Business Case
Communication Site Infrastructure

ERGON. ENERGY NETWORK

Executive Summary

The Communication Site Infrastructure Program addresses issues with existing communication buildings and structures. The equipment housed inside the buildings and antennas on the structures are vital to ensure that the transmission of protection signalling, Supervisory Control and Data Acquisition (SCADA) and field voice services remain operational.

A total of 160 communication buildings and 280 structures are located across the Ergon telecommunications network. A small number of these assets have been identified to have reached the end of their maintainable life and need either significant refurbishment or replacement in order to maintain risk at levels as low as reasonably practical (ALARP).

A counterfactual, 'Do nothing' option was considered but rejected. Failure to replace the buildings and structures would result in deterioration of the infrastructure's condition resulting in unacceptable risk to the communication network and increase the risk to staff, contractors and the community. Three network options were evaluated as part of this business case:

Option 1 – An accelerated program to replace or rectify all legacy buildings and structures as soon as possible.

Option 2 – A risk-based rolling program, which involves a staged rollout of replacement and refurbishment based on identified needs and prioritised based on risk.

Option 3 – A risk-based rolling program (with maximum risk), under which infrastructure is only proactively replaced at core critical sites. Infrastructure at less critical telecommunication sites will be replaced or refurbished reactively when identified by scheduled preventive maintenance.

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 ensure the infrastructure supporting the networks communications systems remain functional.

To this end, Option 2 is the preferred option, as its Net Present Value (NPV) result of -$2.2 million was the least negative of the three options considered.

The direct cost of the program for each submission made to the AER is summarised in the table below. Note that all figures are expressed in 2018/19 dollars and apply only to costs incurred within the 2020-25 regulatory period for the preferred option.

Regulatory Proposal	Draft Determination Allowance	Revised Regulatory Proposal
$2.4M	N/A	$2.4M

Contents

1. Introduction

The Communication Site Infrastructure Program addresses issues with existing communication buildings and structures, which house core Ergon Energy communications infrastructure. The equipment contained inside the buildings and antennas on the structures are vital to ensure that the transmission of protection signalling, Supervisory Control and Data Acquisition (SCADA) and field voice services remain operational. This proposal identifies at risk assets, and outlines options to ensure that communications site infrastructure remains safe for use and fit for purpose.

1.1 Purpose of document

This document recommends the optimal capital investment necessary for significant refurbishment or replacement of communication buildings and structure that have been identified as reaching the end of their useful lives. These assets are vital to ensure the transmission of protection signalling, SCADA and field voice services remain operational.

This is a preliminary business case document and has been developed for the purposes of seeking funding for the required investment in coordination with the Ergon Energy Revised Regulatory Proposal to the Australian Energy Regulator (AER) for the 2020-25 regulatory control period. Prior to investment, further detail will be assessed in accordance with the established Energy Queensland investment governance processes. The costs presented are in $2018/19 direct dollars.

Supporting information is contained in the Asset Management Plan – Telecommunication and the Intelligent Grid Technology Plan.

1.2 Scope of document

This document will outline the rationale, benefits, and drivers for asset replacement or refurbishment as well as outlining the options identified from the options analysis. These options, their associated risk assessments, delivery timeframes and project costs will be outlined and compared to provide a recommendation for the option that minimises risk and optimises cost efficiency.

The Return to Service (RTS) project is excluded from the program and will operate in conjunction to mitigate risk of in-service failures.

1.3 Identified Need

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 ensure the infrastructure supporting the networks communications systems remain functional.

Communication Site Infrastructure assets are inspected and maintained as per the following standard processes:

- All site infrastructure is subject to visual inspection from the ground on a 6-monthly period.
- Communication structures undergo fall arrest physical inspection (if present) on a 12-monthly schedule, which involves the field team climbing the structure to inspect the fall arrest, including visual inspection.
- A complete physical inspection of communication structures (including all nuts and bolts) is undertaken every five years.

As a result of regular maintenance, a small number of these assets have been identified to have reached the end of their maintainable life and need either significant refurbishment or replacement. This program will fund these activities and as such is outside the normal maintenance program as it is important to ensure the assets continue to perform their designed function.

Condition is the major driver for the replacement of the communication site infrastructure that are utilised by Ergon Energy. Once the condition of the site infrastructure is below the designed requirements, various risk factors begin to increase until ongoing use of the asset is considered as intolerable. Maintenance activities are identified and completed under scheduled site visitations. This program is required for assets that require either significant refurbishment or replacement; these requirements are outside the maintenance program.

This program is consistent with the strategy as detailed in the Telecommunications Asset Management Plan and Intelligent Grid Technology Plan. This proposal aligns with the CAPEX objectives and criteria from the National Electricity Rules (NER) as detailed in Appendix C.

1.4 Energy Queensland Strategic Alignment

Table 1 details how Communication Site Infrastructure contributes to Energy Queensland's corporate and asset management objectives. The linkages between these Asset Management Objectives and EQL's Corporate Objectives are shown in Appendix D.

