Clearance to Ground & Structure Program

Business Case

17 January 2024

ERGON ENERGY NETWORK
Part of Energy Queensland

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DOCUMENT VERSION

Version Number	Change Detail	Date	Updated by
1	Initial Draft	5/7/2023	Manager Line Standards and Ratings
2	Final	13/12/2023	Manager Line Standards and Ratings
3	Approved	13/12/2023	General Manager Asset Standards

RELATED DOCUMENTS

- Attachment – Strategic Asset Management Plan (SAMP)
- Attachment – Asset Management Plan Overhead Conductor
- Electrical Safety Regulation 2013, https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2013-0213

1. SUMMARY

<table>
<tr><th>Title</th><th>Clearance to Ground & Structure Program</th></tr>
<tr><td>DNSP</td><td>Ergon Energy Network</td></tr>
<tr><td>Expenditure category</td><td>☐ Replacement ☒ Augmentation ☐ Connections ☐ Tools and Equipment
☐ ICT ☐ Property ☐ Fleet</td></tr>
<tr><td>Identified need
(select all applicable)</td><td>☒ Legislation ☒ Regulatory compliance
☐ Reliability ☐ CECV ☒ Safety ☐ Environment ☐ Financial
☐ Other
Ergon Energy has a legislative obligation to maintain minimum electrical clearances of its overhead conductors to ground (CTG) and to structure (CTS) to ensure public safety. This business case sets out the options to meet the obligations and evaluates the costs and risks.</td></tr>
<tr><td>Summary of preferred option</td><td>The preferred option is to remediate 12,270 defects across the Ergon Energy network over the 2025-2030 regulatory control period.</td></tr>
<tr><td>Expenditure</td><td>A total of 11,139 CTG and 1,131 CTS defects are forecast to be remediated over the 2025-2030 regulatory control period at a unit rate of $12,530 and $15,307 respectively. Total cost of $156.9 million in 2022-23 $ is required over the 5 years.
<table>
<tr><th>Year</th><th>2025-26</th><th>2026-27</th><th>2027-28</th><th>2028-29</th><th>2029-30</th><th>Total</th></tr>
<tr><td>$m, direct 22-23</td><td>32.6</td><td>31.1</td><td>31.3</td><td>29.7</td><td>32.2</td><td>156.9</td></tr>
</table></td></tr>
<tr><td>Benefits</td><td>Benefits – implementation of the preferred option will ensure that Ergon Energy can meet its compliance obligations and in so doing, keep customers and the community safe.</td></tr>
</table>

2. PURPOSE AND SCOPE

This document sets out the capital investment required for remediating clearance to ground (CTG) and clearance to structure (CTS) issues for overhead conductors. It compares the benefits of options to remediate the known defects, with the risks associated with unmitigated clearance problems identified through the aerial LiDAR program.

This business case has been developed for the purpose of justifying the investment required for clearance programs to be included in the Ergon Energy Network 2025-30 Regulatory Proposal to Australian Energy Regulator (AER). This investment is a key public safety component of operating a safe distribution network across regional Queensland.

This document is to be read in conjunction with Attachment 5.4.18 - Asset Management Plan Overhead Conductor, which details information on the asset class, populations, risks, asset management objectives, performance history, influencing factors, and the lifecycle strategy.

3. BACKGROUND

3.1 Asset Overview

Ergon Energy operates a vast network with a service area of 1.7 million sq. km and an overhead network consisting of over 140,000 km of overhead lines across sub-transmission, high and low voltages. This overhead line network is supported by approximately 980,000 poles installed in a variety of soil types, terrain and climate zones.

Our pole and conductor network has been built to various legacy standards, clearances and climate assumptions. The network is currently facing changing load patterns with an increasing volume of distributed generation across all voltage levels. The overhead network is required to distribute these loads safely and efficiently in an environment of increasing frequency of extreme heat events.

Mechanical, electrical, and environmental factors can combine to cause a legislative clearance breach. The physical properties of metal give rise to conductor elongation through temperature rise. This inherent property of metal, the relationship between conductor sag and conductor tension, the cyclic seasonal summer/winter, and wet/dry climate conditions all contribute to conductor sag. In addition, pole top movement from expanding and contracting soils can also cause excessive conductor sag. While there is no single factor that causes clearance breaches, all factors in isolation or in combination play a contributing factor.

There are also non-network factors associated with clearance breaches such as soil embankments or dams being built under the overhead network and sheds being constructed which encroach legislative clearances of overhead lines.

