Clearance to Ground & Structure Program

Business Case

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energex
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
- 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

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<tr><td>DNSP</td><td>Energex</td></tr>
<tr><td>Expenditure category</td><td>☐ Replacement ☒ Augmentation ☐ Connections ☐ Tools and Equipment
☐ ICT ☐ Property ☐ Fleet</td></tr>
<tr><td>Identified need
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☐ Reliability ☐ CECV ☒ Safety ☐ Environment ☐ Financial
☐ Other
Energex 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 3,995 defects across the Energex network over the 2025-2030 regulatory control period.</td></tr>
<tr><td>Expenditure</td><td>A total of 3,155 CTG and 840 CTS defects are forecast to be remediated over the 2025-2030 regulatory control period at a unit rate of $12,358 and $14,059 respectively. Total cost of $50.8 million is required over the 5 years.
<table>
<tr><th>Year</th><th>2025-26</th><th>2026-27</th><th>2027-28</th><th>2028-29</th><th>2029-30</th><th>2025-30</th></tr>
<tr><td>$m, direct 2022-23</td><td>10.2</td><td>10.3</td><td>10.2</td><td>10.2</td><td>10.2</td><td>50.8</td></tr>
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</td></tr>
<tr><td>Benefits</td><td>Benefits – implementation of the preferred option will ensure that Energex can meet its compliance obligations and in so doing, keep customers and the community safe.</td></tr>
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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 Light Detection and Ranging (LiDAR) program.

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

This document is to be read in conjunction with the 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

Energex operates the Southeast Queensland distribution network consisting of 1.6 million customers supplied by an overhead network consisting of 35,000 km of overhead lines across sub-transmission, high and low voltages. This overhead line network is supported by approximately 700,000 poles installed in a variety of soil types and terrain.

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 2018, 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 2018, Energex commenced using LiDAR technology with provider Fugro, to survey the Energex distribution network to detect clearance breaches. This was on the back of an already mature program with Ergon Energy.

Ergon Energy and Energex has continued the practice of utilising LiDAR technology to detect non-compliance with statutory clearances across the networks. Details of the LiDAR program are discussed further in Section 3.3 below.

3.2 Compliance Obligations

Table 1 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, Energex 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.

ROAMES was developed within Ergon Energy and operated on the timeline shown in Figure 1 below. The Energex network was first flown in 2018 parallel with Ergon Energy's Cycle 6. The naming convention adopted for Energex's first flight program was Cycle 1 then aligned to the Cycle 7 naming convention in 2020. Hence the first two Energex flight cycles will be referred to as Cycle 1 and Cycle 7 from this point forward.

Since the introduction of LiDAR into the Energex network, 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. With Cycle 7 now complete, a new contract for another 3-year flight cycle (Cycle 8) is expected to commence in Feb 2024.

Figure 1: LiDAR Program Delivery Timeline

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

- Energex Cycle 1 commenced in Feb 2018 where 26,000 clearance defects were raised. Cycle 7 then commenced in July 2020 where 8,130 defect were raised and the downward trend is expected to continue into Cycle 8. As defects are remediated, a baseline level of defects are expected from each 3-year LiDAR flight cycle. The baseline is expected to be achieved in Cycle 8 and plateau out to the same rate in Cycle 9.
- Cycle 7 raised 8,130 (6,657 CTG + 1,473 CTS) LiDAR clearance defect work orders which represents a 69% reduction in defect volumes from Cycle 1. This reduction is due to the first sweep of Cycle 1 capturing all long standing defects, then Cycle 7 capturing the changes. The works required to remediate the 8,130 defects will span the 2020-2025 and 2025-2030 regulatory periods.

Further, 1,311 defects from Cycle 7 have compliance dates that fall into the 2025-2030 regulatory control period while another 2,065 are low priority defects will be monitored and remediated opportunistically with other works. These 2,065 defects are not included in the 2025-2030 regulatory proposal.

- Cycle 8 flights for Energex will start and commence in the 2024 calendar year. This means that Cycle 8 remediation activities will span the 2020-2025 and 2025-2030 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.

Table 2 below shows the defects completed, in progress and forecast over the regulatory control periods.

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 1	26,005*	5	0	0	0
Cycle 7	8,130	4,765	1,311	0	2,065
Cycle 8 (forecast)	2,425	224	2,201	0	0
Cycle 9 (forecast)	2,425	0	483	1,942	0

* From the 26,005 clearance defects identified in Cycle 1, 9,239 defects were assessed as 'No Defect Found.' This was prior to temperature compensation being introduced.

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.

Temperature correction calculates additional sag of 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. Energex 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 24% of clearance defect volumes which is double the percentage of the Ergon Energy network at 12% by volume. The result is not unexpected given the differences in density between the two networks.

Table 3: Cycle 8 Forecast Defects

Cycle 8 Forecast Defects	**CTG**	**CTS**	**Total**
Level 1	196	29	224
Level 2	-	259	259
Level 3	369	283	652
Level 4	332	-	332
Level 5	947	12	959
Total	**1,844**	**582**	**2,426**

The forecast volumes for Cycle 8 are based on a 30% 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 2,426 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 $50.8 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	631	631	631	631	631
	Unit Cost	$12,358	$12,358	$12,358	$12,358	$12,358
CTS	Defects	168	168	168	168	168
	Unit Costs	$14,059	$14,059	$14,059	$14,059	$14,059
Total	$ million	**10.2**	**10.3**	**10.2**	**10.2**	**10.2**

5.2 Cost Summary

Table 5: Cost summary 2025-30, 2022/23 $m

Option	2025-26	2026-27	2027-28	2028-29	2029-30	Total 2025-30
Option 1	10.2	10.3	10.2	10.2	10.2	**50.8**

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 Energex 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 3,155 CTG and 840 CTS defects are forecast to be remediated over the 2025-2030 regulatory control period at a unit rate of $12,358 and $14,059 respectively.

Total cost of $50.8 million in 2022-23$ 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), Energex 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 Energex' 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), Energex 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 Energex's key obligation in relation to ensuring

[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*

NER capital expenditure objectives	Rationale
	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.
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 5.2.10 – 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	Energex	10.2	10.3	10.2	10.2	10.2	**50.8**

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