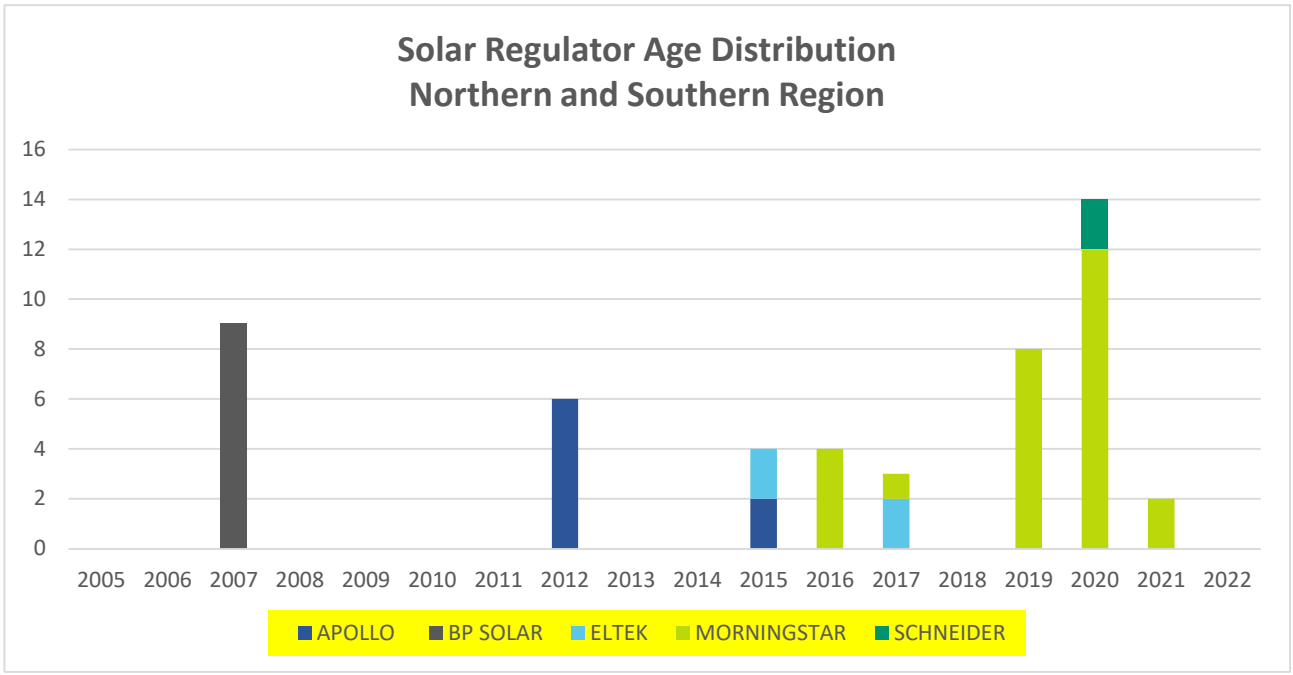



**Figure 2: Age Distribution Solar Regulators**

EQL has a current Generator replacement program from this AER 2020-25 regulatory control period which has been successful in the reduction of generator outages and improved site reliability.

The below table highlight the success of this Generator program with the final generator failure rate at 5% as of 2023.

