A response to the Review of Queensland's *Electrical Safety Act 2002* – key definitions and emerging technologies

Decision Paper

December 2023

Electrical Safety Office
electricalsafety.qld.gov.au

Queensland Government

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1 About this Decision Paper

The purpose of this Decision Paper is to put forward recommended options in response to the three topics explored in the Discussion Paper responding to the Review of Queensland's *Electrical Safety Act 2002* (the Review).

This Decision Paper presents the results of public consultation on the Discussion Paper, released on 16 May 2023. The paper also assesses the costs and benefits of the options proposed, putting forward a recommended option for each topic which has been identified through analysis as providing the greatest net benefit to Queensland.

This Decision Paper has been prepared in line with the Queensland Government Better Regulation Policy.

KPMG was engaged by the Office of Industrial Relations (OIR) to provide support with the preparation of thematic analysis on the stakeholder feedback received in response to the Discussion Paper and to assist OIR with the preparation of this Decision Paper.

2 Executive Summary

2.1 Overview

In 2021, Independent Reviewer Mr Dick Williams delivered the Final Report of the *2021 Review of Queensland's Electrical Safety Act 2002* (the Review).[1] The Final Report made 83 recommendations spanning across the electrical safety framework (ES Framework). Many of the recommendations aimed at ensuring that Queensland's framework remains fit for purpose in the wake of significant technological advancements.

To respond to key recommendations from the Final Report, on 16 May 2023, the Office of Industrial Relations (OIR) released the Discussion Paper - *A response to the Review of Queensland's Electrical Safety Act 2002 – key definitions and emerging technologies.*[2] The Discussion Paper explored three topics (see Table 1) and sought feedback on 7 recommendations in full and 3 in part from the Final Report.

Table 1: Discussion Paper Topics

Topic 1	Topic 2	Topic 3
Electrical safety considerations of new and emerging technologies	Changing landscape of electricity and workforce 1. locating, mounting and fixing of energy generation and storage technology 2. laying, cutting or sealing underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source. 3. mechanical cable protection	Electrical safety and electric vehicles
Recommendations: 1, 4, 13, 74c	Recommendations: 5, 6, 7, 17a, 17c	Recommendations: 2, 8, 74c

The Discussion Paper outlined problem identification and proposed several options to address the identified issues in line with achieving several government objectives. In response to the Discussion Paper, OIR was provided written submissions from a range of stakeholders who voiced their opinion relating to posed questions and a set of proposed options under three broader topics.

Findings from the written submissions have been used to strengthen the analysis of the identified issues and have supported the recommended options found in this paper. This Decision Paper also informs next steps in the policy development process and provides an informed and transparent basis for government decision making.

[1] 2021 Review of Queensland's Electrical Safety Act 2002. Source: https://www.oir.qld.gov.au/system/files/2023-05/ea-act-2002-review-final-report.pdf. Last viewed 23 October 2023.

[2] Discussion Paper: A response to the Review of Queensland's Electrical Safety Act 2002 – key definitions and emerging technologies. Source: https://www.oir.qld.gov.au/sites/default/files/2023/documents/es-act-review-discussion-paper_1.pdf. Last viewed 23 October 2023.

2.2 Findings from the Discussion Paper

Consultation on regulatory proposals

Problem identification and preferred options were canvassed in the Discussion Paper, released by government for public comment. Consultation was open for a period of six weeks, from 16 May 2023 to 27 June 2023. Late submissions were accepted.

OIR recognises that some recommendations contained within the Review proposed to capture industries and types of work not previously regulated under the electrical frameworks. The consultation period for the Discussion Paper provided an opportunity for those affected to provide feedback on the problem identification and options proposed.

A total of 78 responses were received from:

- Individuals (e.g., members of the public, workers, electrical licence holders, electrical contractors)
- Persons conducting a business or undertaking (PCBUs)
- Electrical contractors
- Government Departments, Regulators, Statutory Agencies or Authorities
- Peak bodies
- Prescribed electricity entities
- Non-prescribed electricity entities
- Unions
- Committees
- Skills and training organisations
- Advocacy groups
- Metering services.

A list of those who responded to the Discussion Paper is provided for at Appendix A3, with submissions available on OIR's website where consent was provided.[3]

Analysis of options

As noted previously, a consultation process was undertaken to ensure stakeholder input was provided on emerging technologies and the key definitions provided in the *Electrical Safety Act 2002* (the Act). The consultation process was tailored to assist the Queensland Government in developing an approach to modernising the Act, capturing key insights in relation to the topic areas. Consultation was specifically engineered to elicit information from respondents about their own data or anecdotal evidence for observations and themes. Broadly speaking, stakeholder input regarding Topic 1 supported the problem identification process and the overall option structure presented within the Discussion Paper. On the other hand, input regarding Topics 2 and 3 was more critical of the theory behind the problem identification and therefore, also the options presented. The key concerns raised regarding Topics 2 and 3 include:

- **Topic 2:** Stakeholders suggested that the definition of 'electrical work' would benefit from a more wholistic review to consider additional issues which were not evaluated within the Discussion Paper. Additionally, consultation indicated that the proposed legislative changes lacked both

[3] Source: https://www.oir.qld.gov.au/public-consultation/electrical-safety-act-2002-review.

clarity and commercial viability. Stakeholders also highlighted the lack of evidence regarding serious electrical incidents (SEI) identified within the Discussion Paper.

- **Topic 3:** Consultation suggested that existing efforts to transition from traditional internal combustion engine vehicles to electric vehicles (EVs) are in line with other jurisdictions in Australia. Stakeholders also highlighted the successful development and rollout of training specific personnel to work on EVs and noted EV work is suited to the skillset of automotive technicians as opposed to electricians. Submissions drew on an absence of incidents in Queensland when completing work on EVs and raised significant concerns regarding workforce disruption.

Preferred options for each topic

Table 2, Table 3 and Table 4, summarise the identified sentiment in the written submissions of different stakeholder groups for each option under the three topics. The following summary of sentiment captures only an overarching position. It should be noted that some stakeholders provided input on the options but did not nominate a preferred option – these submissions have also been captured within the tables.

Table 2: Topic 1, stakeholder sentiment

Topic 1- Electrical safety considerations of new and emerging technologies			
Option 1 – Status Quo	**Option 2 - Legislative change**	**Option 3 – Awareness and Education**	**Preferred Option not indicated**
• Licensed electrical worker (1) • PCBU (1) • Government Department or Regulator or Statutory Agency or Authority (1)	• Union (1) • Peak body (7) • Prescribed electricity entity (3) • Government Department or Regulator or Statutory Agency or Authority (7) • Non-prescribed electricity entity (1) • Individual (2) • Individual - electrical contractor (1) • Electrical contractor (1) • Skills and training organisation (1) • Advocacy group (1) • Metering services (1) • PCBU (1)	• Individual (2) • Skills and training organisation (1) • Non-prescribed electricity entity (1) • PCBU (1) • Prescribed electricity entity (1) • Advocacy group (1)	• PCBU (2) • Individual (2) • Government Department or Regulator or Statutory Agency or Authority (2) • Peak body (1)
Total: 3	**Total: 27**	**Total: 7**	**Total: 7**

Table 3: Topic 2, stakeholder sentiment

Topic 2- Changing landscape of electricity and the workforce				
Locating, mounting and fixing of energy generation and storage technology				
Option 1 – Status Quo	**Option 2- Legislative change (Supervision)**	**Option 3 – Legislative change (License)**	**Option 4 – Awareness and Engagement**	**Preferred Option not indicated**
• Peak body (1) • Non-prescribed electricity entity (1) • Individual - licensed electrical worker (1)	• Peak body (3) • Prescribed electricity entity (1) • Non- prescribed electricity entity (1) • Skills and training organisation (1) • Government Department or Regulator or Statutory Agency or Authority (1)	• Union (1) • Prescribed electricity entity (1)	• Individual (2) • Peak body (4)	• Prescribed electricity entity (1)
Total: 3	**Total: 7**	**Total: 2**	**Total: 6**	**Total: 1**
Laying, cutting and sealing of underground cables prior to connection by electricity entities.				
Option 1 – Status Quo	**Option 2- Legislative change (Supervision)**	**Option 3 – Legislative change (License)**	**Option 4 – Awareness and Engagement**	**Preferred Option not indicated**
• Prescribed electricity entity (1) • Non-prescribed electricity entity (1)	• Government Department or Regulator or Statutory Agency or Authority (1) • Prescribed electricity entity (1)	• Union (1)	• Individual (1) • Peak body (1)	• Prescribed electricity entity (1) • Individual (1)
Total: 2	**Total: 2**	**Total: 1**	**Total: 2**	**Total: 2**
Mechanical cable protection				
Option 1 – Status Quo	**Option 2- Legislative change (Supervision)**	**Option 3 – Legislative change (License)**	**Option 4 – Awareness and Engagement**	**Preferred Option not indicated**
• Prescribed electricity entity (2) • Non-prescribed electricity entity (1)	• Non-prescribed electricity entity (1) • Government Department or Regulator or Statutory	• Union (1)	• Individual (2) • Peak body (1)	• Prescribed electricity entity (1) • Individual (1)

• Individual – licensed electrical worker (1) • Electrical contractor (1) • Peak body (3)	• Agency or Authority (2) • Peak body (3)			
Total: 8	**Total: 6**	**Total: 1**	**Total: 3**	**Total: 2**

Table 4: Topic 3, stakeholder sentiment

Topic 3- Electrical safety and electric vehicles			
Option 1 – Status Quo	**Option 2 - Legislative change**	**Option 3 – Awareness and Education**	**Preferred Option not indicated**
• Individual – licensed electrical worker (2) • Individual (1) • Peak body (6) • Peak Body - automotive (10) • Advocacy group (2) • Union (1) • PCBU (2) • Non-prescribed electricity entity (1)	• Government Department or Regulator or Statutory Agency or Authority (4) • Individual – licensed electrical worker (1) • Peak body (2) • Union (1) • Skills and training organisation (2) • PCBU (2) • Prescribed electricity entity (1)	• PCBU (3) • Individual (3) • Peak body (4) • Peak body – automotive (4) • Prescribed electricity entity (2)	• Peak body (3) • Government Department or Regulator or Statutory Agency or Authority (1)
Total: 25	**Total: 13**	**Total: 16**	**Total: 4**

As per Table 2, the majority of stakeholders responding to Topic 1 were broadly in support of some legislative amendment to the definitions of electrical equipment and electrical installation (i.e., Option 2).

As indicated within Table 3, a narrow majority of stakeholders who responded to Topic 2 were in support of a supervision requirement (i.e., Option 2) when it came to the first risk area (i.e., locating, mounting and fixing of energy generation and storage technology). There was no distinct preference which emerged regarding the second risk area (i.e., laying, cutting and sealing of underground cables prior to connection by electricity entities); however, maintaining the status quo was the preferred option for the third risk area (i.e., mechanical cable protection). Across Topic 2, there was no clear majority in support of legislative change. Different stakeholders have different levels of representation and therefore narrow majorities are not indicators of a case for change in isolation of economic cost benefit analysis.

It is important to note that while supervision was supported by some stakeholders, concerns regarding the existing definition of supervision were raised within a number of written submissions. Additionally, stakeholders also raised concerns in relation to the complexity of the existing definition of ‘electrical work’ and the potential commercial viability risks this may pose. Consultation indicated, a clearer definition of ‘supervision’ is necessary to assess the commercial viability of this legislative change. This was included as a caveat to supporting Option 2 by a number of stakeholders. Finally the complexity of the ‘electrical work’ definition was also identified as an area that would benefit from greater clarity.

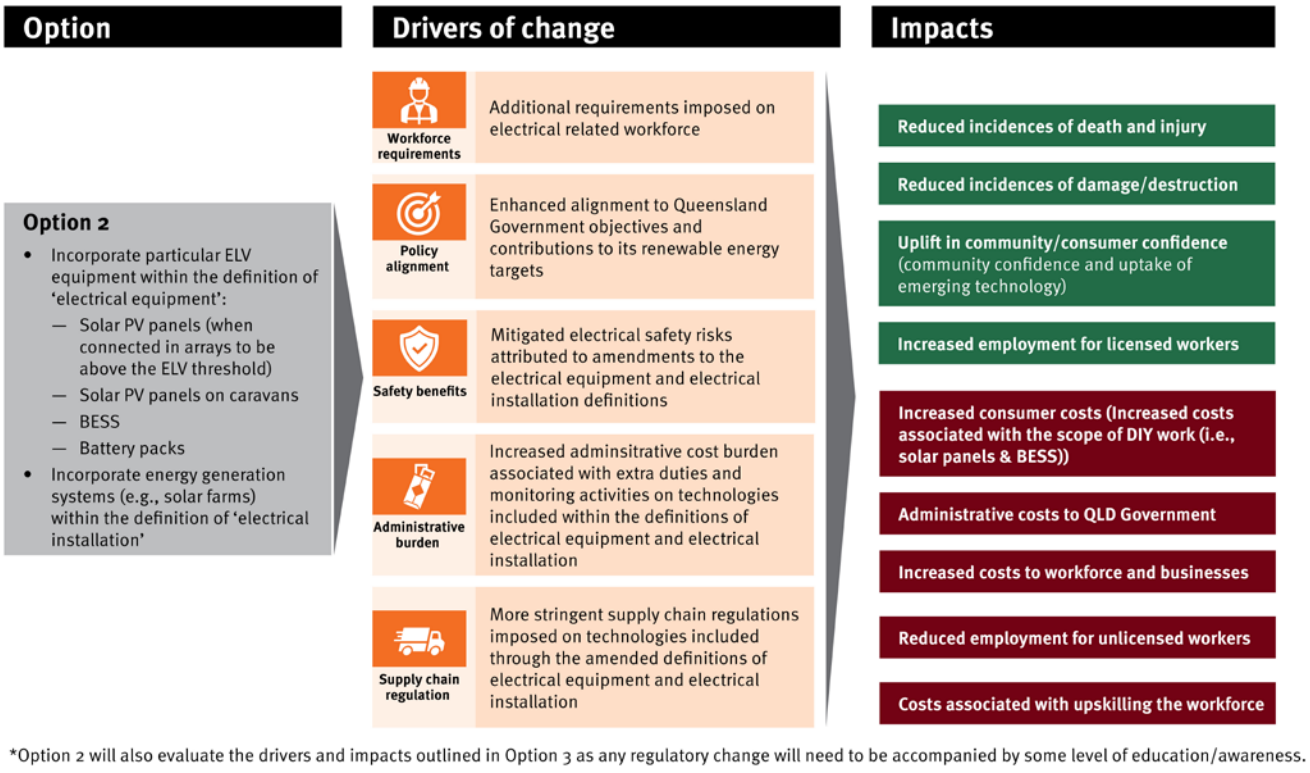
The majority of stakeholders who responded to Topic 2 were in support of maintaining the status quo (see Table 4).

Cost effectiveness of preferred options

Given the feedback received through consultation on Topics 2 and 3 largely supported the status quo, but more particularly, did not provide any significant new data or qualitative evidence, it was found that an economic analysis could not be undertaken on Topics 2 and 3 as it did not meet the threshold of identifiable problem. Instead, while status quo is recommended for Topics 2 and 3 at this time, some supporting actions have been proposed in light of matters raised in consultation. A working group is proposed to explore the 'electrical work' and 'supervision' definition further in response to Topic 2. Additionally, a roundtable has been established to consider electrical safety and electric vehicles with recommendations from the group to be referred for national consideration.

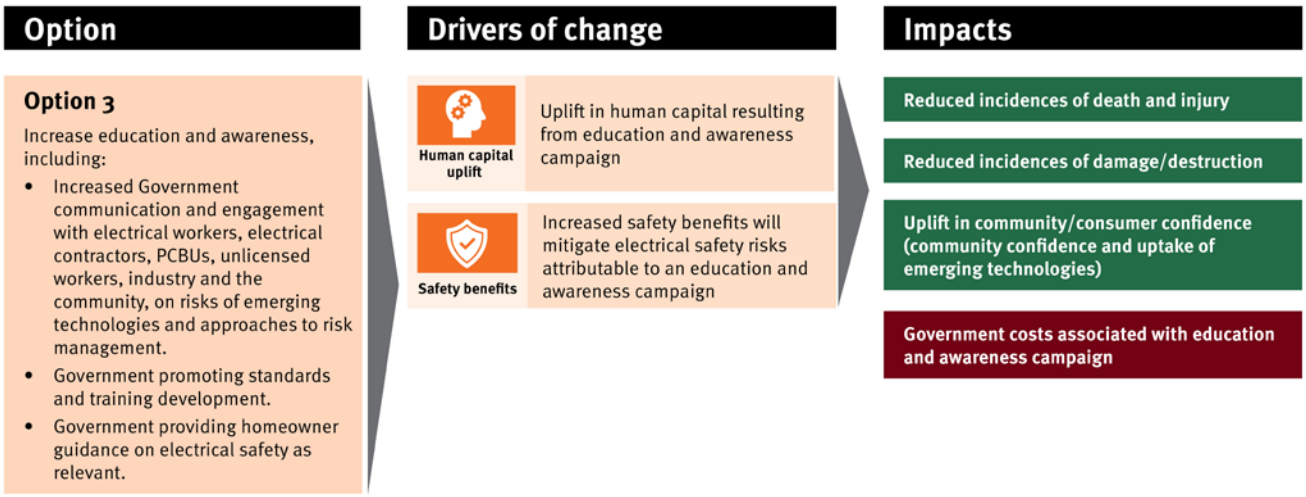
Economic analysis was pursued for Topic 1, the key impacts identified and evaluated for Topic 1 are presented in Figure 1 and Figure 2.

Figure 1: Economic Impacts associated with Topic 1 Option 2



*Option 2 will also evaluate the drivers and impacts outlined in Option 3 as any regulatory change will need to be accompanied by some level of education/awareness.

Figure 2: Economic Impacts associated with Topic 1 Option 3



Due to the absence of data in relation to a number of the impacts identified above, the economic analysis explored a number of impacts qualitatively, only providing quantitative insights where feasible.

This overall assessment process identified that:

- There is commensurate industry support to amend the Act to incorporate certain extra low voltage (ELV) equipment and systems (associated with the emerging technologies) into the definitions of 'electrical equipment' and 'electrical installation'.
- There is broader support of electrical safety education and awareness campaigns to mitigate electrical risks associated with the emerging technologies in question.
- There are a range of benefits associated with the proposed legislative changes which include:
    - Reduced incidents of death and injury associated with poor work practices, faulty and low quality electrical equipment and installations.
    - Reduced incidents of damage and destruction of property associated with poor work practices, faulty and low quality electrical equipment and installations.
    - Uplift in community and consumer confidence resulting from enhanced and targeted legislation, improved electrical safety standards, improved product and service oversight and control, etc.
    - Increased employment and demand for licenced workers who have undertaken the necessary education pathways.
- Amendments to the Act will also result in a range of **costs** to industry, workforces and the broader Queensland economy. These include:
    - A reduction in the scope of what can be performed as DIY work by the community
    - Increased cost to consumers: a raft of regulatory compliance costs which may be passed on to the consumer including:
        - Compliance costs (including regulatory fees and government supply chain duties) potentially being passed on to consumers due to increased regulation and oversight.
        - Potential reduction in competitors in the market as a result of regulations limiting the quality of imported products (i.e., solar PV panels, BESS and storage batteries).see section 3.10 Competition principles.
        - In some instances, increased costs to upskill workforce including undertaking apprenticeships, training, testing, licence renewals, any ongoing professional development training.
        - In some instances, increased business and workforce costs associated with Queensland Government fees for licensing costs (licence registration and renewals), complying with regulations/legislation and insurance costs.
        - In some instances, reduced employment for unlicenced workers due to legislative licensing requirements.
    - Increased costs to the Queensland Government due to increased supply chain duties such as: assessing applications, compliance and audit activities, disciplinary activities, data collection and management, engagement, etc.
    - Costs associated with electrical safety education and awareness campaigns associated with the emerging technologies in question.

In summary, the analysis indicated amending the 'electrical installation' and 'electrical equipment' definitions in line with Option 2 poses a number of significant safety benefits to the workforce and the community including:

- Increased consumer/community confidence.
- Reduced damage and destruction.
- Reduced injuries and fatalities.

The key cost identified through the economic analysis for prescribing high risk ELV equipment in the legislation is the cost of additional licensing requirements for electrical work. It should be noted that based on this finding, together with other considerations such as ELV equipment design and risk, a

modification was made to Option 2 to reduce the regulatory burden posed by licensing requirements to work on prescribed high risk ELV equipment.