Prior to 2013, the only way to identify electrical clearance issues across the network was via a regular cycle of visual inspections and assessments performed by staff or contractors. In 2015, Ergon Energy engaged LiDAR provider Fugro, to survey the Ergon's distribution network to detect clearance breaches. In 2018, this was expanded to include Energex network.

Ergon Energy and Energex have continued the practice of utilising Light Detection and Ranging (LiDAR) technology to detect non-compliance with statutory clearances across the networks. Details of our LiDAR program are discussed further in Section 3.3 below.

3.2 Compliance Obligations

Table 11 shows the relevant compliance obligations for this proposal. Defect rectification timelines are documented in the EQL Standard for Conductor Clearance Prioritisation and Remediation. The Prioritisation Matrix is underpinned by EQL's Network Risk Assessment criteria and prioritisation based on clearance measurements at time of flight. and these measurements, along with location are used to determine the priority for remediation.

Table 1: Asset Function and Strategic Alignment

Legislative Instruments	Obligations	Relevance to this investment
QLD Electrical Safety Act 2002 **QLD Electrical Safety Regulation 2013 (Schedule 4?)**	EQL has a duty of care, ensuring so far as is reasonably practicable, the health and safety of staff and other parties as follows: • Pursuant to the Electrical Safety Act 2002: (a) as a person in control of a business or undertaking (PCBU), EQL has an obligation to ensure that its undertaking 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 (b) as an electricity entity, Ergon Energy has a duty to ensure that its works: (i) are electrically safe; (c) are operated in a way that is electrically safe[2]: (ii) This duty includes ensuring that CTG and CTS clearance requirements are complied with • Pursuant to the QLD Electrical Safety Regulation 2013 which prescribe CTG and CTS clearance requirements	This proposal is a key component in the management of safety for electricity customers. Inadequate clearances to structures or ground are in breach of the Queensland Electrical Safety Regulation 2013, Schedule 4.
Distribution Authority for Ergon Energy or Energex 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)	Fundamentally, this proposal aims to ensure that clearances are adequate and in accordance with standards. This aligns with good electricity industry practice. proposal.

This program focuses on remediating clearances in accordance with Queensland Electrical Safety Regulation 2013, Schedule 4. Emergency defect notification has become a key part of the program whereby critical clearance breaches due to asset failure can be actioned as soon as possible.

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

Ergon Energy and Energex also report quarterly to the Queensland Electrical Safety Office on the status of clearance defect remediation.

3.3 Identification of Defects

Energy Queensland Limited (EQL) has engaged LiDAR provider Fugro, to survey the entire Queensland distribution network.

LiDAR flights Cycle 1 and Cycle 2 were initially used for vegetation management to identify vegetation encroachment zones around overhead lines and direct tree trimming maintenance accordingly. Clearance defects were previously reported by field-based asset inspectors with defects rectified using the P1/P2 defect process under routine maintenance program. Since the LiDAR was directed towards managing statutory clearance defects in Cycle 3, the volume of identified defects has increased significantly and the clearance risk matrix within the EQL Standard for Conductor Clearance Prioritisation and Remediation has been adopted to prioritise the volumes based on accessibility, high risk areas and magnitude of the breach.

A LiDAR flight cycle of 3 years across the Ergon Energy and Energex distribution networks allows the highest risks to be prioritised within the flight cycle and the lowest risks that have a treatment year longer than 3 years to be periodically reviewed.

Figure 1: LiDAR Program Delivery Timeline

Figure 1 outlines the earlier and proposed cycles of clearance related LiDAR program and is summarised below.

- LiDAR was first used in Ergon Energy to survey its distribution network to identify clearance defects in 2015 (Cycle 3).
- Annual flight cycles to detect and identify clearance defects on the Ergon network were undertaken from 2015 to 2018.
- In 2018 (Cycle 6), the service was extended to include Energex network.
- In 2020, the 3-year cycle commenced to survey both Ergon Energy and Energex networks.
- A new contract for another 3-year cycle (Cycle 8) is expected to commence in February 2024.

The cycles relevant to previous, current and next regulatory control periods (2015-20, 2020-25 and 2025-30) are described below:

- At the peak of the Cycle 6 campaign, 35,972 defects were being managed from previous campaigns and Cycle 6. In Cycle 7 there were 15,650 defects raised from the LiDAR program for Ergon Energy and the downward trend is expected to continue into Cycle 8 until plateauing out at the same rate for Cycle 9.
- Cycle 7 raised 15,650 (14,376 CTG + 1,274 CTS) LiDAR clearance defect work orders which represents a 56% reduction in defect volumes from Cycle 6. The works required to remediate the 15,650 defects will span the 2020-2025 and 2025-2030 regulatory periods.