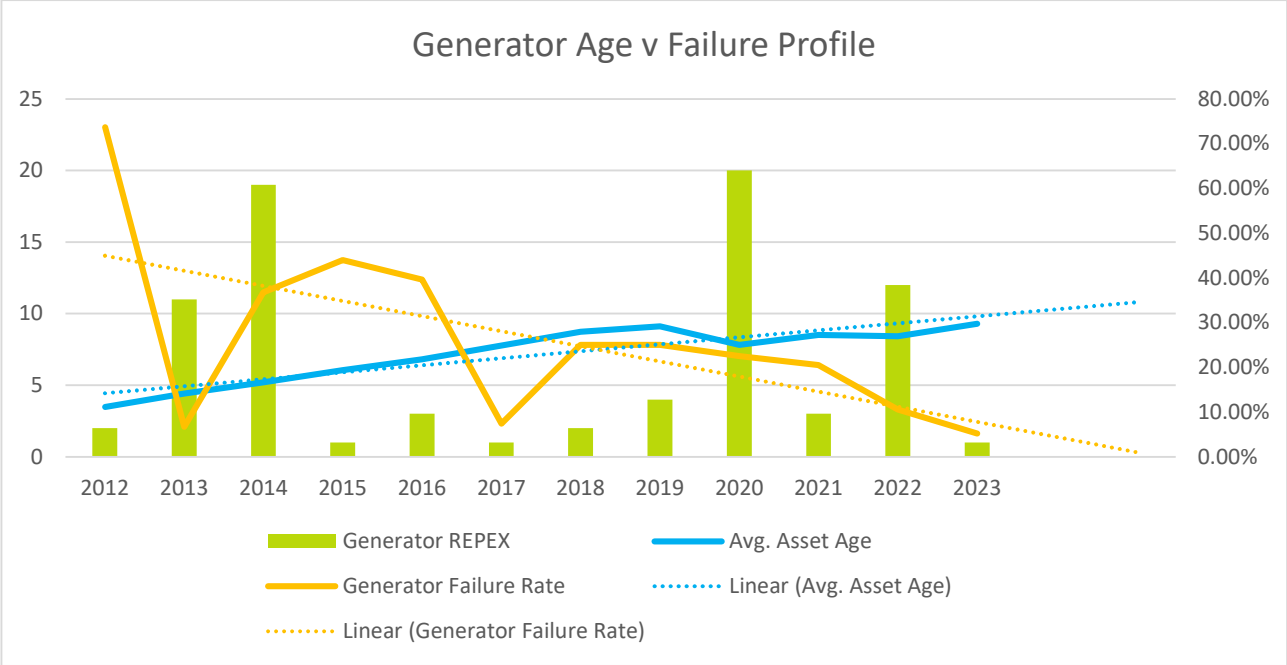



**Figure 3: Generator REPEX v Failure Profile**

However this downward trend will be temporary, with the average age of the assets continuing to increase (assuming no proactive program is progressed), which could moves us back to failure rates above 10% seen previously.

In contrast there has been no program to replace those known solar rectifier which are end of life asset and this is reflected in rising failure rate shown in the below failure rate table.