Modifications to Option 2 instead proposes to introduce supply chain duties, incident reporting duties and duties to comply with regulatory levers such as recalls for prescribed high risk ELV equipment. The modified approach to Option 2 will only prescribe licensing requirements for work on prescribed high risk ELV where the voltage exceeds ELV, on the basis of risks associated with the voltage. Overall, the modification to Option 2 applies more targeted regulatory levers, and reduces the regulatory burden posed by licensing.

The recommended legislative path for electrical equipment is that individual ELV equipment be assessed as and when items are added to the schedule, on the basis of risk and complexity of tasks. Licensed work only then extends to these items when the equipment is arranged in some way where the work involves voltages above ELV. General regulatory oversight that will be able to be triggered when electrical incidents of a serious nature are experienced will take the form of supply and incident duties, recalls and compliance activity around unsafe equipment. In summary, the bulk of the costs estimated will only be incurred in the event of significant safety events.

As a result of the modification a clear net benefit to the Queensland community can be established, so much so that the modified Option 2 provides the greatest net benefit to the community when compared with the status quo (Option 1) and an education and awareness approach (Option 3). As a result, the modified option 2 (Option 2A) is the recommended option.

3 Introduction

The first electric light entered Queensland homes in the 1800s.[4] Since that time, electricity and related technologies have transformed, alongside the regulation of electricity and electrical safety. The electrical equipment used in Queensland homes, workplaces and communities has also undergone rapid transformation with the invention and adoption of new and emerging technologies that make energy generation, storage and use accessible for the entire community. While greatly benefitting society, electricity is dangerous. It poses a risk that cannot be seen, but it is all around us every day. It is important that Queenslanders are protected from electrical safety risks, without being unnecessarily hindered as they go about their daily lives.

3.1 Queensland's ES Framework

The Queensland Government's dedicated ES Framework seeks to manage the risks presented by electricity to prevent death, injury and the destruction of property. The enabler of the ES Framework is dedicated electrical safety legislation; namely the *Electrical Safety Act 2002* (Qld) (the Act). The ES Framework, including the Act, the Electrical Safety Regulation 2013 (the Regulation), codes of practice, and Australian Standards, supports safe access to electricity and use of electrical equipment in our workplaces, homes, schools and hospitals.

The Electrical Safety Office (ESO), which is part of OIR, is established to regulate electrical safety risks. This includes compliance and enforcement regulation of prescribed electricity entities, compliance of electrical equipment, participation in the development of national and international minimum safety standards, occupational and contractor licensing, accreditation of auditors and certification of equipment certifiers, and education and awareness. The ESO also administers the Electrical Equipment Safety System (EESS); a framework for equipment safety regulation adopted in a number of states and territories.

The Act contains three key concepts that define the scope of the ES Framework's regulatory reach: 'electrical equipment', 'electrical installation' and 'electrical work'. When equipment is considered to be 'electrical equipment' for the purposes of section 14 of the Act, it becomes subject to requirements under the Act. This includes duties of care, the Minister's recall powers, and incident and reporting requirements. As such, the precise meaning of the technical term 'electrical equipment' is fundamental to which equipment is, and is not, regulated by the ESO. At present, the term is defined by way of a threshold level of volts. Equipment that is of greater than ELV is within the definition of 'electrical equipment' with few exceptions.

The Act defines 'electrical installation' to mean a group of 'electrical equipment' that is permanently electrically connected.[5] Finally, work involving 'electrical equipment', or an 'electrical installation' is considered to be 'electrical work',[6] which in turn necessitates licensing by the ESO (being a full licence or a restricted licence) and/or supervision requirements in order to undertake these forms of work. The definitions of 'electrical equipment', 'electrical installation' and 'electrical work' have nuances where exclusions apply to particular categories of equipment, situations or occupations.

[4] According to the State Library of Queensland, the electric light first came to Queensland in the 1880s. Electric lighting was first displayed in 1882 in Queen Street. More information is available at: https://www.slq.qld.gov.au/. Last viewed on 11 October 2023.

[5] See section 15 of the *Electrical Safety Act 2002* (the Act).

[6] Section 18 of the Act.

Examples of 'electrical equipment' and 'electrical installations'

The purpose of the ES Framework is to prevent death, injury and the destruction of property caused by electricity. Electrical risks align to this legislative purpose as follows:

- Death – caused by electrocution, fatal electric shock and electrically initiated fire
- Injury – caused by electric shock, burns and arc flash
- Property damage and destruction – caused by electrically initiated fire.

Examples of common items of equipment that fall within the definition of 'electrical equipment' are stoves and electric hot water systems, which can both operate at 240V AC (therefore above the 50V AC definition of ELV). An example of portable 'electrical equipment' are pedestal fans that operate at 240V AC. An everyday piece of household electrical equipment, a pedestal fan can pose an electrical hazard when they are faulty or defective, resulting in risks including electric shock, burns and fire. The potential harm these risks can pose are severe, including death and injury. Defective electrical equipment impacts consumers who own the equipment, in addition to electrical workers who may work on the equipment.

The likelihood of harm occurring is reduced through the ES Framework, which places duties throughout the supply chain to ensure the equipment is safe and compliant before it reaches the consumer. Recall powers and prohibition powers are also established by the ES Framework in respect of electrical equipment. Additional protections further reducing the likelihood of harm occurring are provided through the EESS. Another electrical hazard posed by pedestal fans is unsafe electrical work, which poses risks including electric shock and burns that can result in severe injury or death. Unsafe work primarily impacts the person undertaking the work, however, can also extend to those using the equipment subsequent to the work. The likelihood of harm occurring is reduced through the ES Framework where a licensing requirement exists to work on this equipment, mitigating the likelihood of unsafe work by ensuring only those with specialist knowledge and skills to work on the equipment safely can undertake the work.

For items captured within the 'electrical equipment' definition, a number of regulatory levers are available to respond to critical risks to life and property. These levers are a responsive mechanism for the ESO, Regulator and the Minister to protect the community from immediate risks. An example of the use of one of these levers involved particular models of misting fans in 2020.

Effective 9 June 2020, particular models of misting fans were recalled due to easily contactable parts of the fan being 'live' which could cause electric shock. This is a specific example of an immediate electrical risk (electric shock causing injury) via 'electrical equipment' (a misting fan, and particularly exposed live parts within it). The recourse to Ministerial recall was enabled by these fans being greater than ELV and therefore within the definition of 'electrical equipment'.

3.2 Changing electrical landscape

The rate of technological change has never been as swift as it is now. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) Chief Executive Dr Larry Marshall has described this change as a tidal wave of disruption and stated that it is critical to get ahead of it.[7] The rate of technological change is impacted by many global trends, including climate change, energy security, scarcity of resources, mass production and changes to our lifestyles.

New electrical technologies offer exciting advancements that will improve lifestyles and reduce carbon emissions, however, the risk profile associated with these new technologies – from different electricity generation and distribution methods through to portable battery packs – must be considered and assessed.

3.3 Renewables and emerging technologies

Since the establishment of Queensland's ES Framework in 2002, the landscape in which Queenslanders interact with electricity has changed immensely. New risks are emerging with the rapid transformation of the electricity grid, renewable energy technologies and the increase in consumer interaction with electricity, energy storage and electrical equipment. However, in parallel, new and innovative uses of existing technology are presenting new electrical safety risks. Furthermore, the way in which skilled workers work safely with electricity is also evolving to keep pace with technological advancement and adoption.

The pace of change is now unlike anything Queensland has experienced in the past. Noting the growing focus and reliance on new and emerging technologies, particularly renewables, the landscape will continue to change. This transformation involves the increasing commonality of equipment with novel electrical risk profiles and while, in general, this equipment includes improved safety features, the risk of injury, death and property destruction must be appropriately managed. As risks are better understood, community, industry and the Queensland Government's ES Framework must be positioned to adapt.

3.4 Government energy transformation policy and trends

Currently, there is an increasing and mutually reinforcing shift in both energy generation technology and focus on re-prioritised energy policy across the globe. It is no different in Queensland. The Queensland Government has committed to transition and transform Queensland's electricity grid to ensure clean, reliable and affordable energy for the future. Spurred on by renewable energy targets and an accessible economic landscape that encourages both public and private investment into renewable energy projects, the way that Queenslanders interact with electricity, and how workers and businesses operate, is being transformed.

In September 2022, the Queensland Energy and Jobs Plan (QEJP) was released. The QEJP's vision is to ensure clean, reliable, and affordable energy, providing power for generations. The QEJP has coverage from 2022 to 2035 and seeks to achieve a number of outcomes for Queensland's electricity system. Driving the QEJP are Renewable Energy targets of:

- 50 percent renewable energy by 2030
- 70 percent renewable energy by 2032
- 80 percent renewable energy by 2035.

The Queensland Government has released a number of other strategies, plans and initiatives to guide the energy transition across community, industry and government. These include, but are not limited to:

[7] CSIRO. (2022, 07 27). Seven megatrends that will shape the next 20 years. Retrieved from https://www.csiro.au/en/news/all/news/2022/july/seven-megatrends-that-will-shape-the-next-20-years

- The Queensland State Infrastructure Strategy (released in June 2022) includes objectives of realising Queensland's future as a renewable energy superpower, creating liveable communities, connecting our regions and building a Brisbane 2032 legacy. The 1,022 projects outlined in the strategy have a combined value of over $14 billion and all include significant electrical installations, electrical work and electrical equipment. These projects are spaced throughout Queensland with a particular focus on regional Queensland.
- The Brisbane 2032 Olympic and Paralympic Games are being positioned as a carbon neutral event and will include renewable energy installations.
- The Queensland Zero Emission Vehicle Strategy 2022-2032 and the Zero Emission Vehicle Action Plan 2022-2024.

In addition, Construction Skills Queensland (CSQ) released Queensland's Renewable Future (August 2022), which considers the pipeline of renewable energy projects in Queensland and the impact on investment, jobs and skills.[8] The report and subsequent interactive data on the CSQ website identified 217 projects that may proceed to delivery with a combined estimated value of $73.4 billion.[9]

To respond to the growing focus on a net zero and renewable future, consumers, industry and government are shifting the use of existing technology and are welcoming new technologies.

3.5 Reviewing Queensland's ES Framework

In 2019, electrical safety concerns regarding large-scale solar farms escalated, resulting in legislative change. However, it was determined that the regulations about safety on solar farms did not fall within the powers granted under the Act.

In response, on 25 June 2019, the Queensland Minister for Education, Minister for Industrial Relations, the Honourable Grace Grace MP (the Minister), announced that the Commissioner for Electrical Safety, Mr Greg Skyring (the Commissioner), would lead discussions on safety in large-scale solar farms.

In January 2020, the Commissioner delivered findings and recommendations to the Minister in the form of the *Improving Electrical Safety in Queensland: A Report by the Commissioner for Electrical Safety* (the Commissioner's Report). The first recommendation of the Commissioner's Report was that the Queensland Government should undertake a review of the Act, including the objectives of the Act and regulation-making powers, to ensure it is fit for purpose and can keep pace with new and emerging technologies.

In August 2020, the Minister announced the *Review of Queensland's Electrical Safety Act 2002* (the Review), to be undertaken by an external independent reviewer with the support of a departmental secretariat within OIR. In December 2020, Mr Dick Williams was appointed as the Independent Reviewer (the Reviewer), with the Review's terms of reference requiring consideration of:

- All definitions under the Act to ensure relevance and effectiveness
- All duties and requirements under the Act and Regulations, including on suppliers and generating entities, to ensure relevance and effectiveness
- How the Act can be future proofed for other emerging energy technologies, including renewable energy generation and storage devices
- Aligning the provisions of the Act with Queensland's work health and safety legislative scheme under the *Work Health and Safety Act 2011* (Qld) (WHS Act)
- How any recommendations resulting from the review will create public value by enhancing Queensland's ES Framework (increasing the net benefit to the community through evidence based legislative and/or regulatory change).

[8] Construction Skills Queensland 2022. Queensland's Renewable Future: investment, jobs and skills. CSQ, Brisbane, Australia.
[9] CSQ. (n.d.). Explore by project. Retrieved from Renewables Projects: https://www.csq.org.au/renewables/renewables-projects/

In December 2021, a Final Report containing 83 recommendations was provided to the government. The Review was broad and comprehensive, reflecting the significant technological advancements that have occurred in the last 20 years, particularly in energy generation and storage. Ensuring that Queensland's ES Framework remains fit for purpose in the wake of significant technological advancements forms the basis of a number of key review recommendations. Many of these recommendations pertain to the scope of the legislation and definitions of key terms used throughout the legislation. Beyond this, the recommendations are comprehensive in providing reform proposals across the breadth of the ES Framework.

3.6 Overview of topics

To respond to key recommendations from the Final Report, on 16 May 2023, a Discussion Paper – *A response to the Review of Queensland's Electrical Safety Act 2002 – key definitions and emerging technologies* was released.[10] The Discussion Paper explored three topics (refer Table 5) and sought feedback on 10 recommendations from the Final Report.

The Discussion Paper provided information on the issue (problem definition), options for addressing the issue and questions for community and industry consideration.

Table 5: Overview of Topics

Topics		
1	Electrical safety considerations of new and emerging technologies	Section 4.0
2	Changing landscape of electricity and the workforce	Section 5.0
3	Electrical safety and electric vehicles	Section 6.0

Topic 1 considers the risks and options presented by emerging technologies related to energy generation, transmission, distribution (including energy storage) and utilisation (equipment changes relevant to the emerging technology or expanded uses of existing technology). This includes the relationship between the 'electrical equipment' definition and ELV equipment, including solar photovoltaic[11] (PV) modules and related renewable energy technology equipment and the definition of 'electrical installation' with respect to new and emerging technologies.

Topic 2 considers the changing nature of work in relation to electricity and emerging risks due to technological advancement and how work is conducted. This includes whether existing exemptions under the 'electrical work' definition contemplate risks identified in the Review.

Topic 3 looks specifically at the electrical safety risks presented by EVs and considers the existing education and training landscape, current licensing requirements and the shape of an ES Framework into the future. While this topic area could be considered under the broader definition of 'electrical equipment' (Topic 1) and 'electrical work' (Topic 2), its emerging ubiquity, diversity and interest to consumers, industry and various regulators have led to a standalone treatment in Topic 3.

3.7 Thematic analysis

As a result of the publication of the Discussion Paper, the Queensland Government received 78 written submissions from the community representing:

- PCBUs
- Individuals (i.e., Community members, licensed electrical workers, electrical contractor, etc.)
- Government departments, Regulators or Statutory Agencies or Authorities
- Peak bodies
- Prescribed electricity entities

[10] Available at: https://www.oir.qld.gov.au/sites/default/files/2023/documents/es-act-review-discussion-paper_1.pdf. Last viewed on 11 October 2023.
[11] Photovoltaic refers to cells converting light into electricity at an atomic level.

- Non-prescribed electricity entities
- Unions
- Committees
- Electrical contractors
- Skills and training organisations
- Advocacy groups
- Metering services.

Due to the number of responses and the qualitative nature of the content within the written submissions, a thematic analysis was undertaken.

The purpose of the thematic analysis was to identify common themes across the 78 written submissions (received by OIR) responding to the Discussion Paper's topics, proposed options and highlighted recommendations. The results from the thematic analysis, and the consultation process more broadly, are discussed throughout this document (refer Sections 4.5, 5.6 and 6.5).

Thematic analysis is a qualitative research approach used to identify, analyse, and interpret patterns within data. It involves breaking down large amounts of data into smaller themes and then exploring those themes to gain an understanding of the data. Thematic analysis can be used to gain insights into how the community views a particular policy or program, or to understand how public opinion is shifting on a certain issue.

4 Topic 1: Electrical safety considerations of new and emerging technologies

4.1 Overview

Current regulatory framework

Queensland's dedicated ES Framework has been briefly summarised in Section 3 Introduction. Among other matters, it was noted that the Act establishes:

- Duties, including a primary duty of care and duties regarding designing, manufacturing, importing, suppling, installing and repairing electrical equipment
- Licensing, accreditation and certification requirements relating to installing, auditing and certifying electrical equipment and its installation
- Ministerial recall orders if it is or will place persons or property at risk
- Incident and other reporting requirements.

It was further noted that three key concepts define the scope of the ES Framework's regulatory reach: 'electrical equipment', 'electrical installation' and 'electrical work'. The ES Framework does not regulate all equipment that operates electrically. Rather, the technical term 'electrical equipment' defines what is regulated by the ES Framework via the following definition (section 14 of the Act):

> *14 Meaning of electrical equipment.*
>
> (1) Electrical equipment means any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that—
>
> (a) is used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage; or
>
> (b) is operated by electricity at a voltage greater than extra low voltage; or
>
> (c) is part of an electrical installation located in an area in which the atmosphere presents a risk to health and safety from fire or explosion; or is, or is part of, a cathodic protection system.
>
> (2) Electrical equipment does not include any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that is part of a vehicle if—
>
> (a) the equipment is part of a unit of the vehicle that provides propulsion for the vehicle; or
>
> (b) the electricity source for the equipment is a unit of the vehicle that provides propulsion to the vehicle.

Broadly, the concept of 'electrical equipment' is defined by way of a threshold; namely those forms of equipment with voltage 'greater than ELV'. Only equipment that falls within the definition of 'electrical equipment' becomes subject to requirements under the Act. This includes duties of care and incident reporting requirements. Therefore, the scope of the meaning of 'electrical equipment' dictates the kinds of equipment the ESO regulates.

Where items are excluded from the 'electrical equipment' definition, this has secondary impacts, most notably excluding them from electrical work licensing requirements, supply chain duties and incident notification requirements.

Sub-sections (c) and (d) are exceptions to the rule, as they define specific forms of 'electrical equipment' without reference to a minimum voltage threshold. Furthermore, the definition of 'electrical equipment' also contains exclusions for some elements of a vehicle at section 14(2) of the Act (EVs are discussed further at Section 6 of this paper). That is, even if those parts are greater than ELV, they are currently excluded from the definition of 'electrical equipment'.

Exceptions aside, voltage levels play the central role in the definition of 'electrical equipment'. Three levels are recognised throughout the Act, defined as follows:

> ***extra low voltage*** means voltage of 50V or less AC RMS, or 120V or less ripple-free DC.
>
> ***low voltage*** means voltage greater than extra low voltage, but not more than 1,000V AC RMS or 1,500V ripple-free DC.
>
> ***high voltage*** means voltage greater than low voltage.

Related to the concept of 'electrical equipment' is 'electrical installation', defined by section 15 of the Act. Essentially, an 'electrical installation' is a group of items of 'electrical equipment'. An example is the permanently connected switchboard, wiring, lighting and socket outlets in a house.

> *15 Meaning of electrical installation*
>
> (1) An electrical installation is a group of items of electrical equipment that:
>
> (a) are permanently electrically connected together; and
>
> (b) can be supplied with electricity from the works of an electricity entity or from a generating source.
>
> (c) do not include items that are works of an electricity entity.

4.2 Problem identification

Relationship between current regulation and energy transformation

As noted, the landscape in which Queenslanders interact with electricity has changed significantly since 2002. Technology with novel electrical risk profiles falling outside the ambit of the Act is increasingly common. In particular, ELV equipment has proliferated in diverse forms but is not captured as part of the definition of 'electrical equipment'.[12]

At the time the Act was introduced, it was considered that ELV equipment had a low risk profile. This equipment usually operated at the lower end of ELV, such as at 9V or 12V. Devices of greater operating power tended to be Low Voltage (LV) plug-in or fixed wired equipment, with the main types of battery equipment being devices such as torches, clock radios and other devices with replaceable, non-rechargeable batteries.

At that time, the potential harm of defective equipment or unsafe work on ELV equipment was viewed as "mild" and not requiring government intervention such as that applying to LV equipment.

The example of solar, explored in detail below, is important and instructive – a single solar panel is ELV and therefore not a form of 'electrical equipment'. When not connected to form an array that adds up to being LV, it is currently not captured by the 'electrical equipment' definition and therefore the specific regulatory requirements under the ES Framework do not apply, including, amongst others, supply chain duties, licensing requirements, recall duties and incident notification duties.

Where technology operates at LV or High Voltage (HV) and fits within the confines of the 'electrical equipment' definition, it is already captured by the ES Framework (see the example in Section 3 Introduction). Certainly, the ambit of new and emerging technologies extends to LV and HV.

[12] The Act provides for only two exceptions: where the equipment is part of a *cathodic protection system* or where the equipment is part of an electrical installation located in an area in which the *atmosphere* presents a risk to health and safety from fire or explosion: s 14(2).

However, given the structure of the ES Framework, this report's focus is on new and emerging electrical technologies operating at ELV.

It is important to note, however, that not all ELV equipment has evolved. For instance, replacing AA batteries is not considered to pose risks requiring consideration of a regulatory response.