Further, 6,103 of the 15,650 defects from Cycle 7 have compliance dates that fall into the 2025-2030 regulatory control period while another 7,348 are low priority defects will be monitored and remediated opportunistically with other works. These 7,348 defects are not included in the 2025-2030 regulatory proposal.

- Cycle 8 flights will commence in the 2025 calendar year for Ergon Energy and are planned to finish by the end of the 2026 calendar year. This means that Cycle 8 remediation activities will span the 2025-2030 and 2030-2035 regulatory periods.

EQL has completed flights and processing of Cycle 7 which includes, LiDAR flights, point cloud processing and network matching, clearance defect identification and defect work order generation. Cycle 8 has been awarded and transition activities are underway. Cycle 8 has been awarded to the Cycle 7 LiDAR provider Fugro. Cycle 8 will then commence in the Energex network in February 2024 and Ergon Energy will follow with flights in the 2025 calendar year.

The table below shows the defects completed, in progress and forecast over the regulatory control periods. Note that the same defect may be represented across multiple cycles. For example, of the 15,650 defects raised in Cycle 7, there were 717 duplicates with a higher priority that were escalated meaning the Cycle 6 defect work order is left open due to possible committed resources.

Table 2: Defects Remediated by Regulatory Control Period

Cycle No	No of defects	2020-25	2025-30	2030-35	Monitor and complete with other works
Cycle 6 + carry over	35,972	3,012	242	0	1,810
Cycle 7	15,650	2,172	6,103	0	7,348
Cycle 8 (forecast)	5,669	45	4,877	747	0
Cycle 9 (forecast)	5,669	0	1,048	4,621	0

Given the overlapping flight, remediation and regulatory timeframes, the volumes are also forecast to reduce in Cycle 8 as defects are remediated and the benefits from the temperature correction algorithm are realised. In Cycle 7, temperature corrected defects represented 32% of the CTG population with 4,588 defects.

Temperature correction calculates additional sag to the line by comparing the ambient BOM temperature at time of flight to a standard temperature of 35°C. This actively identifies conductors that are calculated to breach legislative clearances on the hottest of days. While not a defect at the time of flight, these temperature corrected defects are treated as genuine defects and actioned accordingly as part of the overall clearance program.

This reduction will primarily be realised in the second half of the 2025-2030 regulatory control period where the volumes are predominantly Level 3-5 defects.

3.4 Prioritisation of Defects

Defects are categorised in the EQL Standard for Conductor Clearance Prioritisation and Remediation based on measured LiDAR conductor clearances to structures and ground while considering the severity of the regulatory breach, the location, and public accessibility to the defect. Standard rectification timeframes, defined in the Standard, are then assigned to each defects work orders. There defects levels and timeframes are as follows:

- Emergency – These defects are given the highest response priority and rectified as soon as practicable, normally the same day. EQL has processes to in place with the LiDAR vendor whereby if during point cloud processing, an Emergency defect is suspected, normal quality assurance activities are bypassed and EQL is notified immediately. EQL then validates via desktop assessment and an 'Urgent Public Hazard' fault call is made to the relevant contact centre to dispatch a field crew for assessment and treatment. Low and high voltage conductors are categorised as an Emergency if they are equal to or below 3.5m. Clearance to structure defects receive an Emergency classification depending on their voltage and structure accessibility.
- Level 1 - These defects are given a 9-month rectification timeframe. Accessible CTS defects that are less than 75% of the statutory clearance are assigned Level 1. For CTG defects, any defect below the statutory threshold and in a high-risk area such as schools, hospitals and agricultural areas are assigned Level 1. Level 1 defects also have a flag installed as a control measure and a customer safety advice is issued to nearby residents.
- Level 2 – These defects are CTS defects only and receive an 18-month rectification timeframe. This level captures the remainder of the accessible structure defects and non-accessible defects that are within 66.7% of the statutory clearance requirement. Level 2 defects also have a flag installed as a control measure and a customer safety advice is issued to nearby residents.
- Level 3 – These defects have a 3-year rectification timeframe. This level captures the remainder of the non-accessible CTS defects and sets a minimum CTG threshold of 5m for road crossing for low voltage conductors and 5.8m for high voltage conductors.
- Level 4 & 5 – These defects have 4- and 5-year rectification timeframes respectively and capture the remainder of the CTG defects over areas other than roads, non-trafficable land and road clearances up to the statutory clearance.
- Level 5 Monitor – These are level 5 defects outside high-risk areas and do not cross a minor or major road. These defects are 200mm (up to 33kV) & 400mm (66kV -132kV) from being legislative compliant at locations other than roads.