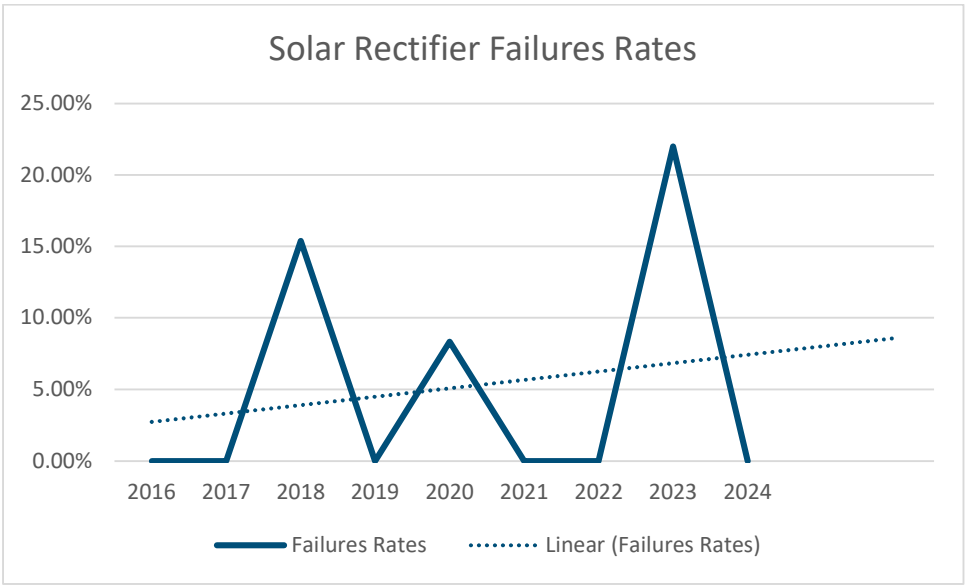


Figure 4: Solar Rectifier Failure Rate

# 4 IDENTIFIED NEED

## 4.1 Summary

This program seeks to manage costs associated with maintaining backup generation for communications by replacing or refurbishing generators and solar regulation infrastructure before in service failure can impact the performance of the communications services. Not proceeding with the program will require expensive reactive replacement of infrastructure as the equipment fails and will increase the risk to worker and public safety, plant damage during faults, restoration of supply time frames and loss of productivity of field staff.

This program supports maintaining staff and public safety, minimising equipment damage during power system faults, efficient and safe field operations, minimising the impact of network outages on customer supply, optimising asset management of equipment and a host of other improvements by ensuring that communications services to substations, depots and control rooms continue to operate at suitable levels of performance.

Ergon Energy aims to minimise expenditure in order to keep pressure off customer prices, however understands that this must be balanced against critical network performance objectives. These include network risk mitigation (e.g. safety, bushfire), regulatory obligations (e.g. safety), customer reliability and security and preparing the network for the ongoing adoption of new technology by customers (e.g. solar PV). In this case safety is a strong driver, based on the need to support communication systems to ensure the network can be operated safely, particularly in instances of network outage or major weather events.

Telecommunications assets are installed at substations, dedicated telecommunications sites, control and data centres, depots, and offices across the Ergon Energy network, and are required to support protection signalling, Supervisory Control and Data Acquisition (SCADA), operational telephony, security, alarming, and ancillary services.

Communications Site Generation systems provide primary and backup power to telecommunications assets, and their correct operation is required to ensure that the network remains operational after power outages or major weather events. Failure to maintain power to the telecommunication network can result in the loss of services that are provisioned for safety and the support of basic services for the efficient completion of operational and supervisory activities for the power network. In-service failures of communications power systems can therefore significantly impact Ergon Energy until repairs are carried out, potentially resulting in the following:

- **Loss of protection circuits between substations,** leading to delays to fault clearance times, potentially resulting in significant damage to equipment and increasing risk to personnel;
- **Loss of SCADA systems and remote control of the network**, with potential customer outage or compliance impacts; and,
- **Loss of communications and site security monitoring**, increasing safety risks to substation or field staff and plant equipment.

## 4.2 Options Analysis

Ergon Energy evaluated multiple options as follows to determine the most prudent asset management approach for the Generator and Solar regulator assets.

These options are summarised in the table below and detailed further in each subsequent section.

| Option | Proactive Replacement Generators | Proactive Replacement Solar Regulators | Total Proactive Cost | Qty Reactive (Generators & Solar Regulators) | Total Reactive Cost | Total Cost | NPV |
|---|---|---|---|---|---|---|---|
| Option 1 – Risk Based Rolling Program – Replacement of the highest risk assets (age/condition) (preferred) | 33 | 13 | $4.4M | | | $4.4M | $860k |
| Option 2 – Replace all end of useful life Assets | 52 | 18 | $6.52M | | | $6.52M | $1.18M |
| Option 3 – Replace only Critical end of life Assets *Match AER proposed 37% reduction* | 22 | 10 | $3.127M | 3,3 | $1.355M | $4.48M | $827k |
| Option 4 Replace units on fail fix only | | | | 25,13 | $7.61 | $7.61 | -$6.42M |

## 4.3 Option 1 (Proposed) – Risk based rolling program

This option presents an optimised replacement scenario in order to balance risk of asset failure with efficient investment principles and prioritised against site criticality measures such as service impacts, site performance monitoring, site autonomy, site access and site proximity to network support services.