Table 1: Asset Function and Strategic Alignment

Objectives	Relationship of Initiative to Objectives
Ensure network safety for staff contractors and the community	Communication Site Infrastructure allows for communication services at substation field sites where works are being conducted. It also allows for continued operation of networks, reducing frequency and severity of outages. These communications reduce risk for staff, contractors and the community, which offers the business the opportunity to reach safety objective goals.
Meet customer and stakeholder expectations	Customers have indicated they want prudent investments in technology to modernise the network, to enable them to interact with the network, manage their electricity costs and take advantage of new products and technology developments. A modern communication network is a critical part of the intelligent grid of the future that will enable this for our customers.
Manage risk, performance standards and asset investments to deliver balanced commercial outcomes	The network (business) risk the organisation would be exposed to if the project was not undertaken is not deemed to be as low as reasonably practicable (ALARP). Addressing the risks through implementation of the preferred option 2 will reduce Ergon Energy's risk exposure while minimising costs compared to other options.
Develop Asset Management capability & align practices to the global standard (ISO55000)	The selection of the buildings and structures under this program are based on risk-based assessments in alignment with global standards. The program will be divided into multiple projects to address differing needs, priorities and completion timings so that works can be completed in an efficient and logical manner.
Modernise the network and facilitate access to innovative energy technologies	The program will support the needs of customers in modernisation of the network, will support the replacement of aged assets that allow for greater facilitation of innovative technologies as the new assets have greater capabilities. A modern communication network is a critical part of the intelligent grid of the future that will enable this for our customers.

1.5 Applicable service levels

EQL has an asset management objective to ensure a safe and reliable network for the community. Programs associated with these asset classes, therefore, aim to reduce in service failures to levels which deliver a safety risk outcome which is considered So Far As Is Reasonably Practicable (SFAIRP) and as a minimum maintains current performance standards. These performance standards are not expected to change in the near future for telecommunications equipment, however, the associated network will expand as necessary to accommodate for arising needs.

1.6 Compliance obligations

Table 2 shows the relevant compliance obligations for this proposal.

Table 2: Compliance obligations related to this proposal

Legislation, Regulation, Code or Licence Condition	Obligations	Relevance to this investment
QLD Electrical Safety Act 2002 **QLD Electrical safety Regulation 2013**	We have a duty of care, ensuring so far as is reasonably practicable, the health and safety of our staff and other parties as follows: • Pursuant to the Electrical Safety Act 2002, as a person in control of a business or undertaking (PCBU), EQL has an obligation to ensure that its works are electrically safe and are operated in a way that is electrically safe.[1] This duty also extends to ensuring the electrical safety of all persons and property likely to be affected by the electrical work.[2]	This proposal relates to work that will reduce the risk of asset failure and contribute to ensuring there is adequate protection of its power system assets.
Distribution Authority for Ergon Energy issued under section 195 of *Electricity Act 1994* (Queensland)	Under its Distribution Authority: • The distribution entity must plan and develop its supply network in accordance with good electricity industry practice, having regard to the value that end users of electricity place on the quality and reliability of electricity services. • The distribution entity will ensure, to the extent reasonably practicable, that it achieves its safety net targets as specified. • The distribution entity must use all reasonable endeavours to ensure that it does not exceed in a financial year the Minimum Service Standards (MSS)	This proposal relates to assets that maintain protection systems and enable communication during credible contingency events. Loss of these assets may risk the increase of outage times due to loss of communication.
National Electricity Rules, Chapter 5	Schedule S5.1 of the National Electricity Rules, Chapter 5 provides a range of obligations on Network Services Providers relating to Network Performance Requirements. These include: • Section S5.1.9 Protection systems and fault clearance times • Section S5.1a.8 Fault Clearance Times Section S5.1.2 Credible Contingency Events	This proposal addresses conditional issues impacting the performance of communications assets which are essential for provision of protection systems and fault clearance.

[1] Section 29, *Electrical Safety Act 2002*
[2] Section 30 *Electrical Safety Act 2002*

1.7 Limitation of existing assets

Around 16 communications site infrastructure assets (buildings and structures) have been identified through maintenance and inspection to be in a deteriorated state. Ageing, weather, vandalism and other environmental and human factors can all have a negative impact on the condition of communications site structures, putting the communications network asset at risk.

Failure to replace deteriorated buildings and structures which contain and support key communications site infrastructure would result in deterioration of the infrastructure's condition, resulting in unacceptable risk to the communication network and increase in risk to staff, contractors, and the community.

In-service failures of buildings and structures can significantly impact Ergon Energy until repairs are carried out, potentially resulting in the following serious impacts to the function of the communications network:

- Loss of protection circuits between substations.
- Loss of SCADA systems and remote control of the network.
- Loss of communications and site security monitoring.

The Communications Site Infrastructure Program is required due to the following additional drivers:

Building Replacement or Refurbishment

The deterioration of site building infrastructure 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 buildings within the next regulatory period.

Structure Replacement or Refurbishment at Mount Mackay Substation

The structures at Mount Mackay have been identified to be replaced. A previous project undertook foundation strengthening activities to prolong the assets' life; however, poles are in a poor state of repair, foundation improvements were limited and while they improved the structure loading capability, they do not meet the required standard.

There is a considerable risk that the existing 5 wooden poles at the site will be damaged in an extreme weather event, as a result, the P25 coverage produced from the site could be lost or limited. As the primary purpose of the P25 network is to provide communications for operation staff in emergency events, the impact of deterioration at the site will be compounded in the event of extreme weather.

Access to the Mount Mackay site is limited to helicopter only, the replacement structure is considerably more expensive than a regular site. The total cost is estimated in the order of $958,203.

2 Counterfactual Analysis

2.1 Purpose of asset

Telecommunications assets are an essential component of power network infrastructure as they enable corporate, field communications, advanced protection and control services. This maintains safety for personnel and enables adequate power network performance both during regular operation and during or following an abnormal condition.