4. IDENTIFIED NEED

4.1 Requirement for compliance

The design of power lines in Energy Queensland is based on AS/NZS 7000:2016. Ergon Energy has used LiDAR data, design information, modelling and environmental data to establish which overhead assets have encroached minimum legislative clearance requirements and require rectification as per Tables 3.5 to Table 3.7 of AS/NZS 7000:2016. A dedicated clearance program to manage identified clearance defects is required to address the inherent risk of legislative clearance breaches in a coordinated way.

Clearance defects using LiDAR are tested against Electrical Safety Act 2002 and the Electrical Safety Regulations 2013, where there is no alternative option other than to rectify the clearance breach.

In this analysis, we have considered options to remediate the defects over alternative timeframes and in consideration of our resourcing capability. We have assumed that percentage of CTS defects will continue to track at 12% of CTG volumes.

Table 3: Cycle 8 Forecast Defects

Cycle 8 Forecast Defects	CTG	CTS	Total
Level 1	572	46	618
Level 2	-	457	457
Level 3	962	131	1,093
Level 4	554	-	554
Level 5	2,945	2	2,947
Total	**5,032**	**637**	**5,669**

The forecast volumes for Cycle 8 are based on a 35% reduction in CTG and a 50% reduction in CTS defects from Cycle 7. The percentage of L1 – L5 defects for Cycle 8 is based on Cycle 7 actual percentages. As the volume of defects decrease over time, a natural frequency of defects is expected to emerge. This natural frequency is expected to represent the Cycle 8 volumes and carried forward to Cycle 9 at 5,669 defects.

5. OPTIONS ANALYSIS

There is a limited range of options to address known clearance issues. Once defects have been identified there is an obligation to remediate them in a timely manner. Only one option is presented using the compliance timeframes for each defect overlayed with the flight schedule.

5.1 Option 1

This option remediates outstanding and forecast level 1-5 defects within compliance timeframes while monitoring and opportunistically rectifying the lowest priority defect 5 defects. The volume to be delivered is smoothed over the 2025-30 regulatory period.

Total cost is $156.9 million to be delivered over the 5 years.

Table 4: Cost Overview for Option 1 2022-23 $

Item	Description	2025-26	2026-27	2027-28	2028-29	2029-30
CTG	CTG Defects	2,228	2,228	2,228	2,228	2,228
	Unit Cost	$12,530	$12,530	$12,530	$12,530	$12,530
CTS	Defects	226	226	226	226	226
	Unit Costs	$15,307	$15,307	$15,307	$15,307	$15,307
Total	$ million	**$31.4**	**$31.4**	**$31.4**	**$31.4**	**$31.4**

5.2 Cost Summary

Table 5: Cost summary 2025-30

Option	2025-26	2026-27	2027-28	2028-29	2029-30	Total 2025-30
Option 1	**32.6**	**31.1**	**31.3**	**29.7**	**32.2**	**156.9**

The expenditure shown in Table 5 has been phased in the context of the overall program of work for delivery and is slightly different in each year to the smoothed expenditure shown in Table 4. The overall expenditure and clearance issues remediated across the period are the same.

5.3 Risk discussion

Given that the remediation of CTS/CTG defects is a compliance obligation under both the Electrical Safety Act 2002 and the Electrical Safety Regulations 2013, there is no alternative option other than to rectify the clearance breach. Failing to act creates a potential risk to public safety and would place Ergon and potentially its officers at risk of breach of this legislation particularly in circumstances where there has been a failure to address a known risk. A breach of the safety

legislation could result in serious consequences (including jail terms for individuals) for the organisation.

While conductors breaching legislative clearances is unacceptable, to manage overall network risk, EQL will continue to review lower risk works to ensure the management of network investments in accordance with the So Far As Is Reasonably Practicable (SFAIRP) principle.

6. RECOMMENDATION

Option 1 is the preferred option to manage legislative compliance from the LiDAR flight program.

A total of 11,139 CTG and 1,131 CTS defects are forecast to be remediated over the 2025-2030 regulatory control period at a unit rate of $12,530 and $15,307 respectively.