- **Non-Standard Aged Generators:** Units identified as nearing end of their useful life, with no standard monitoring & with increase maintenance issues / failures.
- **Aged solar regulators and generators:** All units near the end of their useful life will be monitored closely and planned for replacement in line with other geographically bundled programs
- **Known defective solar regulators and generators:** solar regulators and generators with known defects will be replaced over the next regulatory period based on risk assessments that include condition assessment and site criticality to network services, resulting in a more prudent and efficient program of investment than an accelerated replacement program.
  **Optimised Investment:** The replacement of solar regulators and generators where feasible will be bundled with other work at the specific site locations, to reduce associated labour and operating costs

## 4.4 Option 2 – End of useful life replacement

An accelerated replacement program, under which all assets at the end of their useful life are replaced as soon as possible to minimise risk of failure as much as practical.

Whilst this option has an improved NPV over the preferred Option 1 it was not selected due to the 48% increase in investment compared to the proposed program.

- **Non-Standard Aged Generators:** All non-standard generation assets shall be replaced as soon as possible, limiting the ability of work crews to bundle replacement works with other geographical programs.
- **Aged Solar regulators and generators:** All units at the end of their useful life will be scheduled for replacement as soon as possible, potentially limiting the ability of work crews to bundle replacement works with other geographical programs.
- **Known defective Solar regulators and generators:** replace generation assets as soon as they are determined to be end of life. This option reduces the risk of in-service asset failure due to the specific identified defects completely but is not considered particularly prudent as it unnecessarily brings forward expenditure, replaces assets that have not been identified as at risk, and is potentially less cost efficient as bundling of replacements based on geographical sites may not be complete.

## 4.5 Option 3 – High Risk replacements only (match AER Submission)

A risk-based rolling replacement program, with maximum risk, under which only assets at the most critical locations are replaced proactively. The remaining assets will be replaced reactively upon failure.

- **Non-Standard Aged Generators:** Unmonitored aged assets will be allowed to run to failure to maximise in-service life and will only be reactively replaced when high failure likelihood or in-service failures are detected during scheduled preventive maintenance.
- **Aged Solar regulators and generators:** Aged assets will be allowed to run to failure to maximise in-service life and will only be reactively replaced when high failure likelihood or in-service failures are identified by scheduled preventive maintenance at critical site locations.
- **Known defective Solar regulators and generators:** Replace only those assets at core critical sites, where the impact of in-service failure would be much greater. There are 32 core critical sites, at high-risk with aged solar regulators or generators. Defective assets at less critical telecommunication sites will only be replaced reactively when high failure risks are identified by scheduled preventive maintenance.

This option carries significant risk of outages as field inspections are only completed on a six-month basis, and the tests carried out typically only identify failures that will occur in the short term. As the age profile of these generation assets increase, some without appropriate network monitoring, it is likely this approach will result in significantly higher replacement costs overall due to the comparatively higher cost of reactive emergency replacement works than that of a proactive planned approach.

## 4.6 Option 4 – Counterfactual (Reactive replacement only)

This program is intended to be purely reactive in nature. The counterfactual considers the continued use of the current infrastructure platform beyond its useful asset life.

In these instances of degradation or imminent failure might not be identified by routine maintenance, causing Site Generation Assets to fail in-service and the associated loss of service with risk and cost impacts as detailed below. With current failure rates it is expected 25 generation & 13 solar regulator units will fail over the 5 year period.

- **Asset Life Reduction:** due to replacement on failure, if generation assets are run to failure and subsequent battery banks are run below manufacturer DOD limits the asset life of the batteries will be significantly reduced and would require premature replacement.
- **Remote access on-cost:** If assets are run to failure and require emergency restoration significant on-cost can be incurred due to difficult site access conditions and environmental considerations.
- **Increased Risk of Plant Damage and Larger than Necessary Outages:** For periods when voice comms, or protection circuits are not operating there are potential risks of damage or premature ageing to plant equipment due to longer periods before backup protection systems clear faults. There are also increased outage impacts should a fault occur during the period of communication issues. The network may not be controllable if SCADA is unavailable resulting is field crew having to attend a network device on site to operate.
- **Loss of Contingency Capability:** When issues occur, various indirect consequences can increase the risk to the organisation. For example, the failure of Solar Regulators can result in the loss of power at site and result in the communication site shutting down.
- **Loss of productivity:** due to Depot Communications being lost or having reduced bandwidth to operate corporate systems when the equipment fails.
- **Larger cost for Reactive work:** Efficiencies of bunding work cannot be realised in fail fix reactive work, significantly more overtime is required, disruption to other scheduled works, and costs from the impacts listed above all result in larger costs for reactive replacement.