Communication Site Infrastructure includes equipment housed inside the buildings which is vital for ensuring the transmission of protection signalling, SCADA and field voice services. A total of 160 communication buildings and 280 structures are located across the Ergon telecommunications network.

Communicate Site Infrastructure also allows for P25 coverage, which provides mission critical field voice communication for the operational workforce, using Internet Protocol (IP)-based technology.

Customer benefits associated with these assets include:

- Ensuring that outage durations and severity (number of customers who lose supply) are not impacted/made worse by ensuring SCADA and protection services maintain adequate performance levels.
- Control of costs for customers by ensuring that malicious damage and theft of assets is minimised through the use of managed security systems.
- Customer's choice - Customers have indicated they want prudent investments in technology to modernise the network, to enable them to interact with the network, manage their electricity costs and take advantage of new products and technology developments. A modern communication network is a critical part of the intelligent grid of the future that will enable this for our customers.
- Ensure network safety for staff, contractors and the community: Provides communication services at substation field sites to reduce risk to staff, contractors and the community, which offers the business the opportunity to reach the safety objective goals.

2.2 Business-as-usual service costs

The business as usual (BAU) service costs for these assets are the maintenance costs associated with ongoing operations. In addition to these costs, significant emergency response and replacement costs would be incurred for the counterfactual BAU case in the event that failures occur. These have not been explicitly costed in this case due to the significant safety, reliability and compliance risks associated with asset failures.

2.3 Key assumptions

The 'Do Nothing' counterfactual in this case is the BAU scenario where no assets are replaced proactively, but rather they are allowed to run to failure.

There are significant potential impacts associated with scenario, mainly linked to the failure of buildings or structures compromising the operation of key communications network assets as follows:

- **Worker safety compromised through building or structure failure:** Allowing substation and field staff to operate around and within deteriorating structure presents a workplace hazard, which could result in serious injuries should asset failure occur while staff are in the immediate vicinity.
- **Loss of P25 network and field mobile coverage due to structural compromise:** Failure of the P25 network due to building or structure failure such as damage to antennae could have a

significant impact on restoration or planned works by reducing field staff efficiency and would introduce additional risks to field staff by limiting communication ability.

- **Loss of protection circuits:** Damage to antennas, building, or communication assets could result in failure of protection circuits for plant equipment, which could lead to delays to fault clearance times and potentially catastrophic impacts to plant and equipment before backup systems are able to clear faults.
- **Loss of SCADA systems and remote control of the network:** Damage to antennas, building, or communication assets could result in failure of SCADA communications links, which would likely have various business, legislative, customer, and safety impacts, and in cases of widespread network outage loss of backup power systems could extend the duration of outages by reducing control over remote start-up systems.
- **Loss of communications and site security monitoring**: This can introduce significant risks to staff and plant equipment. Loss of fixed voice communications due to lack of power introduces safety risks to field staff operating in areas with poor mobile reception and tends to increase the duration and risk of repair and restoration works. Loss of site security monitoring can expose site equipment to damage by vandalism.

As well as the potential safety, reliability, and security impacts which may occur as a result of in-service failure of backup power assets, a 'Do Nothing' approach does not represent prudent application of asset management principles. The counterfactual ignores the deteriorating state of key site assets, in particular the Mount Mackay substation, and the fact that replacing or repairing assets after in-service failure carries significant emergency cost increases.

2.4 Risk assessment

This risk assessment is in accordance with the EQL Network Risk Framework and the Risk Tolerability table from the framework is shown in Appendix E.

Table 3: Risk assessment of BAU scenario

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
Building or infrastructure integrity compromised resulting in **significant impact on restoration or planned works >$500,000**.	Business Impact	*3 (Significant impact on restoration of planned works equating to business impact >$500,000)*	*3 (Unlikely to occur)*	***9 (Low risk)***	2019
Building or infrastructure integrity compromised resulting in **significant interruption with time to restore to normal operations > 1 Day**.	Customer Impact	*4 (Customer interruption for >1 day)*	*3 (Unlikely to occur)*	***12 (Moderate risk)***	2019
Building or infrastructure impacted by severe weather that damage antennas, building or communication assets result in **the inability to remotely control the network or provide communications** to customers or workers.	Business Impact	*3 (Inability to remotely control an Ergon substation)*	*3 (Unlikely to occur)*	***9 (Low risk)***	2019

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
Building or infrastructure integrity compromised resulting in risk to worker's safety through **multiple serious injuries**.	Safety Impact	*4* *(Multiple serious injuries / illnesses)*	*2* *(Very unlikely to occur)*	***8*** ***(Low risk)***	2019
National Electricity Rules (NER) require duplicated communication paths for protection services. They are at risk should assets fail and there are no like-for-like replacement assets, leading to an **improvement notice issued by the regulator**.	Legislative Impact	*4* *(Ergon identified issue requiring regulator to be notified. Improvement notice issued)*	*3* *(Unlikely to occur)*	***12*** ***(Moderate risk)***	2019
Building or infrastructure impacted by severe weather that damages antennas, building or communication assets resulting in an inability to communicate with field crews via field mobile radios **impacting on restoration and planned works**.	Business Impact	*3* *(Impact on restoration or planned works >$500,000)*	*3* *(Unlikely to occur)*	***9*** ***(Low risk)***	2019
Building or infrastructure impacted by severe weather that damage antennas, building or communication assets result in failure of the SCADA communications link that results in **loss of control of multiple zone substations**.	Business Impact	*4* *(Inability to remotely control >=2 bulk supply substations)*	*3* *(Unlikely to occur)*	***12*** ***(Moderate risk)***	2019

Further Details of the risk ratings and descriptions can be found in Energy Queensland's Network Risk Framework.