Total cost of $156.9 million in 2022-23$ is required over the 5 years.

APPENDIX 1: ALIGNMENT WITH THE NATIONAL ELECTRICITY RULES

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 6: 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) (2) **comply with all applicable regulatory obligations or requirements associated with the provision of standard control services;**	Pursuant to the Electrical Safety Act 2002, as a person in control of a business or undertaking (PCBU), Ergon Energy has an obligation to ensure that its works are electrically safe and are operated in a way that is electrically safe.[3] This duty also extends to ensuring the electrical safety of all persons and property likely to be affected by the electrical work.[4] This proposal addresses Ergon's key obligation in relation to ensuring that it works are electrically safe. Clearances of electricity infrastructure to external structures and to ground are key factors in managing electrical safety risks and are compliance obligations related to Queensland Electrical Safety Regulation 2013, Schedule 4.
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**	While the primary purpose of this program is the delivery of safe outcomes for customers, it does also address reliability issues associated with service failures.
6.5.7 (a) (4) **maintain the safety of the distribution system through the supply of standard control services.**	Pursuant to the Electrical Safety Act 2002, as a person in control of a business or undertaking (PCBU), Ergon Energy has an obligation to ensure that its works are electrically safe and are operated in a way that is electrically safe.[5] This duty also extends to ensuring the electrical safety of all persons and property likely to be affected by the electrical work.[6] This proposal addresses Ergon's key obligation in relation to ensuring that it works are electrically safe.

[3] Section 29, *Electrical Safety Act 2002*
[4] Section 30 *Electrical Safety Act 2002*
[5] Section 29, *Electrical Safety Act 2002*
[6] Section 30 *Electrical Safety Act 2002*

	Clearances of electricity infrastructure to external structures and to ground are key factors in managing electrical safety risks and are compliance obligations related to Queensland Electrical Safety Regulation 2013, Schedule 4.
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 consistent use of the estimation system is essential in producing an efficient CAPEX forecast by enabling: • Option analysis to determine preferred solutions to network constraints • Strategic forecasting of material, labour and contract resources to ensure deliverability • Effective management of project costs throughout the program and project lifecycle, and • Effective performance monitoring to ensure the program of work is being delivered effectively.
6.5.7 (c) (1) (ii) **the costs that a prudent operator would require to achieve the capital expenditure objectives**	Attachment Cost Comparison of Energex RIN Unit Costs to the NEM outline the efficiency of the delivery of our work in comparison to other DNSPs.

APPENDIX 2: RECONCILIATION TABLE

Table 7: Reconciliation

Expenditure	DNSP	2025-26	2026-27	2027-28	2028-29	2029-30	2025-30
Expenditure in business case $m, direct 2022-23 in AER capex model input page	Ergon	**32.6**	**31.1**	**31.3**	**29.7**	**32.2**	**156.9**

APPENDIX 3: STRATEGIC ALIGNMENT

Alignment to Energy Queensland's Strategic Framework

This investment aligns with the following Energy Queensland 'Enable' Building Blocks:

Table 8: Alignment to 'Enable' Building Blocks

'Enable' Building Blocks	How this investment contributes	Impact
1. Safety The safety of our people, customers and communities is our first priority	Clearances of electricity infrastructure to external structures and to ground are key factors in managing electrical safety risks for the public under Queensland Electrical Safety Regulation 2013, Schedule 4.	High
2. Keep the lights on We will design, build and maintain a safe and reliable electricity network	This program audits and outworks solutions to ensure the overhead network is maintained in a safe state.	Medium
3. Financial sustainability We will ensure funds spent are done so prudently and we will grow our revenue streams.	Legislative compliance is the primary driver for the Clearance program.	Low
4. People & Culture Continue to build a capable & productive workforce to ensure we deliver EQL's electric life ambition.	Communicate requirements to rectify and manage defects through deployment of Standards.	Low

Regulatory and Compliance Obligations

The proposed investment addresses the following regulatory and compliance obligations.

Table 9: Alignment to Regulatory/Compliance Obligations

Regulatory/ Compliance Obligation	How this investment contributes to compliance	Implication	Residual Risk Level
Electrical Safety Act 2002	▪ This Clearance program directly outworks compliance through adherence to electrical clearance in Electrical Safety Regulation 2013, Schedule 4.	▪ Directly managing compliance with Electrical Safety Regulation 2013 Schedule 4 ensures the requirements of the Electrical Safety Act 2002 are met.	Low