Other safety regulations

Where electrical items of any voltage are present in a workplace, the Act's primary duty of care applies.[13] This requires the PCBU to ensure the workplace is electrically safe. Furthermore, under Australian Consumer Law, businesses must meet a set of basic consumer guarantees when they sell products or services, which applies to electrical items both in and out of the Act's scope.

Finally, the EESS is a regulatory framework aimed at increasing consumer safety in household electrical equipment throughout participating jurisdictions in Australia and New Zealand. The household equipment captured by the EESS is defined as 'in-scope equipment'. The EESS forms Part 2A of the Act. As the EESS covers only LV consumer items,[14] the relevant technologies considered in this paper are not presently captured as in-scope equipment by the EESS. Therefore, requirements for supplier registration and for equipment imported to be registered do not apply. Consultation with participating jurisdictions would need to occur to consider any amendment to the EESS.

Electrical Safety considerations of ELV equipment

There are various forms of new and emerging technologies that often operate at ELV, including solar PV panels, BESS and rechargeable battery packs. The context for solar PV panels can range from caravans to household rooftops to large-scale solar farms.

4.2.1.1 Solar PV

The scale of solar uptake and consequent workforce changes are briefly noted in the context of the general growth in renewable energy generation, before considering the potential electrical safety risks.

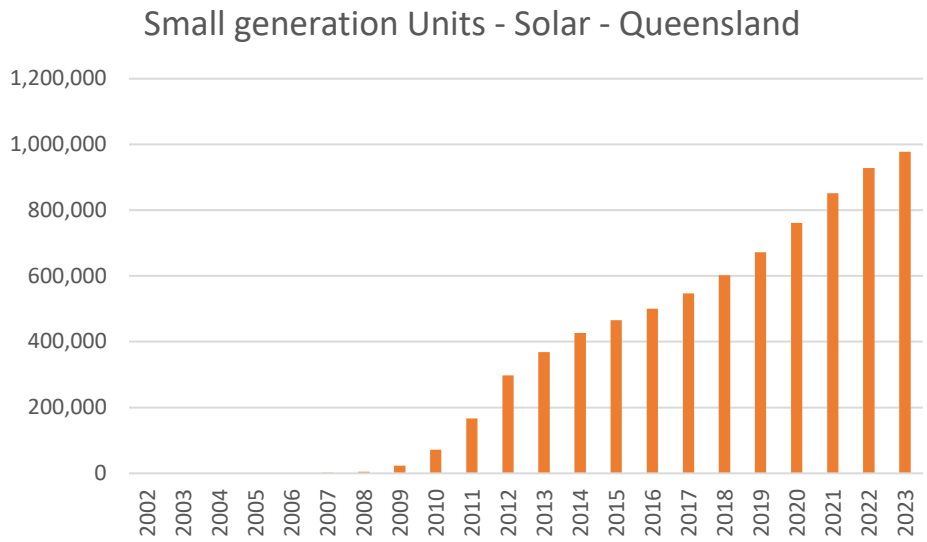
Scale of solar usage and renewables generally

The use of solar PV cell technology is continuing to become increasingly common. Being installed anywhere from caravans to household rooftops to commercial (large scale) solar farms, PV solar is diverse and continues to be a significant contributor to meeting renewable energy targets.

As of 26 September 2023, there were a total of 977,011 small solar generation units (i.e., rooftop solar systems) in Queensland. Installation numbers have grown exponentially; with 475 occurring in 2007 to 90,192 in 2021 and 77,263 in 2022 (refer Figure 3).

[13] Section 30 of the Act.
[14] Section 48B of the Act.

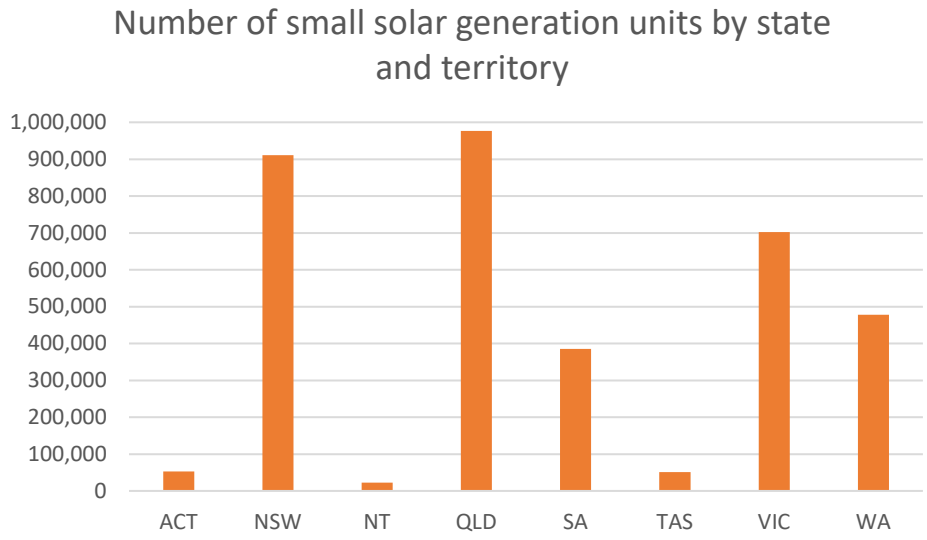
Figure 3: Number of installed solar generation units



Source: Clean Energy Regulator

Figure 4 below shows a state-by-state comparison of the number of installed small solar generation units. As presented, Queensland has the highest number of installed solar generations units.

Figure 4: Number of installed solar generation units by state and territory

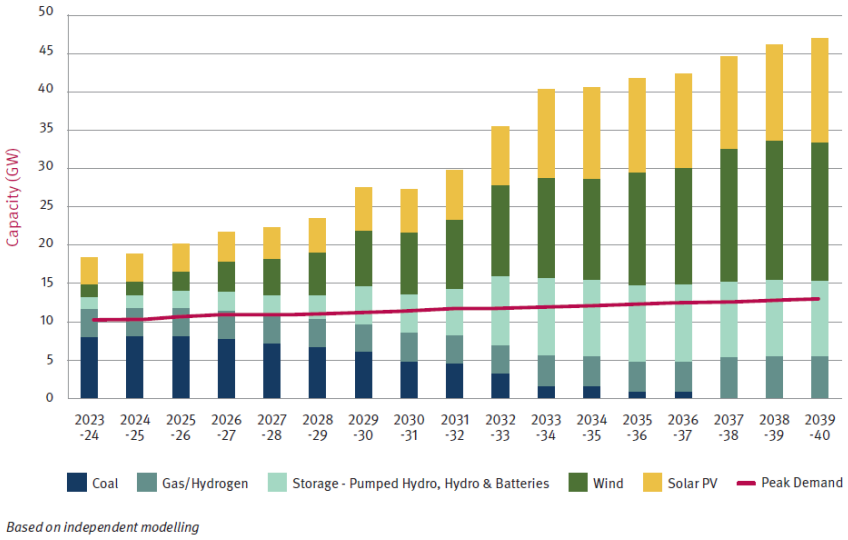


Source: Clean Energy Regulator

As of June 2022, 21.4 percent of Queensland's energy was derived from renewable energy sources, with a combination of rooftop solar, commercial solar, wind, hydro and bioenergy. Independent modelling indicates significant projected growth in a variety of renewable sources of electricity; including solar PV (see Figure 5).[15]

[15] Department of Energy and Public Works. (2022, 09). Queensland Energy and Jobs Plan. Retrieved from https://www.epw.qld.gov.au/energyandjobsplan/about

Figure 5: Projected growth of electricity sources



Source: Queensland Department of Energy and Public Works. Queensland Energy and Jobs Plan

Contexts of solar usage

It is useful to distinguish two common contexts in the use of solar that differ significantly in size and scale: rooftop solar, such as that on domestic properties, and solar farms.

4.2.1.2 Rooftop solar

Interactions with energy generation in a domestic context, mainly through rooftop solar, has only emerged in the last two decades. Previously, electricity generating systems were the purvey of large electricity entities alone. Now, energy generation is available to renters and homeowners as well as to those operating businesses and community facilities, such as schools, sporting facilities, retail centres and car parks. In these residences, commercial and community settings, there are often scenarios where several solar panels (also known as a PV array) are linked and then connected with a BESS and an inverter to form an energy generation and storage system. This example of equipment connected to form a system can occur in a form that is either at ELV but has high energy capacity (and outside the scope of the Act), or it could result in a system that operates at LV, with similar high energy density but also higher voltages, and is therefore covered by the current regulatory scope of the Act.

4.2.1.3 Solar farms

Solar farms have components of electrical equipment that operate individually at ELV in the form of solar PV panels, but, when installed, operate or transmit electricity at above ELV. Solar farms may have systems with components of AC and DC systems and voltages at ELV, LV and HV. Solar farms may also have assemblies of large, pre-installed equipment such as switchboards or switch rooms.

Solar farms include AC and DC electricity at differing voltage levels, different sources of electricity and different conductive material, such as PV solar array and modules which are considered to be live (energised) as soon as they are removed from packaging.

Workforce and community interactions

Changes to the energy generation landscape have caused more workers to interact with renewable energy technologies or work in new ways with existing electrical equipment. For example:

- New supply chain opportunities due to the demand for solar and the opening of business opportunities to assist with the supply of this technology in Queensland. Often, this technology is not designed and manufactured in Australia, but instead is imported from overseas. As ELV equipment is not currently captured by Queensland's electrical safety framework, the supply chain duties that ensure electrical equipment is electrically safe do not currently apply.

- Work to install solar, and the emergence of a workforce dedicated to that task in both roof tops and in solar farm contexts. This work spans both labourers and electrical workers depending on the activity and the voltage of the solar panel. This is further explored below.
- Work to maintain solar, including the emergence of a maintenance industry for this technology.
- Work to disconnect and dispose of equipment that has reached the end of its working life or is no longer required or wanted.

Workers involved in these forms of work include licensed electrical workers and contractors, labourers in labour hire arrangements and employees and contractors of Queensland Government owned corporations. Additional insight from the Clean Energy Council (CEC) has been provided below in relation to the current workforce profile for the solar industry (refer Box A).

Box A: Solar Industry Workforce Profile

CEC submitted the following:

> "Trained electrical installers comprise roughly 25% of the utility solar workforce, with the remaining 75% being skilled builders, trained and untrained labourers."

Electrical safety risks and incidents

Solar installations of all types, including domestic, commercial and solar farms, pose certain electrical safety risks. Work on this equipment, when connected, may result in the joined equipment operating at a higher voltage than the individual pieces of equipment and therefore, at an increased voltage which changes the risk profile of this work, and the harm posed.

Further contributing to the risk profile for ELV solar panels is that unlicensed individuals may lack specialist technical knowledge in how to comprehensively manage electrical safety risks. Technological developments, which allow a variety of ELV equipment to be combined, heighten this risk.

Work on solar farms includes establishing the solar farm initially, by locating, mounting, fixing and connecting solar panels, as well as ongoing maintenance and, finally, disconnection. The electrical aspects of a solar farm pose a number of specific risks; exemplified by several incidents that have affected workers at solar farms in Queensland.

Where defective or unsafe work, including the installation of defective equipment, is undertaken at the construction stage of the solar farm, an increased risk is posed to those workers completing maintenance. This risk of harm therefore extends beyond electrical workers to labourers undertaking maintenance. These risks can lead to electric shock, arc flash, and fire, which can ultimately result in injury, death and damage to property and equipment.

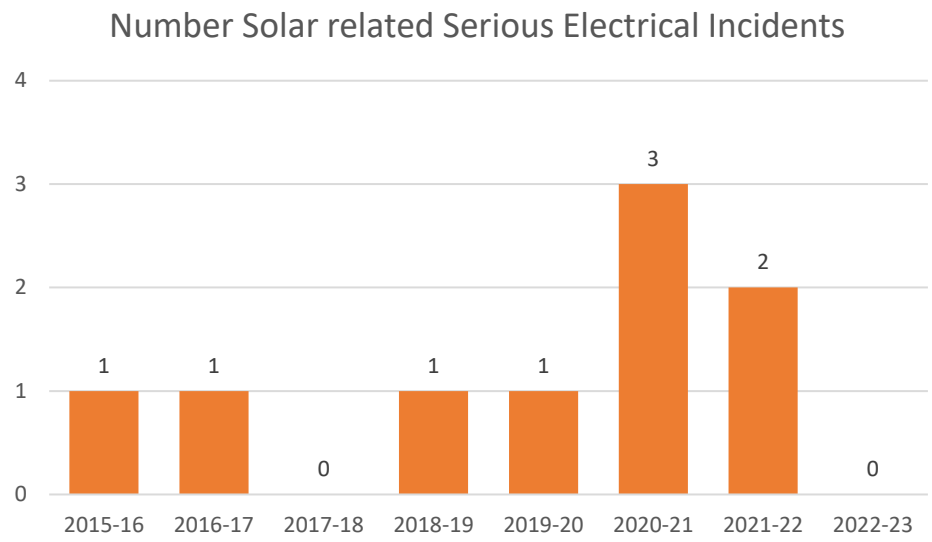
In the case of rooftop solar, unsafe work or defective equipment can expose the community to these risks.

The risks are comparable to those seen in a traditional electrical installation, such as that of the switchboard, wiring, lighting, socket outlets and other electrical equipment permanently connected for a house or residential unit. These traditional installations are captured within the scope of the ES Framework under the definition of 'electrical installation' and therefore receive additional regulatory oversight.

Since 2015-16 there have been nine SEI relating to solar installations (refer Figure 6).[16]

[16] Electrical Safety Office SEI Data 2015/16 to 2022/23.

Figure 6: Solar related SEIs in Queensland



Source: Office of Industrial Relations: Electrical Safety Office

These figures do not include incidents outside of the legislative definitions (and therefore the reporting requirements) of a 'Dangerous Electrical Event' or 'Serious Electrical Incident'. The definition of these terms is linked to the definition of 'electrical equipment' and therefore to equipment at LV or HV (but not ELV).[17] As such, the ESO may only become aware of an incident involving ELV where the incident is very serious or causes a fatality.

As an example, in 2021, a homeowner was changing and reconfiguring solar panels when fatally electrocuted. While this incident was reported, due to the solar panels operating at ELV, it did not meet the definition of a 'Serious Electrical Incident'. This incident highlights the risk posed by the energy stored in ELV equipment and the seriousness of the consequences, including injury and death.

The ESO is only notified of incidents relating to renewable energy technologies, such as solar installations, where the incident arises from 'electrical equipment'. Incidents arising from equipment that falls outside of the current definition of 'electrical equipment' are not currently notifiable. As an example, in the first quarter of 2023 in the Gold Coast and Ipswich regions of Queensland, ESO Electrical Safety Inspectors have responded to five separate incidents involving smart meters connected to solar PV installations. These incidents involve an equipment failure that resulted in a loss of energy supply, damage to property (through fire) and electric shock to occupants. These renewable energy installations range in age from being established between 2019 to 2022.

Knowing that these risks arise and that the current ES Framework is limited in its ability to encapsulate these risks gives rise to the question of the most appropriate measure for reducing or eliminating the potential for harm. Options are considered, below (Section 3.4 Discussion Paper Options).

Electrical installations

Reflecting the previously centralised energy generation landscape, the current definition of 'electrical installation' includes a criterion that an electrical installation 'can be supplied with electricity from the works of an electricity entity or from a generating source'. In practice, this creates an ambiguity where energy generation systems, such as solar farms, may be excluded from this definition as they are not 'supplied with electricity.' This may exclude solar farms from the regulatory requirements for electrical

[17] Sections 11 and 12 of the Act.

installations. As such, the definition of ‘electrical installation’ may need to be updated to accurately capture technologies now and into the future.

Where a solar farm has a generation capacity of 30MW or above, a generation authority would likely be gained through the Department of Energy, resulting in status as an ‘electricity entity’ under the Act. The ‘works’ of an electricity entity, being its electrical equipment and electric line-associated equipment (section 25 of the Act), are regulated by way of a duty to ensure the ‘works’ are electrically safe (section 29 of the Act). Solar farms are defined as having an operating capacity from 100kW. Where energy generation systems (such as solar farms) reach a generation capacity of 30MW, they reach the threshold to be a generating entity. While works of an electricity entity are excluded from the definition of ‘electrical installation’, there are a significant number of energy generation systems operating below 30MW that may not be captured by the ‘works of an entity’ or ‘electrical installation’ definitions.

The ES Framework sets out a series of duties and regulatory requirements for both electrical installations and the works of an electricity entity to ensure the safety of this equipment and those working on it. However, as indicated above, some emerging energy generation systems may fall outside of both definitions and therefore, outside of regulatory reach.

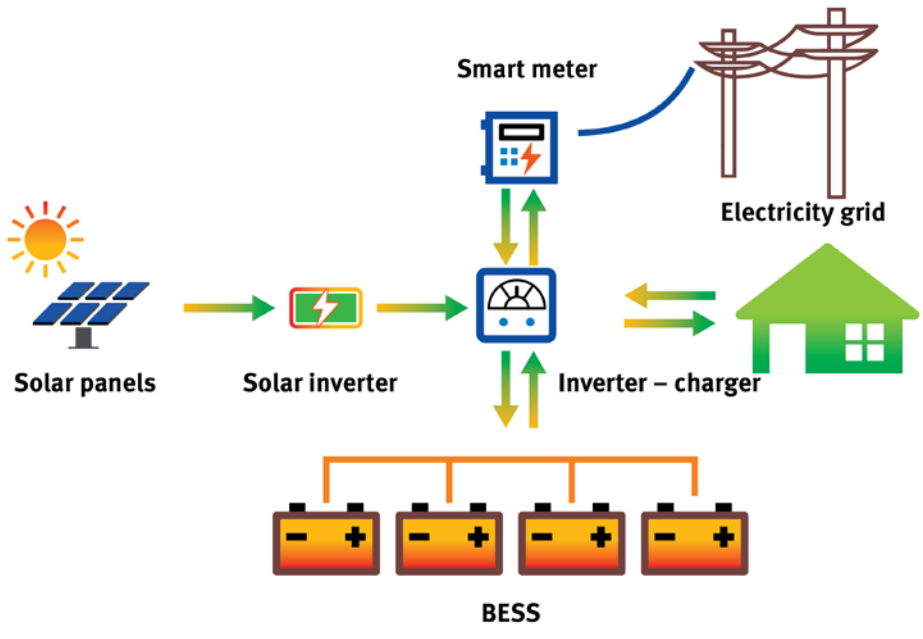
4.2.1.4 Battery Energy Storage Systems

Concurrent to the rise of solar and other renewable energy generation technologies is the growth in uptake of BESS. These systems consist of one or more batteries that store electrical energy for later use. These systems are a cost-effective way to store energy generated by solar and other renewable sources. Varying in size from small domestic systems designed to store energy produced from solar rooftop installations to commercial systems linked to large energy generation operations, such as solar farms, these systems are becoming increasingly common in Queensland. They can operate at ELV or LV.

As ELV systems do not meet the definition of ‘electrical equipment’, the ESO is unable to apply the current regulatory framework which covers electrical equipment, electrical work, electrical workers, and installations and the Minister is unable to mandate a recall on defective equipment.

As the installation is not subject to development or building approvals, the quantity and location of BESS in Queensland is unknown. However, it is understood that BESS are widely used, with the potential to therefore impact many members of the community. Figure 7 depicts an example of a BESS arrangement, in this case connected to solar as the generating source.

Figure 7: BESS arrangement



Source: Office of Industrial Relations

Much like the emergence of solar PV technology, the rise of BESS has been a significant change for the workforce and the community. Renewable energy targets and financial benefits for installing BESS are likely to drive further transformation.

Workforce and community interactions

Potential impacts for community and workforce begin at the supply chain, where the demand for this technology has opened opportunities for design, manufacture, supply and importation.

Beyond the supply chain, a workforce has also emerged that installs BESS. Installation includes the locating, mounting and fixing of the technology, in addition to the connection of an inverter and connection to form an electrical installation as well as generation technology, such as a solar PV array as depicted in Figure 7.

Naturally, BESS requires maintenance and, at the end of its life, disconnection, removal and disposal. These emerging areas of work will continue to expand as technology ages and reaches the end of its life.

The community also has a growing interaction with BESS through its increased presence in residential settings, in community precincts and in workplaces. This increased interaction can amplify the risks posed by this equipment.