2.5 Retirement or de-rating decision

Communication Site Infrastructure is vital for ensuring the transmission of protection, SCADA and field voice services. Failure of any communications asset to perform its designed function will result in a negative impact to EQL's objectives relating to safety, service delivery, customer outcomes and legislative compliance. Without appropriate structures to house and support communications infrastructure, assets would experience accelerated ageing and deterioration due to environmental exposure and would be unable to function as intended. There is no suitable de-rating or retirement decision associated with this infrastructure due to its criticality to network operations.

3 Options Analysis

3.1 Options considered but rejected

One option was considered and rejected in this case.

Counterfactual BAU – Do Nothing

Failure to replace the buildings and structures would result in deterioration of the infrastructure's condition resulting in unacceptable risk to the communication network and increase the risk to staff, contractors and the community. The business will possibly fail to reach the safety objective goals.

The cost of replacing assets following failure is anticipated to be higher than if replacement or refurbishment is conducted while the asset remains in service.

The network (business) risk the organisation would be exposed to if the project was not undertaken is not deemed to be as low as reasonably practicable (ALARP).

3.2 Identified options

3.2.1 Network options

Option One – Accelerated Program

Under this option, the identified 16 sites requiring replacement or refurbishment would be remediated as soon as possible. This proposal is not considered prudent as it unnecessarily brings forward expenditure and is potentially less cost efficient as bundling of replacements or rectification work based on geographical sites may not be complete.

Option Two – Risk Based Rolling Program (Recommended)

Under this option the replacement or refurbishment of 16 sites is proposed based on risk-based replacement drivers. This allows for an ongoing focus on cost efficient and prudent replacement of assets based on risk assessments that include condition assessment and criticality of the specific services. The replacement of buildings and structures where feasible will be bundled with other work at the specific site locations.

Option Three – Risk Based Rolling Program with Maximum Risk

Under this option the replacement and refurbishment program is deferred as long as possible taking significantly more risk in regard to site failure and safety hazards at the sites.

This approach is not recommended as it is likely to result in significantly higher replacement costs than the recommended planned proactive risk based rolling program, should failures occur. An additional cost premium of 20% has been added to the replacements in the later years to take into account the likelihood of asset failures driving unscheduled emergency replacement activities. This approach imposes greater risk on staff, contractors and the community from failing infrastructure and network outages and the business will possibly fail to reach the safety objective goals.

3.2.2 Non-network options

No viable non-network options were identified as part of this business case.

3.3 Economic analysis of identified options

3.3.1 Cost versus benefit assessment of each option

The Net Present Value (NPV) of each option has been determined by considering costs and benefits over the program lifetime from FY2019/20 to FY2049/50, using the EQL standard NPV analysis tool. The following costs and benefits have been considered for each option.

Capital Costs

Capital costs (CAPEX) associated with each option have been defined as the labour and material costs required to replace services and assets at each site.

The scope of work was costed based on internal asset risk replacement drivers including:

- Building Replacement or Refurbishment: costs and resources required for construction or rectification work of the buildings and migration of equipment are well established. These activities have been ongoing over the last 8 years.
- Structure Replacement: costs and resources required for the installation of a structure and migration of services are well established. These activities have been ongoing over the last 8 years.

Assumptions relating to the assets include:

- The condition of the site infrastructure does not experience an accelerated failure rate.
- Asset condition assessed from site maintenance is based on the same criteria and acceptable standard across all field groups.
- The replacement infrastructure meets the expected life forecasted.
- No delay or extended delivery times greater than 3 months.

Option 1: Accelerated

The Accelerated option assumes building and structure replacements are conducted as soon as possible given resource availability. For this analysis projects are completed by FY2021.

Table 4: Cost Summary Option 1

FY	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Program							
Buildings	9	6					15
Structures		1					1
Cost Summary							
Labour	$132,747	$221,749	$0	$0	$0	$0	$354,496
Material	$543,904	$1,502,256	$0	$0	$0	$0	$2,046,160
Total:	**$676,651**	**$1,724,005**	**$0**	**$0**	**$0**	**$0**	**$2,400,656**

The Accelerated option is the lowest risk as infrastructure is replaced as soon as possible, reducing risk of infrastructure failure. However, this is not the most cost-effective option as it replaces or replenishes infrastructure prior to the useful end-of-life and is not considered the most prudent option. The accelerated expenditure results in this option presenting a lower NPV (higher project cost) than Option 2.

Option 2: Risk Based Rolling Program (Recommended)

The Risk Based Rolling option applies a staggered approach whereby assets and infrastructure are replaced or replenished at the end of their useful life but prior to their expected failure such that operational risk is minimised. Planned expenditures are outlined below. Large expenditures are expected in FY23 due to the planned structural upgrades of Mount Mackay.

This program has an ongoing requirement to maintain critical operational and supervisory services to meet external and internal driven requirements. The replacement of buildings and structures will be prioritised based on risk. Material and labour costs are to be rolled out evenly across the five-year period, with the higher priced Mount Mackay structure replacement expected in FY2022/23.