As well as the potential safety, reliability, and network impacts which may occur as a result of in-service degradation or failure of communication Site Generation assets, a Do-Nothing approach does not represent prudent application of asset management principles. The counterfactual ignores newly emerging failure modes in Site Generation systems and the fact that replacing or repairing assets after in-service failure carries significant emergency cost increases.

## 4.7 Risks

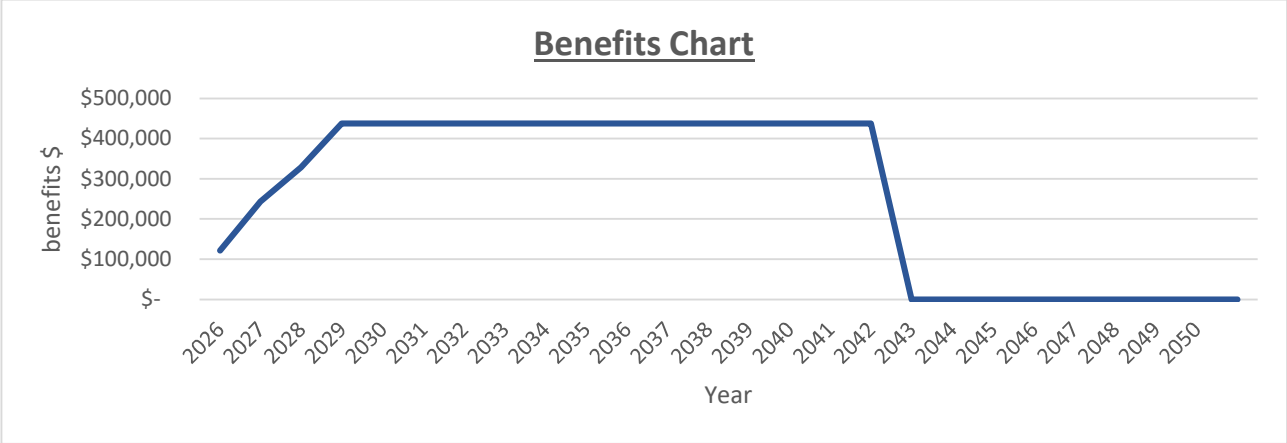
The risks addressed under this business case primarily address the serviceability of Ergon Energy sites and staff utilisation of communication systems. The following estimations/assumptions have been made regarding the risk below:

- Costs to replace failed solar regulator would be double in a reactive response compared to a proactive program.
- Costs to replace failed generators would be double in a reactive response compared to a proactive program.