Electrical safety risks and incidents

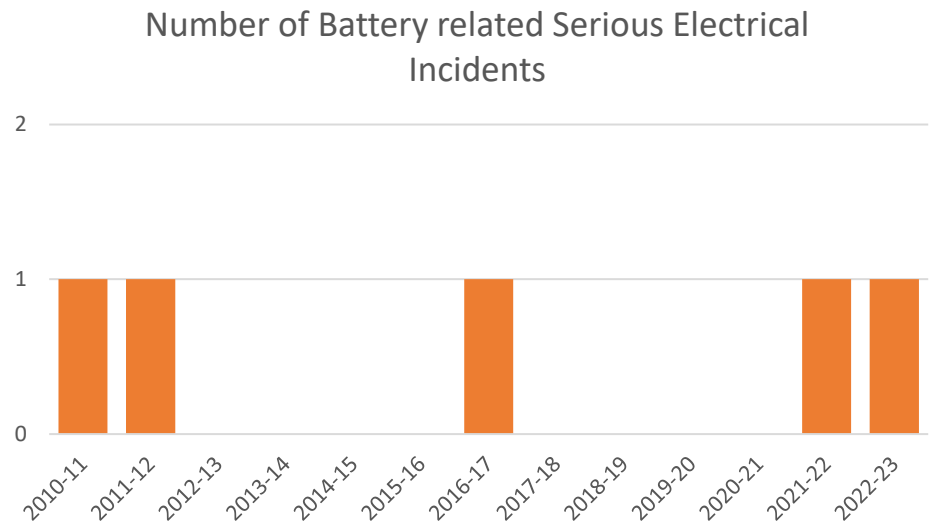
BESS can have significant energy storage capacities, and pose potential risks that lead to fire, explosion flash (sudden uncontrolled release of the stored energy creating arc flash risk (even at ELV)), exposure to hazardous chemicals and/or electric shock.

Without adequate maintenance of a BESS and replacement of aged parts, the risk of harm occurring through fire increases.[18] This risk of harm is increased where there is defective equipment, or interference with the equipment results in damaged parts. Work on this equipment can pose a risk of electric shock, arc flash or exposure to hazardous chemicals. The growing presence of BESS in the community means there is the potential of increased exposure of people to the risks. From 2010-2011, there were five SEIs (under the current ES Framework) relating to batteries (see Figure 8 below).[19]

These SEIs include BESS, battery charging devices and batteries connected to electricity for an uninterrupted power supply. This data is limited by the current ES Framework, where incidents involving ELV are not captured.

[18] Electrical Safety Office. (2023). Battery energy storage systems. Retrieved from Electrical safety: https://www.electricalsafety.qld.gov.au/electrical-safety-home/battery-energy-storage-systems
[19] Electrical Safety Office SEI Data 2010/11 to 2022/23

Figure 8: Battery related SEI in Queensland



Source: Office of Industrial Relations – Electrical Safety Office

The Australian Competition and Consumer Commission (ACCC) recently urged consumers to check whether their LG, SolaX or Opal home energy solar systems utilise LG solar energy storage batteries which are under recall.[20][21] The ACCC recall required electrical safety regulators across Australia to investigate the safety of the equipment and take suitable actions to reduce the risk. The LG battery equipment had various models, some operating at LV and some operating at ELV. The basis for the recall was concern around the potential for fire. In a written submission responding to the Electrical Safety Act 2002 Review, the ACCC further highlighted the dangers and incidents associated with ELV batteries (refer Box B).

[20] Australian Competition & Consumer Commission. (2022, 11 21). ACCC warns consumers about potentially deadly solar batteries. Retrieved from Media Releases: https://www.accc.gov.au/media-release/accc-warns-consumers-about-potentially-deadly-solar-batteries#:~:text=The%20batteries%2C%20which%20may%20be,associated%20with%20the%20faulty%20batteries.

[21] Queensland Government. (2023, 10 06). Recall of LG Energy Solution Australia Pty Ltd ESS Home Energy Storage System Batteries. Retrieved from WorkSafe.qld.gov.au: https://www.worksafe.qld.gov.au/safety-and-prevention/hazards/electricity/electrical-products-and-equipment/electrical-product-recalls/recall-of-lg-energy-solution-australia-pty-ltd-ess-home-energy-storage-system-batteries#:~:text=Recall%20of%20LG%20Energ

Box B: ELV Battery Incident Data

ACCC submitted the following:

> "Since October 2019 there have been 12 reported incidents associated with recalled batteries in Australia. Of these, nine (9) have occurred in the initial voluntary recall batteries and the latest three (3) have occurred in batteries that had a software fix applied to address safety issues. In October 2021, one incident involving a software fix of a recalled battery resulted in the complete destruction of a property in Victoria."
>
> "A catastrophic lithium-ion battery failure can result in a fire event, as has occurred in several jurisdictions. In response to the ACCC's Lithium-ion Batteries Issues Paper (Issues Paper), a submission from Queensland Fire and Emergency Services (QFES) indicated there were 157 recorded fires between 1 July 2021 and 17 January 2023 caused by lithium-ion batteries. QFES also noted there is a strong possibility that this figure is underreported due to the difficulties involved in determining the exact cause of fires. While extra low voltage equipment may have a different risk profile to other equipment, they raise serious safety concerns."

To reduce the risk of similar incidents in the future, it is important to consider the scope of the current ES Framework and consider the most appropriate measures to control risks and reduce, or eliminate, the potential for harm. Options are considered, below (refer Section 4.4).

4.2.1.5 Rechargeable ELV battery packs[22]

Technological advancements have also seen rechargeable ELV battery pack technology develop and become more widely used. This newer form of rechargeable ELV battery pack technology enables greater energy storage, even when operating at ELV. In contrast, small, removeable batteries, such as AA batteries, have limited energy density/storage and are an example of ELV equipment that does not pose an electrical safety risk that requires consideration of a regulatory response by government.

The growth of rechargeable ELV battery packs has seen applications proliferate, including by use of rechargeable ELV battery packs in e-bikes, e-scooters, robot vacuum cleaners, garden tools and power tools. While some of the supply of rechargeable ELV battery packs (including the design and manufacture of equipment) occurs in Queensland, there is also a significant proportion of product coming from outside of Queensland and Australia.

Electrical safety risks and incidents

High-capacity batteries (of multiple battery cells) contain significant energy that, if released in an uncontrolled manner, can lead to explosion and fire.

Notably, there are categories of equipment containing lithium-ion battery packs that are commonly exposed to trauma which requires consideration given that this can lead to a higher risk of explosion, fire and the leaking of hazardous chemicals.

More specifically, there are several factors that are understood to have already led to incidents, including:

- Continuously charging once the battery charge is at capacity
- Getting the battery pack wet
- Battery packs getting damaged
- Using a different charger than the one supplied with the product.

[22] Note: references to 'rechargeable ELV batteries' have been amended to "rechargeable ELV battery packs".

Risks have been evidenced by media reports on explosions and fires associated with e-scooters (battery packs).[23] At the most extreme end of the spectrum, a rechargeable ELV battery pack was associated with a tragic fatality in Queensland in March 2022, where a person died as a result of burns from an e-scooter lithium-ion battery fire that spread to a caravan. In January 2023, it was reported that in the six months prior, Queensland firefighters had been called to 24 house fires linked to lithium-ion batteries, with 48 callouts in 2021-22. These incidents are not captured by the existing ES Framework due to the current ELV exclusion, despite the clear electrical risk.

Contributing to the contemporary ELV equipment risk landscape is the increase in cheaper products on the market that are sometimes of poor quality. Purchasing these products online rather than in stores can make it difficult for consumers to be as informed about the safety of these products.

4.2.1.6 Connected ELV equipment

A further contributor to the potential for harm is the rise of consumers purchasing ELV equipment online and connecting and using multiple pieces of equipment together, based on advice or instruction from social media.[24] In doing so, these individuals may elevate the voltage of the installed equipment above ELV or have modified the equipment for a use not intended by the manufacturer. In both situations, there is a risk of shock if the work is not performed correctly, or events of fire, burns or explosion and arc flash. This poses risk to both persons and property. Foundational causes of this include both the competency of those connecting the equipment, the accessibility of incomplete information online and the accessibility of poorly manufactured or defective ELV equipment online.

These risks and limitations with the current ES Framework give rise to the question of the most appropriate measure to control risks and reduce or eliminate the potential for harm. Options are considered, below (Section 3.4 Discussion Paper Options).

Interjurisdictional analysis

Across Australia, the regulation of electrical safety has many similarities, however, it is not a harmonised framework.

The model Work Health and Safety Regulation 2011 (model WHS Regulation), coordinated by Safe Work Australia, has been adopted by several states. The model WHS Regulation contains a part on electrical safety (Part 4.7). While the regulation of electrical safety is therefore to some degree uniform, even model jurisdictions depart in places from the model WHS Regulation and/or regulate electrical safety in other legislation. Queensland, while maintaining a framework with many similarities to those contained in the model WHS Regulation, departs from the harmonised approach through the establishment of a standalone ES Framework that includes a dedicated Act and Regulation that goes beyond the workplace context.

The EESS operates in participating jurisdictions across Australia and New Zealand. The EESS is expected to be reviewed in the near future. Should ELV equipment be included in the scope of the EESS, it may still not apply in Queensland under the current ES Framework, as the current definition of electrical equipment commences at LV.

In relation to electrical equipment, Victoria is currently the only jurisdiction in Australia to have ELV equipment in scope for electrical safety legislation. However, in November 2022, New South Wales also issued a Discussion Paper on the statutory review of the *Gas and Electricity (Consumer Safety) Act 2017* (NSW), which sought feedback on a proposal for NSW to regulate ELV equipment. This

[23] Brewster, A. (2023, 01 17). Second e-scooter house fire in a week leaves four Ipswich residents in hospital. Retrieved from ABC News: https://www.abc.net.au/news/2023-01-17/e-scotter-fire-ipswich-four-in-hospital/101863568
Shine, R. (2023, 01 18). Concerns over growing number of fires linked to lithium-ion batteries in e-scooters and e-bikes. Retrieved from ABC News: https://www.abc.net.au/news/2023-01-18/e-scooter-lithium-battery-fire-risk-fears-/101863902
[24] Battery BACKUP for Home - DIY Step by Step. (n.d.). Retrieved from YouTube: https://www.youtube.com/watch?v=BzMAW8kW0CU
Do It Yourself Solar Power? - Easy DIY Solar Panel Installation! (n.d.). Retrieved from YouTube: https://www.youtube.com/watch?v=jSa1tvrrFZg

proposal was made in response to industry concern over potential safety risks in some ELV equipment. Similar concerns were raised in Queensland's review. The NSW Discussion Paper also proposed an amendment to the definition of 'electrical equipment' to include 'a battery or energy storage system, operating at any voltage, which is used to supply an electrical installation'.

Furthermore, the NSW Discussion Paper raised the definition of 'electrical installation'. The paper discussed changes to the definition of 'electrical installation' to include generation, and ultimately to require people working on solar and wind farms to hold an electrical licence or be supervised by a person holding a licence.

Box C: Outcomes/findings from the NSW Discussion Paper

Feedback in response to the 2023 NSW Review Statutory Review of the *Gas and Electricity (Consumer Safety) Act 2017* opposed regulating all ELV equipment under the framework, citing the regulatory burden as disproportionate to the inherent risk posed by ELV equipment. However, the Review Report did recognise that some ELV equipment using higher energy density supplied from internal batteries or specific rechargeable battery packs can pose a fire risk.

Accordingly, the Review Report made several recommendations in relation to definition of 'electrical equipment', including to capture high-risk ELV equipment where needed, also proposing the scope of the Act should be increased to enable the Secretary to declare any ELV equipment as high-risk where needed.

The Review Report also found a number of opportunities to refine and future proof definitions relating to the "electrical work" definition, these included "electrical equipment" and "electrical installation". Further recommendations were made to address these opportunities.

In the Australian Capital Territory, under the *Electrical Safety Act 1971* (Act), generation technology is captured under the existing definition of 'electrical installation'.

Box D: ACCC lithium-ion report

In December 2022, the ACCC released an issues paper scoping product safety issues and potential hazard prevention strategies in relation to lithium-ion batteries.[25]

The ACCC received 74 submissions to the issues paper from manufacturers, consumer advocates, individual consumers, testing and certification agencies and government agencies.

The Lithium-ion batteries and consumer product safety - Report has now been published by the ACCC and makes several recommendations aimed at improving lithium-ion battery safety outcomes for consumers, including through electrical safety regulation.

4.3 Objective of government action

The overall objective of the Queensland Government in relation to electrical safety under Topic 1 is to:

- Reduce the risk of exposure to electrical risk for industry and the community posed by new and emerging electrical technologies while minimising regulatory burden.
- Ensure the ES Framework can remain responsive and withstand the emergence of new technologies.

[25] Australian Competition & Consumer Commission. (2022, December). Lithium-ion Batteries - Issues Paper. Retrieved from https://consultation.accc.gov.au/accc/lithium-ion-batteries-issues-paper/

- Encourage technological growth and innovation, particularly of electrical technology contributing toward government renewable energy targets while maintaining an effective and efficient ES Framework, preventing risk to life and property.

4.4 Discussion Paper Options

The Discussion Paper sought feedback on three options that proposed to meet government objectives and respond to problems identified for the 'electrical equipment' and 'electrical installation' definitions. These options are presented within Table 6.

Table 6: Overview of options under Topic 1

Topic 1 Options	Description
Option 1	**Status Quo (Base Case):** • No legislative change – emerging technologies continue to be regulated as they are currently, which is with some falling outside of the ES Framework.
Option 2	**Legislative Change:** <u>Electrical Equipment</u> Incorporate particular ELV equipment as prescribed in the Regulation within the definition of 'electrical equipment'. Under this option individual ELV equipment would be assessed as and when items are added to the schedule, on the basis of risk and complexity of tasks. Examples of items identified on the basis of risk includes: • Solar PV panels (when connected to be above ELV) • Solar on caravans • BESS • Battery packs. <u>Electrical Installation</u> • Incorporate energy generation and storage systems (e.g., solar farms) within the definition of 'electrical installation'.
Option 3	**Increase education and awareness, including:** • Increased government communication and engagement with electrical workers, electrical contractors, PCBUs, unlicensed workers, and the community, on risks of emerging technologies and approaches to risk management • Queensland Government promoting standards and training development • Queensland Government providing homeowner guidance as relevant.

4.5 Results of Discussion Paper consultation

To inform decision making on Topic 1, stakeholders were asked a series of questions included in the Discussion Paper concerning:

- The identified problems and the associated impact on stakeholder activities
- Stakeholder views on a licensing regime and their preferred options (if any) for reform.

Questions pertaining to Topic 1 are outlined in Box E.

Box E: Topic 1 Discussion Paper questions

- How are you, your organisation or your stakeholders affected by the problems identified and to what extent?
- Do you agree with the assessment of the problem identified, and are there any other elements to the issue that you think have not been captured? If yes, what are they and can you provide examples of these issues?
- What practical impact in the form of benefits would the options proposed in the Discussion Paper have on you, your organisation, the workforce or the community? Please provide examples, where possible, including for new and emerging technologies and ELV equipment.
- What practical impact in the form of costs would the options proposed in the Discussion Paper have on you, your organisation, the workforce or the community? Please provide examples, where possible, including for new and emerging technologies and ELV equipment.
- What is your preferred option for the various ELV discussed and why will it be best for you, your organisation and your stakeholders?
- If you prefer Option 1 (Status Quo), how would the potential electrical safety risks of newer ELV technologies be minimised or eliminated?
- Do you have suggestions for other options to address the problems identified? Please provide examples (including costs, where appropriate) of your suggested options, including how it would ensure the workforce are electrically safe and conduct electrically safe work for community safety.
- Are you aware of evidence of the dangers of particular forms/categories of ELV equipment? If so, what evidence is available?
- Should certain ELV equipment be included in the scope of the Act's regulatory reach that are not currently covered?
- What approach to including ELV equipment within the scope of the ES Framework should be adopted in Queensland?
- Should a measure of energy density/capacity be adopted? If so, which measure and what amount (e.g., how many watts per hour)?
- Are you aware of evidence of the dangers of particular forms/categories of ELV equipment? If so, what evidence is available?

Reponses to these questions and additional comments in the submissions determined the support or opposition for each option among the different categories of stakeholders.

It should be noted that submissions were nuanced in nature and many stakeholder positions were provided alongside conditions and caveats. Common caveats provided for Topic 1 include the following:

- Support for legislative change only when ELV equipment is connected together (i.e., solar panels connected in an array) and if voltage levels exceed the current ELV threshold.
- Support for legislative change with the caveat that options are further refined to ensure there are no unintended consequences.
- Support for legislative change on the condition that clearer definitions of the proposed changes are provided, and requirements are proportionate to risk.
- Support for a combination of options (i.e., a hybrid option in which Option 2 in combined with Option 3).
- Support for legislative change assuming that all ELV equipment is captured with an exclusion approach for low risk ELV equipment.

Table 7 provides a high-level overview of stakeholder support for each option under Topic 1. The table captures the stakeholders' overarching position based on the overall sentiment provided in their submissions. It should be noted that some stakeholders provided their opinion on the proposed options but did not directly state a preferred option.

Table 7: Stakeholder alignment to options

Topic 1- Electrical safety considerations of new and emerging technologies			
Option 1 – Status Quo	Option 2 - Legislative change	Option 3 – Awareness and Education	Preferred Option not indicated
• Individual- licensed electrical worker (1) • PCBU (1) • Government Department or Regulator or Statutory Agency or Authority (1)	• Union (1) • Peak body (7) • Prescribed electricity entity (3) • Government Department or Regulator or Statutory Agency or Authority (7) • Non-prescribed electricity entity (1) • Individual (2) • Individual - electrical contractor (1) • Electrical contractor (1) • Skills and training organisation (1) • Advocacy group (1) • Metering services (1) • PCBU (1)	• Individual (2) • Skills and training organisation (1) • Non-prescribed electricity entity (1) • PCBU (1) • Prescribed electricity entity (1) • Advocacy group (1)	• PCBU (2) • Individual (2) • Government Department or Regulator or Statutory Agency or Authority (2) • Peak body (1)
Total: 3	**Total: 27**	**Total: 7**	**Total: 7**

As presented above, the majority of stakeholders responding to Topic 1 were broadly in support of some legislative amendment to the definition of 'electrical equipment' (i.e., Option 2).

The thematic analysis identified common themes and specific arguments expressed by stakeholders. Common themes relating to each option under Topic 1 are summarised in Table 8.

Table 8: Topic 1 identified themes

Option 1	Option 2	Option 3
• Maintaining the Status Quo (Base Case)	• Update to definitions of 'electrical equipment' and 'electrical installation' • Other items to be considered alongside the implementation of Option 2 • Consideration of the safety of other ELV products • Suggested approach to combine Options 2 and 3 (hybrid option)	• Investment in education and awareness will be of benefit

In general, the thematic analysis identified the following insights for each option:

- **Option 1:** A small number of written submissions directly corresponded to maintaining the Status Quo (no regulatory change). Three respondents expressed support for maintaining the Status

Quo, and five respondents indicated an opposing point of view. The small number of excerpts opposing the Status Quo may indicate support for the need to address the risks associated with new and emerging technology.

- **Option 2:** A significant number of submissions relating to Option 2 expressed support for some form of expansion of the definition of 'electrical equipment' and 'electrical installation'. A substantial number of considerations were suggested alongside the implementation of Option 2, as well as a hybrid approach combining Options 2 and 3.
- **Option 3:** A small number of submissions made reference to the option for investment in an education and awareness initiative / campaign. A small number of submissions also provided caveats alongside their general support for education and awareness.

The overall positioning of stakeholders, as well as the themes identified for each option, have been used to validate the option structure presented within the Discussion Paper. Based on these insights, the suitability of options identified through the Discussion Paper are discussed in the following section.

4.6 Changes to options raised during consultation

In general, stakeholders aligned their feedback to the three options presented in the Discussion Paper and presented overall support for legislative change in response to electrical safety risks of new and emerging technologies. As such, the Economic Analysis on Topic 1 (refer Section 4.7) is, for the most part, based on the option structure proposed in the Discussion Paper.

The ACCC proposed an approach that all ELV equipment should be captured in the ES framework then excluded by regulation where risk profile was not commensurate. This approach was discounted on the basis of regulatory burden, and high risk of unintended consequences burdening the Queensland community.

As outlined above, some submissions presented an argument for a combination of Options 2 and 3. There is a likelihood that any legislative change will be supported by some level of Queensland Government-led education and awareness campaign. As such, the impacts associated with education and awareness will be considered within the economic analysis of Option 2. It should also be noted that some submissions regarding Topic 1 presented the argument that e-scooters and e-bikes should be considered within the Act. The economic analysis also gives consideration to these technologies. In particular, the risks associated with battery packs including lithium-ion batteries are evaluated within the analysis.