Table 5: Cost Summary Option 2

FY	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Program							
Buildings	0	3	3	3	3	3	15
Structures	0	0	0	1	0	0	1
Cost Summary							
Labour	$0	$44,249	$44,249	$177,476	$44,249	$44,249	$354,472
Material	$0	$271,952	$271,952	$958,203	$271,952	$271,952	$2,046,011
Total:	**$0**	**$316,201**	**$316,201**	**$1,135,679**	**$316,201**	**$316,201**	**$2,400,483**

The Risk Based Rolling option provides a more prudent investment compared to option 1 in that it allows assets to be utilised until the end of their useful life. Risks of asset or infrastructure failure are managed through the measured replacement of assets prior to their anticipated failure. This allows the business to maintain adherence to safety requirements.

Option 3: Risk Based Rolling Program with Maximum Risk

The third option assumes assets and infrastructure will mostly be replaced only following its failure. For this example, expenditure is assumed at delayed times compared to Option Two, following initial works completed in FY2020/21. Failures are initially anticipated within the next twelve months, following which the timing of asset failures is more uncertain. For the purpose of developing a cost comparison, it is estimated failures will continue from FY2022/23 onwards, with the Mount Mackay failure estimated in FY2024/25. These estimates are tested in a sensitivity analysis in the next section.

A cost multiplier of 1.2 has been applied to the base costs, to provide a more representative estimate of the cost increases expected when replacement and refurbishment occurs after asset failure. Higher costs are incurred due to increased delays in replacement, expected increases in damage caused by asset failure, and increased labour costs due to contractor movements on short notice.

Table 6: Cost Summary Option 3

FY	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Program							
Buildings	0	3	0	3	6	3	15
Structures	0	0	0	0	0	1	1
Cost Summary							
Labour	$0	$53,099	$0	$53,099	$106,198	$213,000	$425,396

FY	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Material	$0	$326,342	$0	$326,342	$652,685	$1,150,022	$2,455,391
Total:	**$0**	**$379,441**	**$0**	**$379,441**	**$758,882**	**$1,163,022**	**$2,680,786**

Due to the increased costs incurred as a result of waiting for equipment failure, this is the highest cost option. This option is also the highest risk and would lead to the business likely failing to meet its safety obligations following infrastructure and asset failure.

Results

The NPV of each option is summarised below in Table 7. Regulated Real Pre-Tax Weighted Average Cost of Capital (WACC) rate of 2.62% has been applied as the discount rate for this analysis (as per EQL's Standard NPV Tool). Option 2 is preferred, as it has the least negative NPV result of the three options evaluated.

Table 7: Net present value of options, expressed as $'000s

Option	Option Name	Rank	NPV ($'000s)
1	Accelerated	2	-2,303
2	Risk Based Rolling Program	1	-2,180
3	Risk Based Rolling Program with Maximum Risk	3	-2,603

3.4 Scenario Analysis

3.4.1 Sensitivities

To provide a more robust cost estimation the timing of works was varied to determine the level of sensitivity to project costs. Project costs were estimated given work was performed one year prior and one year following the estimates presented in Option 3. The results are summarised in the table below.

Table 8: Net present value of sensitivity analysis, expressed as $'000s

Option Name	Rank	NPV ($'000s)
Accelerated	2	-2,303
Risk Based Rolling Program (Option 2 – recommended)	1	-2,180
Risk Based Rolling Program with Maximum Risk	4	-2,603
Risk Based Rolling Program with Maximum Risk -1year	5	-2,671
Risk Based Rolling Program with Maximum Risk +1year	3	-2,515

If failure occurs earlier than presented in the base Option 3 case, the project NPV experiences a slight increase, and vice versa, delays in expenditure lead to a slight decrease in project NPV. This is as expected. The project NPV of delayed works remains higher than the recommended Option 2. This is due to the cost multiplier in place to represent additional costs incurred when assets are replaced after their failure rather than proactively. The sensitivity shows the cost multiplier has a higher impact on project NPV than the relative timing of works. Therefore, the ability to replace assets prior to their failure provides the best option for cost savings for the business.

3.4.2 Value of regret analysis

In this case the proposed option represents a risk- based replacement approach that limits premature capital investment while managing risks of failures. The sensitivity analysis demonstrates that this option is robust to a change of assumptions and remains the preferred option under the scenarios tested. This is a low regret option given the optimal timing of investment.

3.5 Qualitative comparison of identified options

3.5.1 Advantages and disadvantages of each option

Table 9 below details the advantages and disadvantages of each option considered.

Table 9: Assessment of options

Options	Advantages	Disadvantages
Option 1 – Accelerated Program	• Risk of equipment failure significantly reduced	• Unnecessary acceleration of costs leading to poor cost efficiency • Does not maximise useful life of assets
Option 2 – Risk Based Rolling Program (Recommended)	• Risk to reduced ALARP • Cost efficient	• Some existing risk exposure in early years of program
Option 3 – Risk Based Rolling Program with Maximum Risk	• Low upfront capital cost • Maximises useful life of assets	• Risk exposure remains for non-core critical sites until reactive work completed • Poor cost efficiency as works needed not able to be allocated efficiently • Emergency or reactive works upon asset failure incur emergency premium costs
Option 4 – Do Zero	• No upfront capital cost	• Unacceptable risk exposure for all sites • Poor cost efficiency

The network (business) risk the organisation would be exposed to if the project was not undertaken is not deemed to be as low as reasonably practicable (ALARP). Addressing the risks as detailed above through implementation of the preferred option 2 will reduce Ergon Energy's risk exposure.