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

| Risk Scenario | Description of risk |
|---|---|
| Equipment obsolescence: Obsolete equipment is unable to be supported by vendor for spares or repairs and requires significant design and implementation changes to integrate replacement devices. Significantly increasing the replacement effort and outage times. | The asset population for both solar regulators and generators is comprised of models that are no longer made or supported by the vendor. If failure of these models occurs a redesign will be required as no spares for carried for the obsolete models. In the event that we do not proceed with the program over the life of the equipment we will need to reactively replace equipment, likely costing more than 2 times the cost to replace with a proactive program and with a 5% yearly probability. |
| SCADA – Failure of communication AC power systems results in loss of visibility of SCADA derived data which leads to a reduced capacity to remotely control the network | With the continued use of poor preforming and/or aged Site Generation the telecommunication network is at risk of an extend outage where SCADA services will be out of service for extended periods of time in the event of asset failure. |
| Protection – An unstable or failed communication AC power system results in delayed relay operation and the fault is unable to be cleared within specified timeframes, resulting in significant damage to equipment and plant and an inability to control ≥2 bulk supply substations supply area. Additionally, an AC power systems failure could result in impaired protection services leading to a breach of National Electricity Rules | With the continued use of poor preforming and/or aged Site Generation the telecommunication network is at risk of protection services being out of service for extended periods of time in the event of Site Generation failure |
| Corporate voice/data – Failure of corporate voice, data and internet communication due to failure of communications AC power systems results in inability to access corporate IT (Information Technology) systems and inability to remotely control or manage the network across multiple sites. | With the continued use of poor preforming and/or aged Site Generation the telecommunication network is at risk of Corporate voice/data being out of service for extended periods of time in the event of Site Generation failure |
| Field Voice - Inability to communicate with field crews via substation phones. Control Centre unable to transmit switching sheets impacting restoration and planned works equating to productivity lost of $9K pa. | With the continued use of poor preforming and/or aged Site Generation the telecommunication network is at risk of field voice services being out of service for extended periods of time in the event of Site Generation failure |

Table below outlines the cost benefits over the program period and asset life.




# 5 ECONOMIC ANALYSIS

## 5.1 Cost summary 2025-30

**Table 3 Cost summary 2025-30**

| Options | 2025-26 | 2026-27 | 2027-28 | 2028-29 | 2029-30 | Total 2025-30 |
|---|---|---|---|---|---|---|
| Option 1 (Preferred) | $0.701M | $0.879M | $0.880M | $0.881M | $1.058M | $4.4M |
| Option 2 | $1,305,131 | $1,305,131 | $1,305,131 | $1,305,131 | $1,305,131 | **$6.52M** |
| Option 3 | $896,582 | $896,582 | $896,582 | $896,582 | $896,582 | **$4.48M** |
| Option 4 | $1,522,026 | $1,522,026 | $1,522,026 | $1,522,026 | $1,522,026 | **$7.61M** |

## 5.2 NPV analysis

The NPV calculations have been modelled as a complete program, with only the proactive part of the program providing benefits.

**Table 4 NPV analysis**

| | | | Discount rate | Benefits | |
|---|---|---|---|---|---|
| **Options** | **NPV** | **2.5%** | **4.5%** | **125%** | **75%** |
| Option 1 (Preferred) | $860,541 | $1,202,698 | $573,910 | $2,000,489 | -$277,945 |
| Option 2 | $1,162,247 | $1,668,266 | $738,437 | $2,830,682 | -$504,780 |
| Option 3 | $827,945 | $1,179,013 | $533,790 | $1,982,312 | -$325,013 |
| Option 4 | -$6,415,113 | -$6,730,350 | -$6,118,597 | -$6,415,113 | -$6,415,113 |

# APPENDICES

## Appendix 1: Alignment with the National Electricity Rules

**Table 5 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)**<br>meet or manage the expected demand for standard control services over that period | |
| **6.5.7 (a) (2)**<br>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 site generation infrastructure. Without this program, these obligations would be at significant risk of being breached. |
| **6.5.7 (a) (3)**<br>to the extent that there is no applicable regulatory obligation or requirement in relation to:<br>(i) the quality, reliability or security of supply of standard control services; or<br>(ii) the reliability or security of the distribution system through the supply of standard control services,<br>to the relevant extent:<br>(iii) maintain the quality, reliability and security of supply of standard control services; and<br>(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)**<br>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)**<br>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.<br>Specialised contractors are utilised as appropriate to ensure that costs are efficiently managed through market testing.<br>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)**<br>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.<br>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)**<br>a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives | NA |

# Appendix 2: Reconciliation Table

**Table 6 Reconciliation**

| Expenditure | DNSP | 2025-26 | 2026-27 | 2027-28 | 2028-29 | 2029-30 | 2025-30 |
|---|---|---|---|---|---|---|---|
| GRID COMMS Site Generation REPEX ($ Direct) | Ergon | $0.701M | $0.879M | $0.880M | $0.881M | $1.058M | $4.4M |