4.7 Economic analysis

Methodology and approach

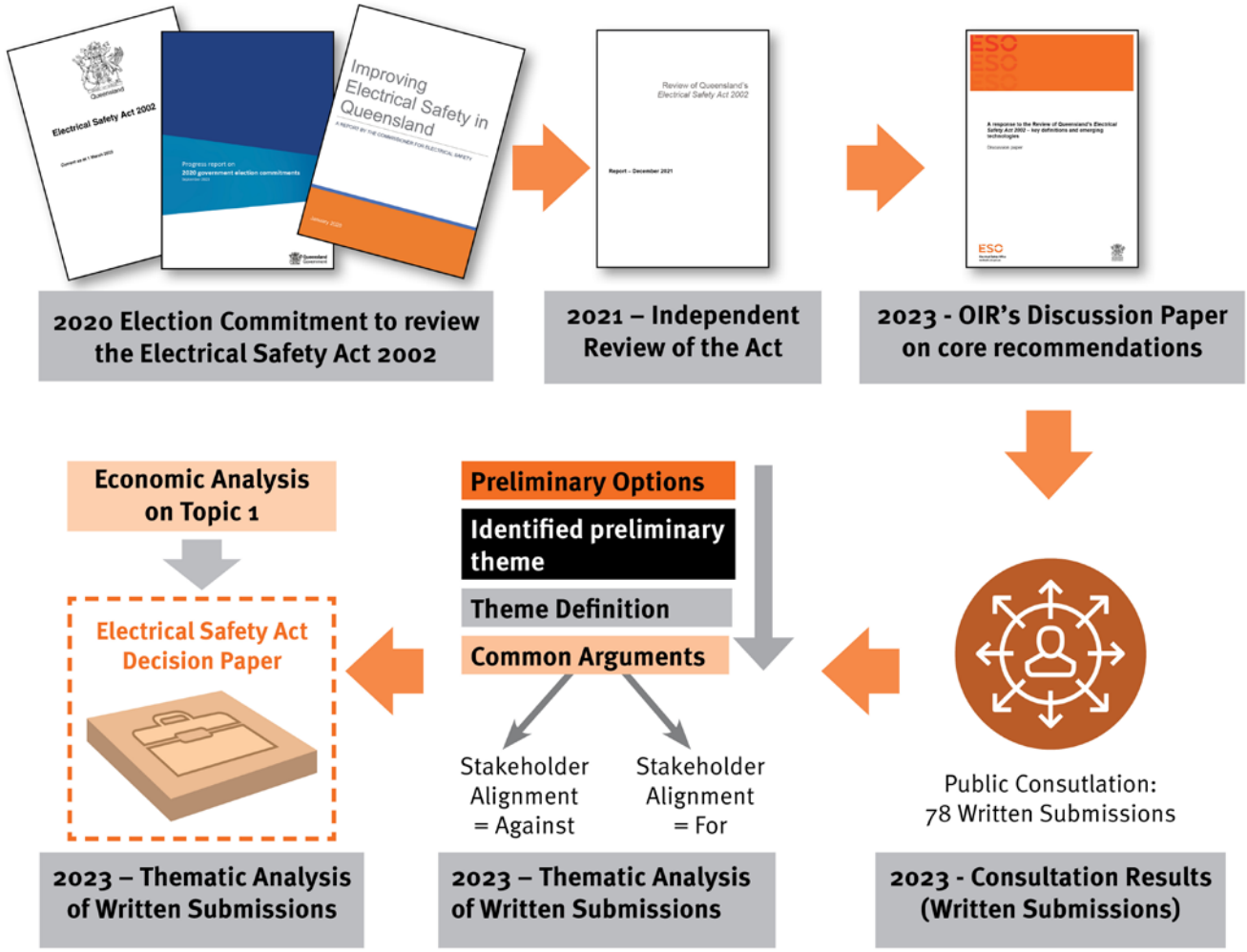
4.7.1.1 Purpose

The purpose of this economic analysis is to support this Decision Paper in robustly evaluating the options set forth in response to electrical safety related risks of new and emerging technology (Topic 1) identified within the Discussion Paper.

This analysis builds on previous investigations and extensive consultation activities to support the Queensland Government decision-making process.

Figure 9 presents a timeline of activities, studies and investigations since the 2020 election commitment to review the Act and how these have led to the development of this Discussion Paper and its economic analysis.

Figure 9: Discussion Paper pathway - previous studies and investigations



As noted in Section 4.5, following extensive consultation and analysis, the thematic analysis on the written submissions identified that an economic analysis should be undertaken on *Topic 1 Electrical safety considerations of new and emerging technologies.*

The economic analysis that follows provides an evidence base and narrative of the economic costs and benefits to be realised by the three options proposed as part of this Discussion Paper.

4.7.1.2 Community of interest

The first step in conducting the economic appraisal is to define the community of interest, and to identify the potential bearers and beneficiaries of the incremental benefits and costs that lie within the community of interest, as well as those that fall outside it.

The community of interest for the purposes of this appraisal is Queensland, including:

- Queensland-business
- Queensland workforce
- Queensland residents
- The Queensland Government.

This is in line with the Queensland Government Better Regulation Policy (QGBRP) [26], the methodology of which stipulates that economic agents outside of Queensland who are bearers / beneficiaries of the Project's impacts are not included in the community of interest.

4.7.1.3 Economic analysis limitations

While every effort has been made to provide a comprehensive assessment of the economic impact of Topic 1, there are some inherent limitations of the analysis that must be considered, including the:

- Difficulty ascertaining the magnitude of the electrical safety risk posed by the emerging technologies under consideration
- Lack of data pertaining to the number of unlicenced workers currently completing tasks related to the emerging technologies under investigation
- Uncertainty regarding the magnitude and causality of any potential impacts related to education and awareness
- Incomplete / insufficient data pertaining to serious and non-serious electrical incidents.

Due to the limitations noted above, it is not possible to undertake a robust and defensible quantitative analysis. As a result, the economic analysis has adopted a largely qualitative approach which follows leading frameworks, drawing upon quantitative insights where feasible and relevant.

These elements lent support to the conclusion that was ultimately drawn which was that legislative amendment needed to be made in such a way that a span of possible regulatory approaches was possible depending on risk.

Project Options

As outlined in Section 4.6, there are three options being considered within the economic analysis of Topic 1. These are presented in Figure 10.

Figure 10: Overview of Topic 1 Options

Option 1 **Status Quo (Base Case)**	The Base Case reflects the Status Quo. More specifically, the Base Case represents a scenario in which there is no legislative change. Emerging technologies (i.e., solar PV, BESS, batteries, etc.) will continue to be regulated as they are currently and will continue to not be included in the ES Framework.
Option 2 **Legislative Change**	Option 2 includes the scenario in which the Act is amended resulting in particular ELV equipment captured within the definition of 'electrical equipment'. These include: • Solar PV panels (when connected in arrays to be above the ELV threshold) • Solar PV panels on caravans • BESS • Battery packs. The Act will also incorporate energy generation systems (e.g., solar farms) within the definition of 'electrical installation'.
Option 3 **Education & Awareness**	Option 3 will see increased Queensland Government communication and engagement with electrical workers, electrical contractors, PCBUs, unlicensed workers, and the broader community, on electrical safety risks of emerging technologies and approaches to risk mangement. In addition, the Queensland Government will promote standards and training development and provide homeowner guidance as relevant.

[26] More information available at: https://www.treasury.qld.gov.au/queenslands-economy/office-of-productivity-and-red-tape-reduction/regulatory-review/. Last accessed on 8 October 2023.

Identification of economic benefits and costs

The economic impacts associated with Options 2 and 3 under Topic 1 were identified in line with the QGBRP. These economic benefits and costs, as well as the stakeholder groups impacted by them, are presented in Figure 11 and Figure 12 below.

Figure 11: Economic impacts associated with Topic 1 Option 2

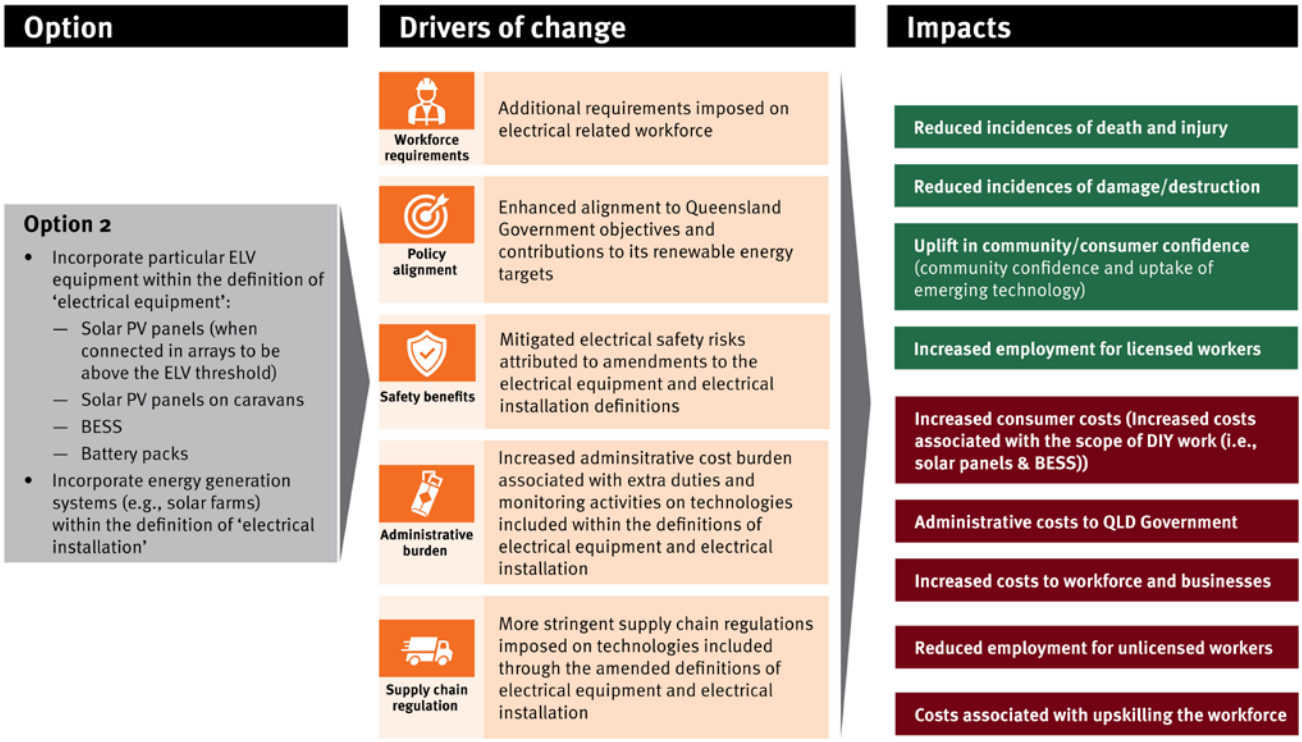
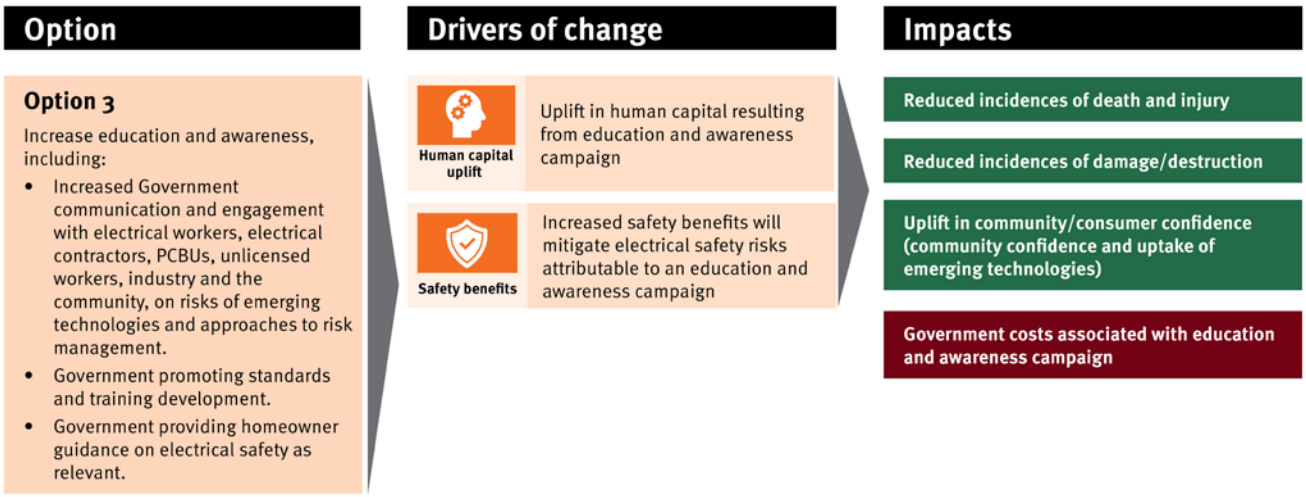


Figure 12: Economic impacts associated with Topic 1 Option 3



The abovementioned economic costs considered in the economic analysis are further detailed in Table 9.

Table 9: Economic costs

Costs	Description	Monetised
Community		
Increased consumer costs	Overall, it is anticipated that costs associated with completing work on the technologies captured by the ES Framework will increase. Incorporating certain definitions of emerging technologies within the Act will reduce the remit of unlicensed workers and limit DIY work on 'electrical equipment' within the community. In addition, a raft of costs borne by licensed electrical workers, PCBUs and industry in general may be passed on to consumers through higher prices.	No
Workforce and Businesses		
Costs associated with upskilling the workforce	The proposed amendments to the Act will enforce new legislative requirements on businesses and the workforce. Unlicensed workers will be required to undertake additional training and long-term apprenticeships (on average four years) to obtain appropriate licensing and other requirements. This will be necessary to fulfil new legislative requirements to be able to perform any work related to 'electrical equipment' and 'electrical installations' which would be captured under the Act. Unlicensed workers seeking to upskill in response to changes in the Act will also bear the costs relating to forgone income while attending the abovementioned training and long-term apprenticeships.	Partially
Increased business and workforce costs (administrative)	The proposed amendments to the Act will result in higher compliance and administrative costs to businesses and the workforce (this includes time spent on administrative tasks).	No
Government		
Increased administrative costs to Queensland Government	Amending the Act will result in increased Queensland Government administrative costs resulting from increased levels of licensing. These costs are due to assessing a higher level of applications for registrations or licences, compliance and audit activities, investigating complaints against electrical workers, disciplinary activities, data collection and management, processing transactions and information and engagement activities.	Partially
Costs associated with education and awareness campaign	Increase in costs associated with implementing and maintaining industry and community education and awareness campaigns to disseminate information regarding electrical safety and new legislative requirements (e.g., media, promotion, resources, etc.).	Yes

The economic benefits which are being considered in the economic analysis are defined in Table 10.

Table 10: Economic benefits

Benefits	Description	Monetised
Reduced incidents of death and injury	Reduction in the occurrence of injury and loss of life associated with the technologies to be included in the revised definitions of electrical equipment and installation.	No

Benefits	Description	Monetised
Reduced incidents of damage / destruction	Reduction in the occurrence of damage and destruction to property and equipment associated with the technologies to be included in the revised definitions of electrical equipment and installation.	No
Uplift in community / consumer confidence	Fewer incidents of faulty work and injury as well as increased knowledge and awareness related to the technologies in question will generate an uplift in consumer confidence, thereby accelerating Queensland Government's uptake of new and emerging renewable technology.	No
Increased employment for licensed workers	Amendments to the definitions of electrical equipment and electrical installation will expand the scope of what is defined as electrical work. In doing so, legislative change will increase demand for licensed electrical workers.	No

Assessment of costs: Option 2

Option 2 proposes to expand the definition of 'electrical equipment' to incorporate particular forms of ELV equipment within the definitions where there is a demonstrated risk to persons or property (such as energy generation technologies (Solar PV modules), Battery Energy Storage Systems and battery packs (such as lithium-ion batteries)).

It is intended that that individual ELV equipment would be assessed as and when items are prescribed in the Regulation, on the basis of risk and complexity of tasks. Therefore, a threshold of risk would be established for any items prescribed to ensure the regulatory levers applied are appropriate.

Option 2 also proposes to expand the definition of 'electrical installation' to incorporate new and emerging energy generation systems (including solar farms).

This section provides an analysis of the costs outlined in Table 9. It is important to reemphasise that the analysis is largely qualitative due to the nature of the proposed amendments to the Act.

4.7.1.4 Consumer costs

Regulatory compliance costs associated with the implementation of the proposed legislative changes may impact households (consumers) by increasing the prices of goods and services. In other words, additional costs borne by licensed electrical workers and businesses are likely to be passed on to consumers in response to legislative change. These additional costs may be a result of (but not limited to):

A reduction in the scope of what can be performed as DIY work by community members.

This will lead to community members seeking appropriately qualified electrical workers to undertake work previously completed on a DIY basis.

While the reduction in the scope of DIY electrical work by community members will result in the increased safety of individuals and their homes from potential electrical hazards, the community will bear additional costs as a result. This means that, in order for certain electrical work to be completed, it must be performed by a suitably qualified electrician (licensed and insured to do so). This includes installing, repairing, or replacing any electrical components associated with the emerging technologies.

Currently, work on equipment which falls outside of the 'electrical equipment' definition can be performed by unlicensed electrical workers, businesses, labourers, and community members. The legislative changes associated with Option 2 will impact how work on 'electrical equipment' and 'installations' are performed and regulated. Examples of work which can currently be completed by unlicensed individuals include:

- Mounting or connecting ELV solar panels together

- Disconnecting solar panels disposing of BESS, rechargeable battery packs
- Specific maintenance activities related to solar panels.

Generally, the average expense associated with a licensed electrical worker is higher than that of an unlicensed worker. The median weekly income for technicians and trades workers was comparatively higher at $1,300 compared to $810 for labourers in 2022.[27] As such, consumers will incur an increase in costs for work which is captured within the expanded remit of the Act.

A general increase in the price of products due to industry (businesses and workforce) complying with stricter regulation and oversight (new licensing requirements, higher/enhanced compliance and administrative costs, and other upskilling costs).

Compliance with regulations often requires businesses to invest in more expensive technology and processes in order to meet new standards and regulations. This may include purchasing new equipment, hiring additional staff, or implementing new protocols and procedures. In particular, businesses in the supply chain will need to ensure the import, design and manufacturing duties conform with the appropriate regulations and that 'electrical equipment', such as solar panels and BESS systems, are electrically safe prior to reaching the final consumer.

Generally, compliance of the proposed 'electrical equipment' would require additional reporting by electrical workers and businesses to the regulator related to the newly emerging technologies (which can trigger compliance promotion, inspection, and enforcement of activities by the regulator).

In addition, increased government regulatory oversight associated with Option 2 will likely result in additional operational costs to suppliers with the burden potentially being transferred to the final consumer. All of the aforementioned factors can have considerable financial impacts on businesses, which may be reflected in higher prices for consumers.

Regulations limiting the number of available competitors in a given market may lead to higher prices to final consumers. This is particularly relevant for businesses operating in the supply chain (importing, designing, manufacturing solar PV panels, BESS, wind farm components, etc.).

When there are fewer competitors, companies have less incentive to compete for market share and price. This can lead to scenarios where prices remain high due to less competition. If the regulations limit the number of companies offering a certain 'electrical equipment' or service then those companies can set their prices higher due to consumers having fewer options.

Regulatory taxes and fees being passed on to final consumers. Such taxes and fees can impact the cost of goods and services for final consumers, as businesses may pass on these costs. This means that consumers may end up paying more for the same products or services than they would without the taxes and fees.

Box F: Regulatory burden on consumers

Increased levels of regulation can generate income redistribution in the long term, particularly from consumers.

According to the Industry Commission[28], while some businesses do take on lower profit margins when complying to regulation, businesses (including contractors and sole traders) are likely to shift regulatory compliance costs to consumers through higher prices.

[27] Australian Bureau of Statistics. (2022, 12 14). Weekly earnings of employees, including distribution of earnings and hourly earnings, by State, Occupation, Industry and Qualifications. Retrieved from Employee earnings: https://www.abs.gov.au/statistics/labour/earnings-and-working-conditions/employee-earnings/latest-release#data-downloads

[28] Industry Commission (1997). *Reducing regulatory burden: does firm size matter?.* Available at: https://www.pc.gov.au/research/supporting/regulatory-burden-firm-size/regburd.pdf. Last viewed on 29 September 2023.

4.7.1.5 Costs associated with upskilling the workforce

The need to ensure that electrical workers are adequately trained and competent to carry out their work to ensure a higher level of electrical safety is of paramount importance. Not only does this benefit the Queensland workforce and the community, but the potential consequences of not doing so can be costly to the community, including raising the risk of death and serious injuries.