The work will be prioritised and organised into bundles with other work to reduce overall program costs. The risk exposure is greater than option 1 as unidentified issues relating to buildings and infrastructure could lead to network outages, however, this will be actively managed to ensure the loss of critical services is minimised for operational sites. The adoption of higher risks (options 3 and 4) expose the business to unsatisfactory risks as an outage must occur on the network before rectification work is undertaken to resolve the underlying issues. In addition, due to their reactive nature, these options are more expensive than the recommended option 2.

3.5.2 Alignment with network development plan

The preferred option aligns with the Asset Management Objectives in the Distribution Annual Planning Report. In particular it manages risks, performance standards and asset investment to deliver balanced commercial outcomes.

3.5.3 Alignment with future technology strategy

This program of work contributes to Energy Queensland's transition to an Intelligent Grid by supporting the reliable and correct functioning of communications infrastructure, in line with the Future Grid Roadmap and Intelligent Grid Technology Plan. The preferred option supports Energy Queensland in maintaining affordability of the network while also maintaining safety, security and reliability, a key goal of the Roadmap. It represents prudent application of asset management and investment decision-making to support optimal customer outcomes and value across short, medium and long-term horizons.

3.5.4 Risk Assessment Following Implementation of Proposed Option

The network business risk the organisation would be exposed to if the project was not undertaken is illustrated in the Table 10.

Table 10: Risk assessment showing risks mitigated following implementation

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
Building or infrastructure integrity compromised resulting in **significant impact on restoration or planned works >$500,000**.	Business Impact	(Original) 3 *(Significant impact on restoration of planned works equating to business impact >$500,000)* (Mitigated) 3 *(As above)*	3 *(Unlikely)* 1 *(Almost no likelihood)*	**9** ***(Low risk)*** **3** ***(Very low risk)***	2019 2021
Building or infrastructure integrity compromised resulting in **significant interruption with time to restore to normal operations > 1 Day**.	Customer Impact	*(Original)* *4* *(15,000 customers for >3 days)* (Mitigated) 4 *(As above)*	*3* *(Unlikely)* 1 *(Almost no likelihood)*	***12*** ***(Moderate risk)*** **4** ***(Very low risk)***	2019 2021
Building or infrastructure impacted by severe weather that damage antennas, building or communication assets result in **the inability to remotely control the network or provide communications** to customers or workers.	Business Impact	(Original) 3 *(Compliance breach with Energex/ Ergon policies or external standards)* (Mitigated) 3 *(As above)*	3 *(Unlikely)* 2 *(Very unlikely)*	**9** ***(Low risk)*** **6** ***(Low risk)***	2019 2021
Building or infrastructure integrity compromised resulting in risk to worker's safety through **multiple serious injuries**.	Safety Impact	(Original) 4 *(Single serious injury/ illness)* (Mitigated) 4 *(As above)*	2 *(Very unlikely)* 1 *(Almost no likelihood)*	**8** ***(Low risk)*** **4** ***(Very low risk)***	2019 2021

Risk Scenario	Risk Type	Consequence (C)	Likelihood (L)	Risk Score	Risk Year
National Electricity Rules (NER) require duplicated communication paths for protection services. They are at risk should assets fail and there are no like-for-like replacement assets, leading to an **improvement notice issued by the regulator**.	Legislative Impact	*(Original)* *4* *(Energex/Ergon identified issue requiring regulator to be notified. Improvement notice issued)* (Mitigated) 4 *(As above)*	*3* *(Unlikely)* 1 *(Almost no likelihood)*	***12*** ***(Moderate risk)*** **4** ***(Very low risk)***	2019 2021
Building or infrastructure impacted by severe weather that damages antennas, building or communication assets resulting in an inability to communicate with field crews via field mobile radios **impacting on restoration and planned works**.	Business Impact	*(Original)* *3* *(Compliance breach with Energex/ Ergon policies or external standards)* (Mitigated) 3 *(As above)*	*3* *(Unlikely)* 1 *(Almost no likelihood)*	***9*** ***(Low risk)*** **3** ***(Very low risk)***	2019 2021
Building or infrastructure impacted by severe weather that damage antennas, building or communication assets result in failure of the SCADA communications link that results in **loss of control of multiple zone substations**.	Business Impact	*(Original)* *4* *(Release of non-public/ sensitive information)* (Mitigated) 4 *(As above)*	*3* *(Unlikely)* 1 *(Almost no likelihood)*	***12*** ***(Moderate risk)*** **4** ***(Very low risk)***	2019 2021

4 Recommendation

4.1 Preferred option

Option 2 provides the best option to allow for assets and infrastructure to reach the end of their useful life and optimise utilisation, delaying required expenditure. Ensuring these upgrades occur prior to unit failure reduces risk and allows the business to maintain its safety obligations.

4.2 Scope of preferred option

Option Two: Risk Based Rolling Program

Assets identified in need of replacement or refurbishment will have works completed on a rolling basis and prioritised based on risk. The replacement of buildings and structures where feasible will be bundled with other work at the specific site locations. The work includes two core activities:

- **Building Replacement or Refurbishment:** It is expected that the building may be replaced or reconditioned to an acceptable standard.
- **Structure Replacement:** The wooden structures at Mount Mackay have been assessed to be at the end of their serviceable life.