The proposed amendment to the Act under Option 2 would impose additional financial and economic costs on businesses and the workforce associated with upskilling and training. These costs would be associated with:

- Testing and registration of new licenses imposed on workforce (workers and contractors) and businesses who were previously unlicensed
- Licence renewal tests for licence holders (skills maintenance: workers are currently required to sit the licence renewal test within two years of licence renewal to ensure competency)
- Ongoing training and professional development for licence holders (i.e., Continuing Professional Development – currently not mandatory in Queensland). While not currently mandatory in Queensland, ongoing training and professional development relates to the continuous maintenance or enhancement of knowledge, skills and experience obtained through the successful completion of formal training.

The introduction of newly emerging generation technologies, systems and BESS into the Act would result in the workforce having a level of need to undertake ongoing additional training (upskilling). Ongoing training may involve both technical and non-technical skills required for carrying out professional and technical duties.[29]

The Queensland ES Framework presents six classes of licences for electrical work, including:

- **Electrical mechanic**: performs all electrical work
- **Electrical linesperson**: performs all electrical line work
- **Electrical fitter**: perform electrical equipment work
- **Electrical jointer**: performs limited specialist work including installing, jointing and terminating electrical cables
- **Restricted electrical work licence**: only performs specific electrical work associated with work from another trade or calling (such as plumbers or refrigeration mechanics)
- **Electrical work training permit:** only performs restricted work under specified conditions while being trained.[30]

Some form of training will be required for unlicensed workers who wish to obtain the requirements necessary to complete certain work on solar PV, BESS and rechargeable battery packs if Option 2 is implemented and the current licensing and electrical work framework is applied.

Table 11 provides a breakdown of the estimated cost and time associated with the obtaining the different electrical licenses relevant to the proposed regulatory changes.

[29] Regulatory Impact Solutions Pty Ltd. (2020). Electricity Safety (Registration and Licensing) Regulations 2020.
[30] Queensland Government. (2020, 05 29). Classes of licences. Retrieved from WorkSafe: https://www.worksafe.qld.gov.au/licensing-and-registrations/electrical-licences/classes-of-licences#:~:text=It%20is%20illegal%20to%20do%20electrical%20work%20in,of%20electrical%20equipment%20installing%20or%20repairing%20telecommunication%20cables

Table 11: Costs to obtain electrical licences in Queensland

License	Requirements for eligibility[31]	Approximate cost to obtain	Approximate time to obtain	Maximum opportunity cost of time (forgone income)[32]
Electrical Fitter License	UEE33020	n/a	4 years	$168,480
Electrical Mechanic License	UEE30820	$32,000[33] (less Queensland Government subsidy of ($17,630)[34]	4 years	$168,480
Restricted Licence[35]	UEE32120	$13,710	1 - 2 years	$84,240
Unrestricted electrical contractor licence (Qualified Technical Person (QTP))	UEEEL0002 UEEEL0030 UEEEL0029	$650 $400 $400	20 hours 15 hours 15 hours	$1,012.5
Unrestricted electrical contractor licence (Qualified Business Person (QBP))	UEECD0007 UEEEL0040 BSBESB402	$95 - $300 $400 $350 - $875	3 - 10 hours 20 hours 6 hours – 3 months	$11,137.5
Restricted electrical contractor licence (QTP)	UEEEL0002 UEEEL0030 UEEEL0029	$650 $400 $400	20 hours 15 hours 15 hours	$1,012.5
Restricted electrical contractor licence (QBP)	BSBSMB401A UEENEEG175A	n/a	n/a	n/a

As per Table 11, the anticipated individual time and cost associated with obtaining a licence varies greatly depending on the specific licence needed. Table 11 also presents the opportunity cost associated with income foregone due to the time taken to complete licencing requirements. It should be noted that, due to the variable nature of apprenticeship wages, the calculation of opportunity cost has excluded any income that might be earned during an apprenticeship.

As noted previously, there are significant challenges associated with measuring the causality between the amendment to the Act and the impact on the workforce in terms of demand for additional

[31] These estimates only include education requirements based on the assumption that all applicants have the relevant prerequisite work experience.

[32] Calculated based upon the average weekly wage of a labourer as per ABS's occupational definition and assuming a 40 hour work week. The counterfactual wages earned during the apprenticeship duration are not captured as an opportunity cost.

[33] UEE30820 - Certificate III IN Electrotechnology Electrician -Cost is based on publicly available information from CQ University and is based on the full fee for 30 units of study credit. Available at: https://www.cqu.edu.au/courses/705786/certificate-iii-in-electrotechnology-electrician

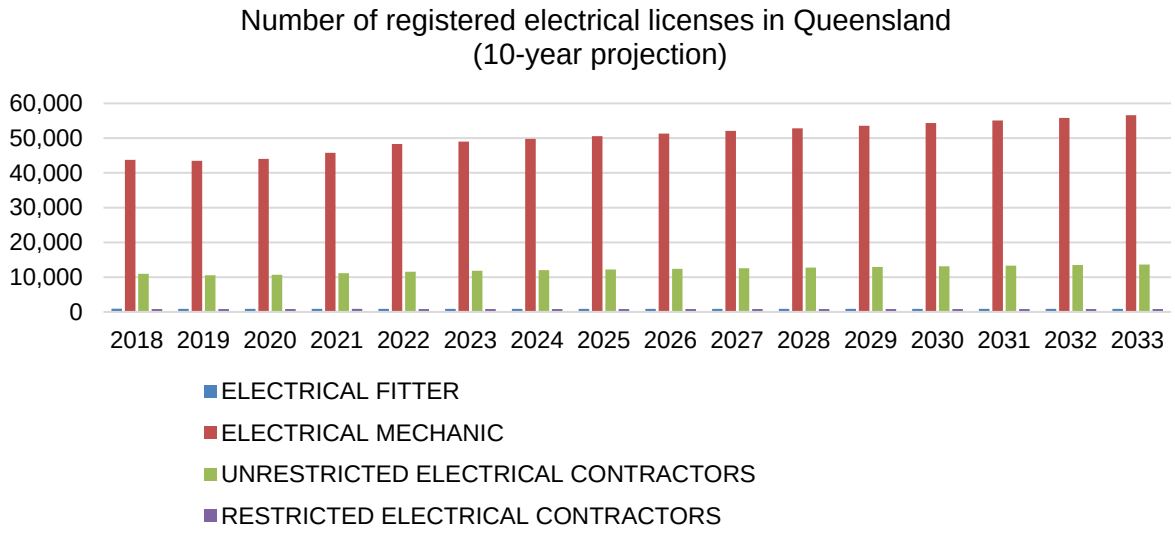
[34] The Department of Youth Justice, Employment, Small Business and Training provides a Queensland Government Subsidy of $17,630 per apprentice for the life of the apprenticeship. The Queensland User Choice Program funds Skills assure suppliers (Registered Training Organisations) for the provision of services to eligible apprentice and trainees.

[35] This represents a future hypothetical scenario where a restricted license is implemented by the regulator. The restricted licence would authorise the holder to perform electrical work involving the prescribed ELV.

licenced electrical workers. However, through the adoption of a range of assumptions, the overall cost to the Queensland economy can be estimated.

Figure 13 outlines a 10 year projection of the future numbers of electrical fitter, electrical mechanic, and electrical contractor licences (restricted and unrestricted) in Queensland. This future projection is based upon the assumption that electrical mechanic and unrestricted electrical contractor licence numbers will grow at the same rate as the Queensland population over the next decade. The projection also assumes that electrical fitter and restricted electrical contractor licences will remain at a constant level over the period of interest as these have fluctuated at around similar levels over the past five years.[36]

Figure 13: 10 year projection of electrical licence numbers



Source: Office of Industrial Relations – Electrical Safety Office

Table 12 provides a breakdown of the costs associated with obtaining each class of relevant electrical licence. The table provides a cost estimate for the workforce (i.e., workers and / or businesses) and for the Queensland Government (i.e., value of subsidy provided to workers and / or businesses). It should be noted that the following estimates of cost are based off consultation with the ESO as well as industry research.

Table 12: Electrical licence cost estimates

Licence Type	Cost for workforce (businesses and workers)	Cost for Queensland Government (subsidy)
Electrical Fitter	$0[37]	$16,380
Electrical Mechanic	$12,370	$17,630
Unrestricted electrical contractor	$1,555[38]	$0
Restricted electrical contractor[39]	n/a	n/a

Table 13 provides a summary of the net present value (NPV), at a 7% discount rate, associated with increased demand for the various categories of electrical licence over the next 10 years (based on

[36] Future growth assumptions are based on historical licence numbers.
[37] Market research indicates that cost is likely to be lower than the government subsidy amount of $16,380.
[38] Based on the full TAFE Queensland fee for required QBP competencies.
[39] Unable to find relevant information to inform cost assumptions; as such, restricted electrical contractor licences have been excluded from the proceeding analysis.

the costs presented in Table 12). It is important to note that the economic benefits are only calculated for new entrants seeking to upskill and acquire a new licence as a result of the amendment to the Act.

Table 13 presents four different scenarios, each one assuming a higher level of induced demand for electrical licences. Due to the uncertainty regarding the causality between the amendment to the Act and the future demand for electrical licensing, this analysis is based on four scenarios which include:[40]

- Scenario 1: 5% increase in demand for electrical licences (fitter, mechanic, and unrestricted)
- Scenario 2: 10% increase in demand for electrical licences (fitter, mechanic, and unrestricted)
- Scenario 3: 15% increase in demand for electrical licences (fitter, mechanic, and unrestricted)
- Scenario 4: 20% increase in demand for electrical licences (fitter, mechanic, and unrestricted).

Table 13: Incremental NPV of costs to the Queensland economy under different causality scenarios (7% discount rate, $ millions)

License Type	NPV assuming 5% growth in 10-year licence projection	NPV assuming 10% growth in 10-year licence projection	NPV assuming 15% growth in 10-year licence projection	NPV assuming 20% growth in 10-year licence projection
Workforce				
Electrical Fitter	-	-	-	-
Electrical Mechanic	3.3	6.6	9.9	13.2
Unrestricted electrical contractor	0.1	0.2	0.3	0.4
Total	**3.4**	**6.8**	**10.2**	**13.6**
Queensland Government				
Electrical Fitter	0.7	1.4	2.0	2.7
Electrical Mechanic	4.7	9.4	14.1	18.8
Unrestricted electrical contractor	-	-	-	-
Total	**5.4**	**10.7**	**16.1**	**21.5**

4.7.1.6 Increased businesses and workforce costs (administrative)

The proposed amendments in relation to 'electrical equipment' and 'electrical installation' within the Act will impose additional costs on Queensland's businesses (PCBUs) and workforce. These additional costs can be summarised within two categories:

- Licencing costs (i.e., application for issue, renewal, reinstatement, replacement, etc.)
- Compliance costs related to increased regulation standards and supply chain monitoring.

Businesses and the workforce bear a range of costs associated with adhering to licensing requirements. As a method to analyse this cost, this section has assessed OIR's revenue streams associated with licencing revenues. OIR (which is partially funded through fees and charges) received:

- $6.2 million for licence registrations and renewals in 2022

[40] Based on historical licence numbers, it is assumed that after an initial increase in demand, electrical fitter licence numbers will plateau and remain constant.

- $6.4 million for licence registrations and renewals in 2023.

The above revenues received by OIR can be alternatively understood as $6.4 million in costs to businesses and the workforce in 2023.

Table 14 contains a more granular breakdown of costs (on a per unit basis) associated with obtaining and maintaining an electrical licence in Queensland which are paid to OIR (through ESO).

Table 14: Individual costs and fees for licence holders

Category	Electrical Work Licence	Electrical Contractor Licence
Application for issue of electrical work licence / permit *(for apprentices, other than apprentice and permit holders)*	$90.9	$434.4
Application for renewal of electrical work licence *(application for renewal, reinstatement or recognition of an expired Queensland electrical work licence)*	$90.9	$434.4
Application for reinstatement of electrical work licence	$90.9*	$434.4
Administration component of fee paid for an application under items 1, 2 or 3 refundable under section 63	$45.6	$344.7
Application for replacement of electrical work licence	$35.7	$35.7

Source: Queensland Government, WorkSafe, 2023

In addition, electrical contractors are required to be appropriately insured in line with regulation which results in additional costs for the newly licenced workforce. As mandated by the Queensland Government, in order to perform electrical work for others, an entity must hold an insurance policy that meets the requirements of the ES Regulation. These requirements include the following:[41]

- A limit of indemnity of at least $5,000,000
- Consumer protection insurance of at least $50,000
- Inclusion of liability arising from testing and certification of work in accordance with the ES Regulation
- Inclusion of injury or damage arising from faulty design work performed by you including where you did not charge a specific fee for such design work.
- Inclusion of injury or damage arising from incorrect advice including where you did not charge a specific fee for such advice.
- Inclusion of goods in your care, custody or control.

The cost of obtaining electrical contractors insurance varies depending on the specific policy and provider. However, industry research indicates that prices for suitable policies start at around $609 per annum.[42]

[41] Queensland Government. (2021, 10 05). Electrical contractor licences. Retrieved from WorkSafe: https://www.worksafe.qld.gov.au/licensing-and-registrations/electrical-licences/electrical-contactor-licences. Last viewed on 1 October 2023.
[42] CoverTradie. (n.d.). Electrical Contractors Insurance Queensland. Retrieved from https://www.covertradie.com.au/electrical-contractors-insurance-qld/. Last viewed on 4 October 2023.

As Option 2 will result in a range of additional demand for electrical work and contractor licences, impacted businesses and workforce will see an increase in associated costs. As noted previously, it is not possible to ascertain the causality between the amendment to the Act and the demand for licences and registrations. Therefore, this analysis is unable to robustly quantify the overall impact to the Queensland economy.

4.7.1.7 Reduced employment for unlicenced workers

While licensed electrical workers will have the assurance of greater job security due to the imposed regulations under Option 2, the amendments to the Act will create a set of challenges for unlicensed workers in maintaining the same levels of current employment.

The amendments to the Act will create a barrier-to-entry for unlicensed workers, as they may not have the same qualifications (and/or experience) as licensed workers to work on certain 'electrical equipment'. Option 2 will ultimately result in a reduction of the employment opportunities for unlicenced workers.

There is no requirement for workers to hold an electrical licence to complete work falling outside the definition of 'electrical equipment' or 'electrical installation' and the subsequent definition of 'electrical work'. More specifically, there is currently no requirement to hold an electrical licence for the following work:

- Mounting or connecting ELV solar panels together
- Disconnecting solar panels
- Maintenance of solar panel installations.

The legislative change proposed at option 2 will require the workforce to hold an eligible licence to be able to complete certain work such as connecting 'electrical equipment' together. While some workers may choose to pursue professional development to obtain the required licence, it is likely that some unlicensed workers will transition to other related activities or exit the workforce. This reduced employment will also impact a number of solar panel installation business which utilise unlicenced labour.

The impact of industry regulation on employment levels is well documented within literature (refer Box G).

Box G: Regulatory impact on employment opportunities

Studies suggest that strict labour market regulations increase the cost of compliance for employers and reduce the incentives for job creation and job destruction.[43 & 44] According to the Organisation for Economic Co-operation and Development (OECD), increasing the flexibility of labour market regulation can lead to reductions in the unemployment rate for male and female labour market participants in the OECD.[45] Findings from the paper suggest that, all else being equal, a one unit increase in the normalised labour market flexibility score from the Fraser Institute's Economic Freedom of the World (EFW) index results in a reduction in the unemployment rate by 0.044 percentage points.[46]

Due to the lack of data relating to the number of unlicensed professionals undertaking work on the emerging technologies in question, it is not possible to undertake a robust quantitative assessment of the related costs. However, using the average salary of a full-time labourer as a proxy for the salary of an unlicensed electrical worker, the value associated with a 'per unit' decrease in full time employment can be assessed.

[43] Bertola G (1990) Job security, employment and wages, European Economic Review, 34(4), pp 851–879
[44] Stähler N (2008) Unemployment and employment protection in a unionized economy with search frictions, Labour, 22(2), pp 271–289
[45] Rafi, B. (2017). The impact of labour market regulation on the unemployment rate: Evidence from OECD economics. Department of Industry, Innovation and Science.
[46] Ibid.

Incremental unemployment for unlicensed electrical workers in Queensland

According to the ABS Census, the average weekly earnings of a labourer in Australia in 2022 was $810.[47]

The incremental increase in full time employment is dependent on the current number of unlicenced workers undertaking work on out-of-scope technologies. However, it can be concluded that the individual financial impact associated with a reduction in a full time unlicensed electrical worker is at least **$42,120 per annum**. It should be noted that any decrease in employment for unlicensed workers is likely counteracted by an increase in work opportunity for licenced workers. This positive impact is discussed below (Increased employment for licensed workers).

4.7.1.8 Administrative costs (Queensland Government)

Licensing associated costs

Amending the Act to include new equipment will reduce the scope of work that can be completed without an electrical license. This will result in increased demand for electrical licenses as workers look to maintain the accreditation required to perform work. The ESO is responsible for providing a number of licensing and compliance services for electrical workers. It is anticipated that any increase in demand for licenses will be accompanied with increased expenditure on licensing and compliance services. These services include the following activities:

- Assessing applications for registration or licence
- Compliance and audit activities to ensure workers are working in accordance with their registration or licence
- Investigating complaints against electrical workers
- Disciplinary activities
- Data collection and management
- Processing transactions, including payments
- Information and engagement.

These activities are mandatory for ESO to meet its legislative functions, and to ensure the objectives of the Act are met in an efficient and effective manner. In particular, these activities are required to fulfil the ESO's role of:

- Ensuring electrical safety laws and standards are followed
- Managing workers' and contractors' electrical licenses (applications, renewing, etc.)
- Providing electrical safety information, education and training including electrical product recalls and safety alerts.

The abovementioned services come at an increased financial cost to ESO (as a regulator), both in terms of operating expenses and employee expenses. Greater numbers of electrical licenses will elicit greater expenditure on licensing services. The total number of electrical work licenses and total expenditure on licensing services (including operating and employee expenses) can be used to determine administrative cost per license. This is useful in determining the potential increase in administrative costs that may be associated with the proposed changes to legislation (see below).

[47] Australian Bureau of Statistics. (2022, 12 14). Weekly earnings of employees, including distribution of earnings and hourly earnings, by State, Occupation, Industry and Qualifications. Retrieved from Employee earnings: https://www.abs.gov.au/statistics/labour/earnings-and-working-conditions/employee-earnings/latest-release#data-downloads

Total administrative cost per license (Queensland Government):

As per the records provided by ESO, the Electrical Licensing Committee recorded an annual expenditure of $3.2 million during 2022-23. The total number of electrical work licenses recorded in 2023 was 61,987. Based on these 2023 figures, the administrative cost associated with a single licence can be estimated at approximately $51.

Supply Chain Duties

In addition to the abovementioned costs to the Queensland Government, ESO will also incur increased costs associated with regulatory activities for prescribed high risk ELV equipment such as solar PV, BESS and rechargeable battery packs. Regulatory activities undertaken by ESO in relation to *electrical equipment and installations (outside of the EESS)* include:

- Product recall. Since 2017, ESO have managed 29 recalls on a range of products.
- Prohibition notices for unsafe equipment. Examples of prohibition notices submitted by ESO include: lichtenberg device (i.e. aesthetic wood burning machine), misting fans and heat press machines.
- Equipment testing. Over the last three financial years, ESO tested: 30 models of cables, five models of lighting, five models of pumps and 10 models of switch gear.
- Awareness and education campaigns.
- E-Safe electrical (subscription-based news email).
- Developing guidance material.
- Electrical equipment safety alerts.
- Licensing compliance and enforcement activities.
- Receiving reports from community on unsafe equipment.

Over the previous three financial years, ESO incurred $188,980 in expenses related to equipment testing. This includes the costs of purchasing equipment, shipping and laboratory tests (noting that this total value does not include employee costs). While this analysis is unable to measure the impact of Option 2 on ESO's supply chain duty costs, it is reasonable to assume that a legislative change will see an increase in associated costs.

4.7.1.9 Costs associated with education and awareness campaign

Any legislative change will need to be accompanied by some level of education and awareness to help transition stakeholders to the new requirements imposed by the Act. Any education and awareness campaign will come at a financial cost to the Queensland Government. Costs will be associated with the following items:

- Development (i.e., creative agency fees, etc.)
- Promotion (i.e., media placement, advertising, etc.)
- Resources
- Partnership fees
- Licensing
- Public sector employee expenses.

The expenses associated with these items will depend on the length and magnitude of the campaign. Table 15 presents a summary of the estimated costs associated with the previous three education and awareness campaigns facilitated for electrical safety.

Table 15: Examples of OIR's education and awareness campaigns

Campaign	Estimated cost	FTE
Don't DIY campaign	$40,000	1 x A07 officer one day per week for eight months + support from web team, graphic designer and managers/directors approvals/reviews

Wiggles partnership / campaign	$550,000	1 x A07 and 1 x A05 half day per week for three years + support from web team, graphic designer, media team and managers / directors approvals / reviews [$450,000 for partnership]
Safety switch campaign	$1,400,000	1 x A07 officer 2 days per week for 12 months + support from web team, graphic designer and managers / directors approvals / reviews

Assessment of benefits: Option 2

The section details the relationship between the proposed legislative changes and the identified benefits associated with the implementation of Option 2.

The positive impacts (benefits) associated with legislative change affect various Queensland stakeholder groups, including the workforce, industry, community members and the Queensland Government.

4.7.1.10 Reduced incidents of death and injury

As outlined within Section 4.2, there are several risks associated with solar PV panels (when connected to form a combined voltage above ELV) and BESS and rechargeable battery packs, as examples. While the specific type and magnitude of risk is dependent on the emerging technology in question, broadly speaking, defective or unsafe work can lead to electric shock, arc flash, explosion flash, or exposure to hazardous chemicals, ultimately leading to injury or, in extreme cases, loss of life.

The above listed risks of injury and loss of life applies to all who conduct work on the emerging technologies which are being proposed to be captured under the ES Framework and the Act. However, the risk is assumed to be higher for unlicensed individuals who are conducting work on technology which currently escapes the definition of the electrical equipment.

The emergence of these new technologies in Queensland has already resulted in a number of SEIs over the past decade. Since 2010, there have been a small number of reported SEIs to ESO, including:

- Nine SEIs related to solar technology.
- Five SEIs related to battery technology.

The majority of the above incidents occurred during work-related activities and resulted in burns of varying levels of severity to the individual worker. Nine of the 14 incidents can be attributed to electrical license holders with other incidents attributed to trade assistants, labourers, employees of electrical contractors, and members of the public.[48]

As outlined previously (Section 3.2 Problem identification), this data does not include incidents which are excluded from legislative definitions (and therefore ESO's regulator reporting requirements) of a 'Dangerous Electrical Event' or a SEI. As such, ESO may only become aware of an incident involving ELV where the incident is considered serious. As a result, data pertaining to SEI fails to appropriately capture ELV-related incidents resulting from interactions with the technologies in question, and therefore may underrepresent the associated safety risks.

The amendments to the Act proposed in Option 2 will increase the scope of work for appropriately trained licensed electrical workers. Limiting the interactions of unlicensed individuals who have not received the appropriate training will generate a reduction in the risk of harm associated with the aforementioned technologies.

[48] OIR data.

Central to the purpose of the Act is preventing the loss of life and injury as a result of electricity. The impact of fatalities and other serious electrical incidents on workplaces, families, friends and communities is immeasurable.

The value offered by preventing serious electrical incidents is significant for industry, workplaces, families, friends and the community. The statistical value of life has not been applied in this analysis with respect to the immeasurable impact of these incidents in communities across Queensland.

4.7.1.11 Reduced incidents of damage / destruction

As outlined in Section 4.2, new and emerging technologies pose a risk in terms of damage and destruction to property. In particular, defective equipment and unsafe work in relation to solar PV panels, solar farms, and battery technologies can lead to serious fire incidents, which in turn can result in injury, death and damage to property and equipment.

Since 2010, there has been only one recorded incident of damage to property in Queensland resulting from fires caused by solar PV panels (when connected to form a combined voltage above ELV), BESS and rechargeable battery packs.[49] However, given that these technologies currently fall outside the Act, evidence of damage originating from the technologies in question is not appropriately recorded. In line with this, while not captured under current reporting requirements, ESO Electrical Safety Inspectors responded to five incidents involving smart meters connected to solar PV installations in the first quarter of 2023. These incidents occurred across the Gold Coast and Ipswich regions of Queensland and involved equipment failure resulting in a loss of energy supply and damage to property through fire.

Also falling outside reporting requirements, more than 450 fires in Australia have been linked to rechargeable lithium-ion batteries since October 2021. At a more granular level, QFES recorded 157 fires related to lithium-ion batteries between July 2021 and 17 January 2023.[50] Furthermore, the ACCC reports that there have been 24 recalls of products containing lithium-ion batteries between 1 January 2017 and 31 December 2022, 22 of which referenced a risk of overheating or fire.[51] The risk associated with lithium-ion batteries is also well documented internationally. In line with this, between 1 January 2017 and 31 July 2022, Health Canada received 1,439 reports related to products containing a lithium-ion battery. Over 75 percent of these reports involved fires, explosions, or other thermal events such as smoke, overheating and combustion.[52]

As outlined previously, amendments to the Act will increase the scope of work for appropriately trained licensed electrical workers. Limiting the interactions of unlicensed individuals with high-risk technologies will generate a reduction in the risk of fires and the resulting damage to property and equipment. Given the incomplete incidence data and difficulties justifying causality, it is infeasible to determine a comprehensive monetary value associated with the proposed amendment to the Act. However, estimates of the economic cost of fire can provide an indication of the per unit savings that could be generated by legislative action.

[49] OIR data.
[50] Australian Competition & Consumer Commission. (2023). Lithium-ion batteries and consumer product safety.
[51] Ibid.
[52] Ibid.

Statistical value of avoided damage and destruction

While there is no established singular economic cost used to measure the impact of fire in Australia, there is a body of literature which can be leveraged to provide an indication of the overall cost to the economy incurred as a result of fire.

The cost of fire to the Queensland economy is approximately $2,518.9 million per annum (in 2022 dollars).53 This estimation of total cost is calculated based on costs in anticipation, costs of response and cost incurred as a consequence of fire.54 Another study establishes a framework for estimating annual economic losses due to fire in concrete building structures. As a case study, the study evaluates the expected fire loss estimated for a five-story reinforced concrete frame building. Direct losses from single-compartment fire scenarios were evaluated at approximately $0.2 million conditional to the occurrence of a severe fire.55

Another indication of the per person costs associated with fire can be determined by assessing the per person expenditure on fire and emergency services in Queensland. As per QFES' annual report, fire and emergency services expenditure were estimated at $156 per person in FY2022.56

4.7.1.12 Uplift in community / consumer confidence

As noted previously, Option 2 will ensure that the aforementioned emerging technologies are captured under the definition of electrical equipment and installation within the Act. This will result in Queensland consumers and community seeing an uplift in consumer confidence due to:

Consumer protection and safety standards for products and services associated with the emerging technologies

Amendments to the Act will enhance electrical safety standards and ensure the safety, health, and wellbeing of consumers. The proposed legislative changes may enhance consumer protection in relation to harmful toxic products (i.e., components within BESS and storage batteries), misleading advertising, and safe practices.

Strengthened oversight of production to ensure enhanced product quality

Option 2 will ensure that all involved parties are in compliance with the same standard of excellence. Quality control standards typically include requirements for processes, materials, products, and services.

By introducing industry-wide standards for quality control, companies can ensure that they are providing their customers with a consistent level of quality across all aspects of their business, from process to product to service. This can help to strengthen customer trust and loyalty, as well as increase overall satisfaction to the broader Queensland community.

As indicated within Section 4.2, since the early 2000s, usage of various forms of new and emerging renewable technologies has become increasingly common within Queensland. In particular, growth in the usage of solar PV technology and BESS is clearly evident. The Department of Energy and Public Works reports that, within Queensland, there was a total of 790,000 homes and small businesses with rooftop solar systems as of 2023.[57] Similarly, there has been exponential growth in the number of installations, with the QEJP reporting that the number of installations has grown from 475 installations in 2007 to 89,971 in 2021.[58] The 2023 Queensland Household Energy Survey reported

[53] ABS population data used to convert cost for the Australian economy to a cost for the Queensland economy value.
[54] Ashe, B., McAneney, J., & Pitman, A. (2007). The Cost of Fire in Australia.
[55] Ni, S., & Gernay, T. (2021). A framework for probabilistic fire loss estimation in concrete building structures. Structural Safety.
[56] Queensland Fire and Emergency Services. (2022). Annual Report 2021-2022. Queensland Government.
[57] Department of Energy and Public Works. (2022, 09). Queensland Energy and Jobs Plan. Retrieved from https://www.epw.qld.gov.au/energyandjobsplan/about.
[58] Ibid.

that 84 percent of surveyed people had a battery storage system in their home.[59] Similarly, the Queensland Super Grid Infrastructure Blueprint suggests that there has been significant household investment in BESS systems with 5,800 MW of distributed batteries across Queensland. The rise in renewable technology more broadly is apparent, with latest estimates suggesting that 26 percent of Queensland's energy is produced by renewable energy sources, including a combination of rooftop solar, commercial solar, wind, hydro and bioenergy.[60]

Despite the apparent growth in renewables across Queensland, consumer confidence in renewable technologies is still at critical risk to facilitating the uptake of renewables across Australia.[61] In line with this, only one in five households maintain the view that renewable technologies will improve electricity reliability, with one-third believing it will make reliability worse.[62]

Amending the definitions of 'electrical equipment' and 'electrical installation' to include solar PV panels (when connected to be above ELV), solar on caravans, BESS, battery packs and solar farms is likely to provide an uplift in consumer confidence. Including these technologies in the Act will have ramifications for the scope of what is considered 'electrical work'. By expanding the remit of licensed electrical workers, this legislative change will reduce the prevalence of faulty work and reduce electrical incidents related to faulty products. This notion is reinforced by one OECD report, which asserts that higher requirements in terms of product safety and quality may stimulate innovations. The report also suggests that product regulation can create incentives for businesses to compete on quality.[63]

Similarly, the implementation of any awareness and education surrounding legislative change will provide an uplift in overall knowledge and comfortability regarding these new and emerging technologies. A reduction in related incidents, improved product and service quality, as well as an uplift in knowledge and understanding, may result in enhanced consumer confidence. This uplift in consumer confidence may act as a catalyst to achieving the renewable energy objectives set out in the Queensland State Infrastructure Strategy 2022.[64]

4.7.1.13 Increased employment for licensed workers

Under Topic 1, the proposed legislative changes would involve amending the definition of electrical equipment to include solar PV panels (where they can be connected together), solar on caravans, BESS, and battery packs. Additionally, legislative change would also incorporate energy generation systems into the definition of 'electrical installation'. Given their exclusion from the definitions of 'electrical equipment' and 'electrical installation', at present, work related to the installation and maintenance of the aforementioned technologies can be undertaken by unlicensed workers when the equipment is classified as ELV. As outlined previously, expanding definitions of electrical equipment and installation will bring these technologies within the remit of what is defined as electrical work. By increasing the scope of works required by an individual with an electrical licence, overall demand for licensed electrical workers in Queensland will increase.

As these technologies currently fall outside of the regulatory reach of the Queensland Government, the number of unlicensed workers currently undertaking work in relation to these technologies is unknown. As a result, the incremental increase in demand for licensed workers cannot be accurately measured. However, utilising estimates of the average salary of a full time licensed electrical worker, the value associated with a 'per unit' increase in full time employment can be assessed.

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[59] Powerlink. (2023). Battery Storage. Retrieved from Queensland Household Energy Survey: https://qhes.com.au/queensland-household-energy-survey-2023/battery-storage-2023/
[60] Department of Energy and Public Works. (2022, 09). Queensland Energy and Jobs Plan. Retrieved from https://www.epw.qld.gov.au/energyandjobsplan/about
[61] EY. (2023, 07 17). Why consumer sentiment could stall the clean energy transition. Retrieved from The CEO Imperative Series: https://www.ey.com/en_au/power-utilities/why-wavering-consumer-confidence-could-stall-the-energy-transition
[62] Energy Consumers Australia. (2023, 06 08). Why Consumers are concerned about the future. Retrieved from https://energyconsumersaustralia.com.au/news/why-consumers-are-concerned-about-the-future
[63] OECD. (2010). Regulatory Policy and the Road to Sustainable Growth. OECD.
[64] Queensland Government. (2022). State Infrastructure Strategy 2022-2042. Retrieved from https://www.statedevelopment.qld.gov.au/industry/infrastructure/state-infrastructure-strategy

Incremental employment for licensed electrical workers in Queensland

In 2023, ESO has 61,987 registered workers who hold some form of electrical license in Queensland, with 9,552 workers holding a restricted electrical license.

The incremental increase in full time employment for license holders is dependent on the current number of unlicenced workers undertaking work on out-of-scope technologies (which is currently undetermined) and how many of these will seek to upskill themselves to comply with legislation.

However, on a per unit basis, it can be concluded that the individual benefit associated with one additional full time licensed electrical worker is approximately the new wage as a certified electrician minus the old wage prior to achieving certification (i.e., as a labourer, handyman or general unskilled construction worker).

At a high level, the benefits associated with increased employment for electrical workers can be estimated as:

> New wage ($107,000 per annum)[65] [minus] old wage ($42,120 per annum)[66] [minus] upskilling (certification / apprenticeship costs).

It should be noted that any increase in employment for licensed workers is likely to be counteracted by a reduction in work opportunity for unlicensed workers. This negative impact related to loss of employment is discussed above. (Reduced employment for unlicenced workers).

Assessment of benefits: Option 3

Option 3 proposes investments towards 'electrical safety' education and awareness campaigns in the context of new and emerging technologies (i.e., solar PV panels, BESS, battery storage, etc.). While any future campaigns are still required to be developed and detailed by OIR, these will likely include the following elements:

- Increased Queensland Government communication and engagement with electrical workers, electrical contractors, PCBUs, unlicensed workers, and the community, on risks of emerging technologies and approaches to risk management
- Queensland Government promoting standards and training development
- Queensland Government providing homeowner guidance as relevant.

The general benefits associated with education and awareness are much the same as those associated with Option 2 and include:

- Reduced incidents of death and injury
- Reduced incidents of damage and destruction
- Increased consumer confidence.

Education and awareness will provide community members and workers with greater levels of understanding regarding the potential risks of new and emerging technologies. Literature points to a significant relationship between knowledge, risk awareness and reduced incidents. In line with this, one study finds that education and risky health behaviours are strongly negatively correlated. The study ascertains that education may enable healthier choices through higher disposable income, increasing information about the harmful effects of risky health behaviours, or altering time preferences.[67] The incremental impact associated with a 'per unit' decrease in electrical incidents is explored quantitatively above (Reduced incidents of death and injury and Reduced incidents of

[65] HAYS. (2023). Salary Guide. As per wage data documented in the 2022/23 Hays Salary Guide, the average annual salary of an electrician is $107,000 but can lie within the range of $87,000 to $117,000.
[66] Average wage for an unlicensed electrical worker. Australian Bureau of Statistics. (2022, 12 14). Weekly earnings of employees, including distribution of earnings and hourly earnings, by State, Occupation, Industry and Qualifications. Retrieved from Employee earnings.
[67] Viinikainen, J., Bryson, A., Böckerman, P., Kari, J. T., & Lehtimäki, T. (2022). Does better education mitigate risky health behavior? A mendelian randomization study. Economics & Human Biology.

damage / destruction). It is anticipated that education and awareness will reduce serious electrical incidents by a smaller magnitude compared with legislative change.

Similarly, the implementation of an education and awareness campaign will promote an uplift in overall knowledge and confidence regarding new and emerging technologies. This uplift in consumer confidence may act as a catalyst to achieving the renewable energy objectives set out in the Queensland State Infrastructure Strategy 2022. Literature highlights the relationship between education and increased adoption of renewable technologies. In line with this, one study examines the theoretical assertion that education is a determinant of renewable energy demand and supply. Findings from the study affirm the hypothesis that education is positively related to an economy's level of renewable energy participation.[68]

Summary of findings

This section summarises the economic analysis findings on the three proposed options under *Topic 1: electrical safety consideration of new and emerging technologies*.

The analysis in Section 4.7 (this section) assessed three distinct options identified in OIR's Discussion Paper:

- Option 1: Status Quo (no legislative change)
- Option 2: Incorporate particular ELV equipment within the definition of 'electrical equipment' (solar PV panels) (when connected to be above ELV), solar panels on caravans, BESS, battery packs. In addition, incorporate energy generation systems (e.g., solar farms) within the definition of 'electrical installation'
- Option 3: Education and awareness campaign

As noted previously, due to the nature of the proposed amendments to the Act, there are a range of challenges in quantifying (or monetising) the overall impact to the electrical industry, workforce and the broader Queensland economy. These are primarily due to:

- The difficulty in ascertaining the level of causality between incorporating the definition of certain electrical equipment and systems into the Act and its impact on overall electrical safety in Queensland
- The lack of publicly available data and lack of evidence generated from industry consultation with respect to electrical safety incidents.

Due to these limitations, it is not possible to undertake a robust and defensible quantitative analysis. As a result, the economic analysis has adopted a largely qualitative approach.

This overall assessment process identified that:

- There is commensurate industry support to amend the Act to incorporate certain ELV equipment and systems (associated with the emerging technologies) into the definitions of 'electrical equipment' and 'electrical installation'.
- There is broader support of electrical safety education and awareness campaigns to mitigate electrical risks associated with the emerging technologies in question.
- There are a range of benefits associated with the proposed legislative changes which include:
    - Reduced incidents of death and injury associated with poor work practices, faulty and low quality electrical equipment and installations
    - Reduced incidents of damage and destruction of property associated with poor work practices, faulty and low quality electrical equipment and installations
    - Uplift in community and consumer confidence resulting from enhanced and targeted legislation, improved electrical safety standards, improved product and service oversight and control, etc.

[68] ÖZÇİÇEK, Ö. (2017). The Role of Education on Renewable Energy Use: Evidence From Poisson Pseudo. Journal of Business & Economic Policy.

- Increased employment and demand for licenced workers who have undertaken the necessary education pathways.

- Amendments to the Act will also result in a range of costs to industry, workforces and the broader Queensland economy. These include:
    - A reduction in the scope of what can be performed as DIY work by the community.
    - Increased cost to consumers: a raft of regulatory compliance costs which may be passed on to the consumer including:
        - Compliance costs (including regulatory fees and government supply chain duties) potentially being passed on to consumers due to increased regulation and oversight
        - Potential reduction in competitors in the market as a result of regulations limiting the quality of imported products (i.e., solar PV panels, BESS and storage batteries)
        - Increased costs to upskill workforce including undertaking apprenticeships, training, testing, licence renewals, any ongoing professional development training.
        - Increased business and workforce costs associated with Queensland Government fees for licensing costs (licence registration and renewals), complying with regulations/legislation and insurance costs
        - Reduced employment for unlicenced workers due to legislative licensing requirements
        - Increased costs to the Queensland Government due to increased supply chain duties such as: assessing applications, compliance and audit activities, disciplinary activities, data collection and management, engagement, etc.
        - Costs associated with electrical safety education and awareness campaigns associated with the emerging technologies in question.

In summary, the analysis indicated amending the 'electrical installation' and 'electrical equipment' definitions in line with option 2 poses a number of significant safety benefits to the workforce and the community including:

- Increased consumer/community confidence
- Reduced damage and destruction
- Reduced injuries and fatalities.

However, the key cost identified for prescribing high risk ELV equipment in the legislation is the regulatory burden posed by additional licensing requirements for electrical work. In light of this finding a modification is proposed to Option 2 (Option 2A).

Modifications to Option 2 (new option 2A)

A modification is proposed to Option 2 (Option 2A) to reduce the regulatory burden posed by licensing requirements to work on prescribed high risk ELV equipment identified in the economic analysis. Option 2A instead proposes to introduce supply chain duties, incident reporting duties and duties to comply with regulatory levers such as recalls for prescribed high risk ELV equipment. However Option 2A will only require an electrical license for electrical work on prescribed high risk ELV where the voltage exceeds ELV, on the basis of risks associated with the voltage. This is a more targeted approach compared with Option 2 which required an electrical license for all electrical work involving prescribed high risk ELV, including when the voltage was at ELV. Overall, Option 2A applies more targeted regulatory levers, and reduces licensing requirements and with those regulatory costs.

Benefit of the modification

The recommended legislative path for electrical equipment is that individual ELV equipment be assessed as and when items are added to the schedule, on the basis of risk and complexity of tasks.

The modification aims to recognise the nature of the prescribed high risk ELV equipment and its design, in terms of whether the equipment was constructed for general use without requiring specialist electrical skills or not. For instance, lithium batteries are designed for lay people to safely fit and replace in their tools and therefore would not trigger electrical licensed workers unless manipulation within a battery was occurring. This reduces some of the cost impact that was calculated as part of the economic analysis, which considered the most extreme circumstances of

regulatory intervention. This will also ensure low risk tasks are able to continue being undertaken without accidentally requiring the need for electrical licenses.