The table below summarises project scope and activities:

Table 11: Delivery timeframe and associated costs of program rollout

Program Description	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Building Replacement / Rectification	0	3	3	3	3	3	15
Structure Replacement	0	0	0	1	0	0	1
TOTAL	0	3	3	4	3	3	16
Costs							
Labour	$0	$44,249	$44,249	$177,476	$44,249	$44,249	$354,496
Material	$0	$271,952	$271,952	$958,203	$271,952	$271,952	$2,046,160
TOTAL	**$0**	**$316,201**	**$316,201**	**$1,135,679**	**$316,201**	**$316,201**	**$2,400,656**

Costs in $18/19 direct dollars

Appendix A. References

Note: Documents which were included in Energy Queensland's original regulatory submission to the AER in January 2019 have their submission reference number shown in square brackets, e.g. Energy Queensland, *Corporate Strategy [1.001], (31 January 2019).*

Energex, *Distribution Annual Planning Report (2018-19 to 2022-23) [7.050]*, (21 December 2018).

Energy Queensland, *Asset Management Overview, Risk and Optimisation Strategy [7.025]*, (31 January 2019).

Energy Queensland, *Asset Management Plan, Telecommunications [7.043]*, (31 January 2019).

Energy Queensland, *Corporate Strategy [1.001],* (31 January 2019).

Energy Queensland, *Future Grid Roadmap [7.054],* (31 January 2019).

Energy Queensland, *Intelligent Grid Technology Plan [7.056],* (31 January 2019).

Energy Queensland, *Network Risk Framework*, (October 2018).

Ergon Energy, *Distribution Annual Planning Report (2018-19 to 2022-23) [7.049]*, (21 December 2018).

Appendix B. Acronyms and Abbreviations

The following abbreviations and acronyms appear in this business case.

Abbreviation or acronym	Definition
$, nominal	These are nominal dollars of the day
$ real 2019-20	These are dollar terms as at 30 June 2020
2020-25 regulatory control period	The regulatory control period commencing 1 July 2020 and ending 30 Jun 2025
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ALARP	As Low As Reasonably Practical
AMP	Asset Management Plan
Augex	Augmentation capital expenditure
BAU	Business As Usual
CAPEX	Capital expenditure
DAPR	Distribution Annual Planning Report
EQL	Energy Queensland Ltd
IP	Internet Protocol
IT	Information Technology
KRA	Key Result Areas
MSS	Minimum Service Standard
NEM	National Electricity Market
NER	National Electricity Rules (or Rules)
Next regulatory control period or forecast period	The regulatory control period commencing 1 July 2020 and ending 30 Jun 2025
NNA	Non-network alternatives
NPV	Net Present Value
OPEX	Operating and Maintenance Expenditure
PCBU	Person in Control of a Business or Undertaking
POE	Probability of exceedance
Previous regulatory control period or previous period	Regulatory control period 1 July 2010 to 30 June 2015
Repex	Replacement capital expenditure
RIN	Regulatory Information Notice
RTS	Return to Service
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAMP	Strategic Asset Management Plan

Abbreviation or acronym	Definition
SCADA	Supervisory Control and Data Acquisition
SFAIRP	So Far As Is Reasonably Practicable
WACC	Weighted average cost of capital

Appendix C. Alignment with the National Electricity Rules (NER)

The table below details the alignment of this proposal with the NER capital expenditure requirements as set out in Clause 6.5.7 of the NER.

Table 12: Alignment with NER

Capital Expenditure Requirements	Rationale
6.5.7 (a) (2) The forecast capital expenditure is required in order to **comply with all applicable regulatory obligations or requirements** associated with the provision of standard control services	As indicated in *Table 2: Compliance obligations related to this proposal*, this proposal ensures that safety obligations, reliability obligations and protection requirements are met by providing an appropriate, economically efficient program of works to ensure that the deterioration of buildings and structures within the Ergon Energy network is addressed appropriately. Without this program, these obligations would be at risk of being breached.
6.5.7 (a) (3) The forecast capital expenditure is required in order to: (iii) maintain the **quality, reliability and security of supply** of supply of standard control services (iv) maintain the **reliability and security of the distribution system** through the supply of standard control services	This program of work addresses the deterioration of buildings and structures within the Ergon Energy network, which support key telecommunications infrastructure assets that are necessary for the safe and efficient function of the distribution network. The correct functioning and good condition of these assets is also necessary to ensure that standard substation activities and restoration works can be carried out in a safe and efficient manner by network staff. This program is necessary to ensure that key communications functionality and by extension the reliability and security of the distribution system is not lost due to asset failure.
6.5.7 (a) (4) The forecast capital expenditure is required in order to maintain the **safety of the distribution system** through the supply of standard control services.	This program ensures that key telecommunications services such as SCADA and protection services supported by structures and buildings within the Ergon Energy network function correctly and are not impeded by failure or deterioration of these structures. Structures and buildings also support field mobile voice services, ensuring that field staff have access to reliable voice communication services to carry out restoration and emergency works in an efficient and safe manner, ensuring that restoration works are not unnecessarily extended impacting on customer safety.
6.5.7 (c) (1) (i) The forecast capital expenditure reasonably reflects the **efficient costs** of achieving the capital expenditure objectives	The options considered in this proposal take into account the need for efficiency in delivery and use historical programs of work as a basis for cost estimates. The preferred option presents a balanced approach to cost and risk. 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. 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 forecast capital expenditure reasonably reflects a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objective	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 submission).

Appendix D. Mapping of Asset Management Objectives to Corporate Plan

This proposal has been developed in accordance with our Strategic Asset Management Plan. Our Strategic Asset Management Plan (SAMP) sets out how we apply the principles of Asset Management stated in our Asset Management Policy to achieve our Strategic Objectives.

Table 1: "Asset Function and Strategic Alignment" in Section 1.4 details how this proposal contributes to the Asset Management Objectives.

The Table below provides the linkage of the Asset Management Objectives to the Strategic Objectives as set out in our Corporate Plan (Supporting document 1.001 to our Regulatory Proposal as submitted in January 2019).

Table 13: Alignment of Corporate and Asset Management objectives

Asset Management Objectives	Mapping to Corporate Plan Strategic Objectives
Ensure network safety for staff contractors and the community	**EFFICIENCY** ***Operate safely as an efficient and effective organisation*** Continue to build a strong safety culture across the business and empower and develop our people while delivering safe, reliable and efficient operations.
Meet customer and stakeholder expectations	**COMMUNITY AND CUSTOMERS** ***Be Community and customer focused*** Maintain and deepen our communities' trust by delivering on our promises, keeping the lights on and delivering an exceptional customer experience every time
Manage risk, performance standards and asset investments to deliver balanced commercial outcomes	**GROWTH** ***Strengthen and grow from our core*** Leverage our portfolio business, strive for continuous improvement and work together to shape energy use and improve the utilisation of our assets.
Develop Asset Management capability & align practices to the global standard (ISO55000)	**EFFICIENCY** ***Operate safely as an efficient and effective organisation*** Continue to build a strong safety culture across the business and empower and develop our people while delivering safe, reliable and efficient operations.
Modernise the network and facilitate access to innovative energy technologies	**INNOVATION** ***Create value through innovation*** Be bold and creative, willing to try new ways of working and deliver new energy services that fulfil the unique needs of our communities and customers.

Appendix E. Risk Tolerability Table

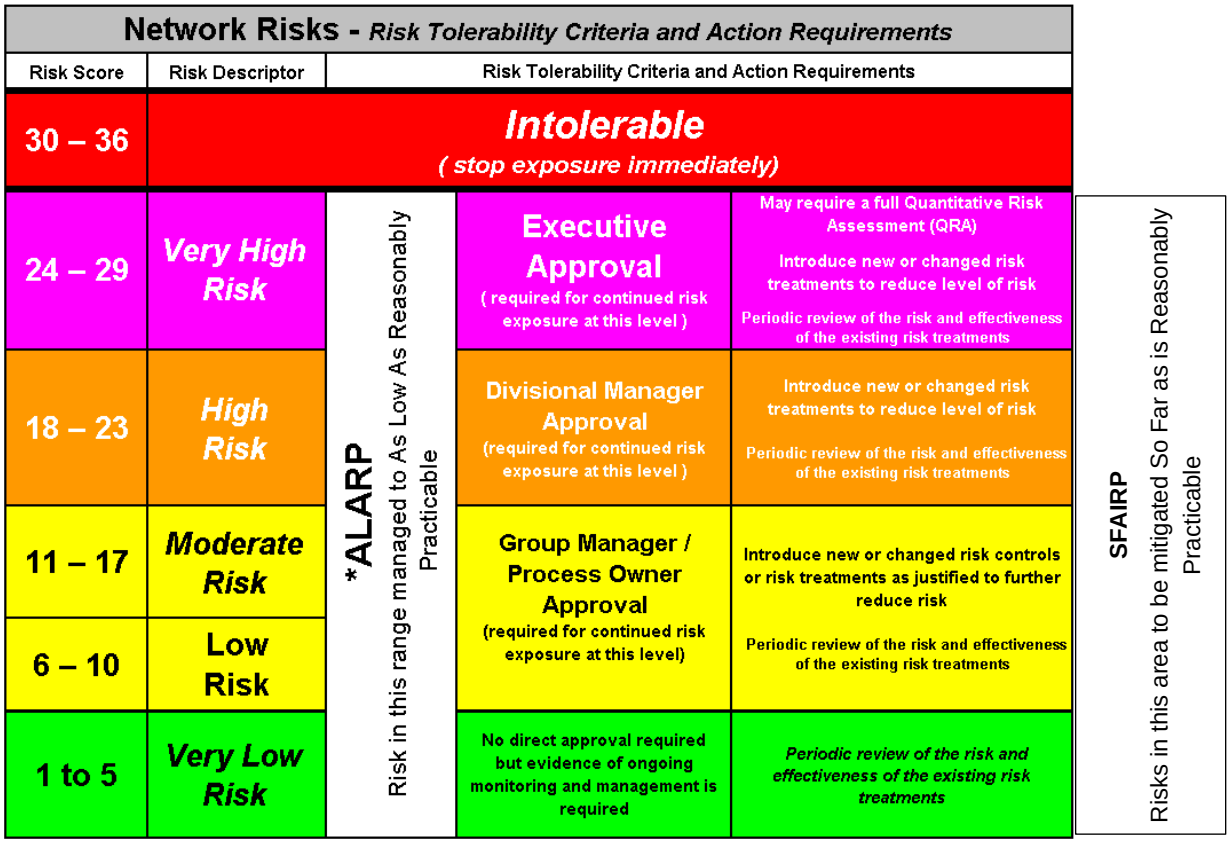

Figure 1: A Risk Tolerability Scale for evaluating Semi-Quantitative risk score

Appendix F. Reconciliation Table

Reconciliation Table Conversion from $18/19 to $2020	
Business Case Value	
(M$18/19)	$2.40
Business Case Value	
(M$2020)	$2.49