Licensed work only then extends to these items when the equipment is arranged in some way where the work involves voltages above extra low voltage. A significant increase in regulatory oversight will be experienced by industry when the nature of the equipment has proven itself to have safety concerns and will be in the form of supply and incident duties, recalls and compliance activity around unsafe equipment. In summary, the bulk of the costs estimated will only be incurred in the event of significant safety events.

Option 2A presents a clear net benefit to the Queensland community through increased consumer/community confidence, reduced damage and destruction and reduced injuries and fatalities. As a result of the reduced impact from licensing requirements, Option 2A can be identified to provide the greatest net benefit to the community when compared with the status quo (Option 1) and an education and awareness approach (Option 3).

Technologies propose to be prescribed

It is proposed that initially technologies such as solar PV panels (that can be connected together to exceed ELV and those on caravans), water equipment, battery energy storage systems and battery packs are prescribed in the Regulation as high risk ELV equipment.

The proposed changes to the 'Electrical Installation' definition are not modified in Option 2A.

These changes propose to modernise the definition of electrical installation, which is currently worded around more traditional forms of technology. For example, the ways in which traditional systems are powered by external sources does not readily apply to the full spectrum of modern electrical installations. The proposed changes to the definition of 'electrical installation' aim to bring the definition in line with advances in technology. These changes will provide clarity of application.

4.8 Recommended option and next steps

Recommended option

On the basis of providing the greatest net benefit to Queenslanders Option 2A is recommended.

Option 2A proposes legislative amendments to the 'Electrical Equipment' definition to include high risk ELV equipment as prescribed in the ES Regulation. This is coupled with changes to licensing requirements to ensure low risk tasks involving prescribed ELV are able to continue being undertaken without accidentally requiring the need for electrical licenses.

Option 2A also proposes legislative amendments to the 'Electrical Installation' definition to ensure it readily applies to modern forms of electrical installations (such as energy storage and generation systems). The proposed changes to the definition of 'electrical installation' aim to bring the definition in line with advances in technology. These changes will provide clarity of application.

Option 2A poses a number of significant safety benefits to the workforce and the community including:

- Increased consumer/community confidence
- Reduced damage and destruction
- Reduced injuries and fatalities.

These benefits were considered to outweigh costs including, for electrical equipment, duties, incident reporting requirements, limited licensing requirements and compliance with regulatory action in the event of significant safety incidents and for electrical installation, compliance with additional regulatory standards.

Next Steps

<u>Electrical Equipment</u>

To give effect to Option 2A, it is proposed the 'electrical equipment' definition would be amended in the ES Act to capture high risk ELV equipment as prescribed in the ES Regulation. It is proposed high

risk ELV equipment would require meeting a threshold of posing a serious risk to life or property. This is intended to ensure the regulatory framework applied to the equipment is proportionate.

Further it is likely a regulation-making power would be introduced to give rise to the prescription of particular high risk ELV equipment within the Regulation.

Finally, legislative changes are proposed to ensure low risk tasks in relation to prescribed high risk ELV are able to continue being undertaken without unintentionally requiring the need for electrical licenses.

These changes will be in addition to the existing exclusions from the definition of electrical work under section 18(2) of the Act including:

- work that involves connecting electrical equipment to an electricity supply by means of a flexible cord plug and socket outlet (s.18(2)(a))
- replacing electrical equipment or a component of electrical equipment if that task can be safely performed by a person who does not have expertise in carrying out electrical work (e.g., replacing a light bulb) (s. 18(2)(c)).

On the basis of risks associated with the voltage, these changes will not exclude prescribed ELV equipment that is connected in such a way that the voltage exceeds ELV. The work activities around equipment that exceeds ELV (such as connecting, disconnecting and maintaining) will be deemed licensed electrical work.

In practice the following regulatory levers make up the regulatory framework for electrical equipment, these will apply to the prescribed high risk ELV equipment:

- duties
- incident and other reporting requirements
- ministerial recalls
- licensing, and auditing requirements for electrical equipment and its installation.

On this basis of risk, it is proposed the following technologies will be prescribed as high risk ELV and captured within the ‘electrical equipment’ definition: BESS, rechargeable ELV battery packs, solar PV panels (with the capacity to be connected together), solar panels on caravans, and water equipment.

Electrical Installation

Option 2A also proposes to amend the Act’s definition of ‘electrical installation’ to capture:

- energy generation systems (e.g., solar farms or wind farms)[69]
- energy storage systems
- permanently connected electrical equipment powered by energy storage systems.

These changes will modernise the definition of electrical installation which is currently worded around more traditional forms of technology. For example, the ways in which traditional systems are powered by external sources does not readily apply to the full spectrum of modern electrical installations. The proposed changes to the definition of ’electrical installation’ aim to bring the definition in line with advances in technology. These changes will clarify the application of the definition to modern technologies.

4.9 Implementation and evaluation

It is proposed that the implementation of the Option 2A would occur through legislative amendment to the definitions of ‘electrical equipment’ (section 14 of the Act) and ‘electrical installation’ (section 15 of the Act). It is proposed to include a further amendment to section 210 (Regulation making powers) to

[69] Noting that this is only in reference to energy generation systems that are not otherwise captured as a works of an electricity entity under the Act.

ensure the power to declare high risk ELV as electrical equipment is included. Finally, an amendment to section 55 of the Act should be progressed to exclude certain activities relating to ELV equipment from licensing requirements that would be otherwise be captured.

OIR will develop a comprehensive communication and engagement plan to educate industry and the community of the changes.

The initial changes will be to the Act, establishing a mechanism to prescribe high risk ELV.

Amendments to the ES Regulation 2013 to establish a schedule to prescribe high risk ELV will be established in a subsequent process. This section will give rise to the prescription of high risk ELV.

Prescription of items will be subject to government's regulatory impact assessment requirements and will be accompanied by communication material to advise industry and the community of any changes.

OIR will undertake monitoring of electrical equipment and electrical installation safety to ensure the changes are effective.

Compliance

The ESO undertakes compliance monitoring and enforcement of provisions under the Act in Queensland.

4.10 Consistency with other policies and legislation

Electrical Safety legislation is the responsibility of states and territories in Australia; however, these frameworks are not harmonised.

At present, Victoria is the only state that administers an electrical safety legislative framework that captures ELV equipment.

The recent Statutory Review of the *Gas and Electricity (Consumer Safety) Act 2017* in New South Wales, published in May 2023 recommended:

- Amending section 6 of the *Gas and Electricity (Consumer Safety) Act 2017* to extend the scope of power for the Secretary to be able to declare any ELV equipment as high-risk, should the need arise. This would allow for the pre-sale regulation of such ELV equipment that has been identified as high-risk but puts the obligation for satisfying this threshold on the regulator rather than individual operators.

This recommendation aligns with the approach proposed for electrical equipment in Queensland.

The proposed approach does not duplicate other Queensland Government or Commonwealth legislation.

Competition Principles

The Competition Principles Agreement requires that legislation should not unduly restrict competition.

The approach will ensure high risk ELV products in Queensland that pose risk to life or property (as prescribed) are subject to Queensland's ES Framework. These regulatory controls aim to prevent people being injured or killed and property being damaged or destroyed.

This approach will require that, where high risk ELV is prescribed in the regulation, this equipment will be subject to supply chain regulation to ensure the product is electrically safe and is supplied with the relevant information through the supply chain. In the event this has a minor impact on competition, via product choice or availability impacts, the safety benefit of this restriction far outweighs the costs.

5 Topic 2: Changing landscape of electricity and the workforce

5.1 Problem identification

How electrical work has changed

Since the Act was established, the nature of electrical work has changed significantly. Changing technologies and the way people interact with this technology at work has accelerated the pace of change.

The Review identified several themes in relation to the changing uses of electricity and how it affects electrical work. These themes can be split into the following three topic areas:

- The emergence of renewable energy generation and storage technology
- The decentralisation of energy generation entities
- The changing nature of the workforce.

The emergence of renewable energy generation and storage technology

The emergence of renewable energy generation technology in the last 20 years has changed the electrical landscape. For example, the concept of solar farms – which emerged with Australia's first solar farm in Western Australia in 2012 – was not contemplated when the Act commenced in 2002.

Between December 2021 and November 2022, approximately 6.8 percent of the energy consumed by Queenslanders was from solar farms and 9.4 percent from rooftop PV. As of October 2023, there were over 132 solar farms in Queensland with a combined generation capacity of 25,035MW.[70] In November 2022, 22.7 percent of the energy used in Queensland was renewable energy. With a target of 80 percent renewal energy use by 2035, a significant increase in renewable energy generation technology is anticipated.

The development of renewable energy generation and storage technology has seen new job roles emerge. As discussed, renewable energy generation and storage technology – including BESS and solar PV panels – has resulted in several new job roles being created in the sector, including:

- Supply chain roles (designing, manufacturing, importing, supplying)
- Fixing, mounting and locating of the technology
- Electrical connection of the technology within the energy generation/storage system
- Ongoing maintenance of the technology
- Dismantling and disposal of the technology.

It is likely that work related to renewable energy generation and storage technology extends beyond the existing definition of 'electrical work' in the Act. The Queensland Government is committed to maintaining community and industry benefits from these technologies, while noting safe interaction with the technology is paramount. An example of community and social benefits associated with the emergence of renewable energy has been provided as part of a written submission provided by the CEC and outlined below (refer Box H).

[70] Department of Energy and Public Works. Retrieved from: https://electricity-generation-map.epw.qld.gov.au/. Last viewed on 11 October 2023.

Box H: Social and community benefits associated with the emergence of renewable energy

The CEC submitted the following:

> "(…) More lowly skilled roles are entry points for underrepresented labour groups in the clean energy workforce such as First Peoples, female trades and the long-term unemployed. For example, some solar EPCs are designing programs that engage women on solar farms to fix modules as an entry into a trade. A solar EPC in NSW also recently employed over 30 local First Peoples at a 240 MW solar farm. This has had a significant impact on the local community, producing 'generational change' through the provision of meaningful work. It has supported the social license for the project and delivered value for the community."

In addition, CEC noted that legislative changes would prevent 'Aboriginal peoples and Torres Strait Islander peoples from gaining employment opportunities in this sector. CEC noted:

> "(…) If the work had required an electrical license, none of the Indigenous workers on site could have been employed. This outcome would run counter to Queensland's 2021 Closing the gap implementation plan, which aims for 62% First Peoples employment by 2031."

Decentralisation of energy generation and increase in electricity entities

The emergence of renewable energy generation technology has dramatically transformed the energy generation landscape. In the last 20 years, electricity generation has moved from a reliance on fossil fuels by a small number of government owned corporations (a centralised model) to a growing and diverse field of energy entities, including many private organisations (a decentralised model). For example, there was a 19 percent increase in the number of electricity entities registered with the Queensland Department of Energy and Public Works from 2017 to 2022. These private electricity entities generate, transmit or distribute electricity.

There is a risk that these new entrants into the renewable energy market do not have a comprehensive understanding of the electrical safety requirements in Queensland. Additional considerations in terms of stakeholders, complexities and risks associated with the transition towards a decentralised model of electricity generation have also been noted in a written submission received from Powerlink, in response to the Discussion Paper (refer Box I).

Box I: Impacts of decentralisation of energy generation

Powerlink submitted the following:

> "The Discussion Paper focuses on the complexities related to the decentralised nature of energy generation entities as the source of new entrants into the renewables sector. This is too narrow a description of the complexity issues for the changing nature of electrical work and the limited understanding by these new entrants of the electrical safety requirements in Queensland.
>
> Powerlink sees similarities with the other types of large entities such as large load customers and other special approval holders.
>
> There are also additional complexities related to rely on the prevalent typical industry contracting structures which outsource electrical work for construction and maintenance. Construction (including initial electrical connection) and operate and maintain contractors are increasingly being relied on by entities to manage electrical safety.
>
> Importantly, as noted above, the increasing contestability scenarios available under Chapter 5 of the National Electricity Rules means that parts of an entities' network can be constructed and owned by a party other than the electricity entity who is nominated by the customer. This party is not working under a contract for services with the entity, and therefore the entity will have limited control over the activities in a way which would justify placing the electrical safety duties for these activities onto the entity."

Changing nature of the workforce

Just as the nature of electrical work has significantly changed over the past 20 years, so has the workforce that carries out electrical work.

For example, subcontracting arrangements are common in the electrical sector for tasks that fall outside of the remit of 'electrical work'. This work is undertaken by labourers who do not hold an electrical licence.

The growth of labour hire working arrangements and the gig economy has also increased risks for workers in the sector. Labour hire is a working arrangement where workers are directly employed by an agency which then 'on-hires' them to perform work for a third-party employer. The agency is responsible for paying the worker and providing other employee entitlements while the third-party employer directs the worker to complete specific tasks. Gig economy workers are often unaware of the risks of completing electrical work without a licence.

These working arrangements pose specific risks to workers and highlight the importance of ensuring that the ES Framework adequately addresses the changing nature of work in the sector. In response to the Discussion Paper, the Electrical Trades Union (ETU) emphasised the need to reduce potential hazards as much as possible in consideration of recent workforce developments in the sector, and uncertainties related to the extent of workers impacted or exposed to risks while completing electrical work without a licence (refer Box J).

Box J: Emerging informal labour market risks

The ETU submitted the following:

> "The growth of decentralised energy generation and storage, coupled with the growth in the informal labour market (including gig work, labour hire and other forms of insecure contracting) make estimation difficult and available data is insufficient to quantify the number of workers impacted by the identified hazards. While this makes the question of quantity difficult to answer, another question must be answered to clarify the formers' purpose. How many workers exposed to unnecessary hazard should be acceptable? How many deaths are permissible? In our view, any and all hazards should be minimized as much as possible, and all deaths should be avoided."

Current regulatory framework

5.1.1.1 What is electrical work?

The term 'electrical work' is fundamental to the ES Framework in Queensland.

Section 18 of the Act defines 'electrical work' as:

- Connecting electricity supply wiring to electrical equipment or disconnecting electricity supply wiring from electrical equipment, or
- Manufacturing, constructing, installing, removing, adding, testing, replacing, repairing, altering or maintaining electrical equipment or an electrical installation.

Examples of electrical work include installing low voltage electrical wiring in a building or maintaining an electricity entity's overhead distribution network.

5.1.1.2 What is not electrical work?

The Act also defines what is *not* 'electrical work'; these tasks are generally lower risk.

Section 18(2) of the Act lists 15 exclusions that are not considered 'electrical work', including:

- Connecting electrical equipment to an electricity supply using a flexible cord plug and socket outlet, for example, plugging in an appliance
- Work on a non-electrical component of electrical equipment, for example, painting electrical equipment covers
- Replacing electrical equipment if that task can be safely performed by a person who does not have expertise in carrying out electrical work, for example, replacing a light bulb.

5.1.1.3 Electrical licences

Electrical work is high risk work. Due to the risks involved, people working in the electrical trades must hold an appropriate licence to carry out electrical work.

Section 55 of the Act requires people who perform or supervise electrical work to hold a current electrical work licence which authorises them to perform the work.

As noted previously, Queensland's ES Framework has six different classes of electrical work licences (refer to Section 4.7 for a full detailed list).

Queensland's electrical licensing system covers approximately 14,000 electrical contractors and 56,000 electrical workers. Between 2007 and 2022, the number of electrical contractors grew by 82 percent while the number of electrical workers grew by 58 percent. This growth is expected to continue into the future in line with the anticipated growth in the renewable energy sector.

To ensure community confidence, it is essential that only suitable individuals who have completed the required training be granted a licence. The strength of the licensing framework is essential to ensuring high standards of electrical safety are maintained across Queensland.

5.1.1.4 Relevant electrical training

Electrical training, such as an electrical apprenticeship, is an important step on the pathway to becoming a qualified electrical mechanic in Queensland. The apprenticeship framework combines on-the-job training with off-the-job formal study to achieve a nationally-recognised qualification and trade certificate. The electrical apprenticeship usually takes four years to complete. It consists of a significant number of technical and safety units of competency, as well as rigorous on-the-job training. Once the apprenticeship is completed, an individual is awarded a Certificate III qualification. This allows a person to apply for an electrical work licence to carry out work as an electrical mechanic.

Apart from an electrical apprenticeship, other pathways to becoming qualified include obtaining a restricted licence and obtaining on-the-job training through, for example, air conditioning work.

Electrical safety considerations from the changing nature of electrical work

The Review identified three areas of risks resulting from the changing nature of electrical work. These were:

1. Fixing, mounting and locating of renewable energy generation and storage technology (such as solar PV panels)
2. Laying, cutting or sealing underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source
3. Mechanical cable protection work.

5.1.1.5 Fixing, mounting and locating of renewable energy generation and storage technology

Renewable energy generation and storage technologies create specific safety risks when workers undertake fixing, mounting and locating work. For example, safety risks identified with this type of work on PV solar panels include:

- PV modules generating electricity the moment sunlight is on the surface and that the module and its associated wiring is not able to be isolated from electricity unless it is covered to prevent exposure to light
- The proximity of other existing arrays of PV modules with high direct current voltages posing an electrical safety risk during fixing, mounting, locating or removal work
- Unsafe removal and replacement of PV modules without proper electrical isolation first.

In addition to the specific risks that apply to solar PV panels, the following electrical risks apply to the fixing, mounting and locating of all renewable energy generation and storage technology:

- Crushing or damage of cable which elevates risk of electric shock, fire and arc flash during connection of the technology, maintenance or dismantling
- For battery technologies, damage to the integrity of the technology which poses a risk of exposure to hazardous chemicals or explosion.

The Review identified different groups of people at risk from this technology include:

- Workers completing this work in the course of their employment
- Members of the public completing this work in their home
- The general community, where there is an elevated risk of fire from using this technology.

These risks may be further heightened because of the increase of renewable energy generation and storage technology work being undertaken. Anecdotal feedback from the Review indicated that labourers without licences and members of the community were often completing these tasks. While a portion of submissions in response to the Discussion Paper also acknowledged that labourers without licences are typically completing these tasks, stakeholders' views differed regarding what work can be performed by unlicenced workers (refer Box K).

Box K: Workforce profile & risks: Fixing, mounting and locating of renewable energy generation and storage technology

The CEC submitted the following:

> "Electricians do not receive special training in handling, locating, mounting, and fixing solar PV panels as part of their electrical apprenticeship, and would need to receive the same training delivered to unlicensed workers who perform this work today. They are, however, highly trained individuals; all electricians consulted for this submission affirmed that this would be repetitive, labour-intensive work ill-suited to their qualification. Low workplace satisfaction and boredom risks lapses of concentration and could lead to more workplace incidents and injuries related to manual handling."

The National Electrical & Communications Association (NECA), National Fire Industry Association of Australia (NFIA) and Master Electricians Australia (MEA) included the following in a joint submission:

> "Our associations agree broadly with the identified risks, however, we are of the view that the initial fixing, installing and mounting of individual PV components is a low risk and can be performed by Trade Assistants under the appropriate level of supervision by an electrician.
>
> We agree that removal, repair, and replacement of PV components is high risk work and should only be performed by a licensed EW."

AGL submitted the following:

> "AGL does not support Options 2 and 3 (legislative responses) to address potential safety concerns, and although the requirement for direct supervision by a licenced electrical worker, or to have works carried out by a licenced electrical worker are onerous, we do not consider that they would have a meaningful effect on mitigating any potential safety risks posed by these categories of works. Tradespersons involved in these works have other specific certifications and expertise in their respective areas and are therefore best placed to safely carry out these works, particular with respect to the second category (laying, cutting, sealing) and third category of work (mechanical cable protection)."

Renewable energy generation and storage technologies consist of a diverse spectrum of items ranging from single solar PV panels (operating at ELV) to domestic BESS to community battery systems operating at HV.

The way these technologies are dealt with by the Act varies based on the voltage of the equipment, as noted in Section 4.1. Despite the Act applying different levels of regulation to these technologies based on their voltages, the requirements for mounting, fixing and locating this technology is consistent across the ES Framework.

However, section 18(2) of the Act provides two exceptions for work that is not considered 'electrical work' related to fixing, mounting and locating work, as follows:

- locating or mounting electrical equipment, or fixing electrical equipment in place, if this task is not performed in relation to the connection of electrical equipment to an electricity supply
- locating, mounting or fixing in place electrical equipment, other than:
    - making or terminating electrical connections to the equipment
    - installing supply conductors that will connect the equipment to a supply of electricity.

These provisions exclude the locating, mounting and fixing of electrical equipment from the definition of 'electrical work'. Therefore, regardless of the voltage of renewable energy generation and storage technology, the fixing, locating and mounting of electrical equipment – where it is not in relation to connection of the equipment – is not electrical work and does not require a licence.

5.1.1.6 Mechanical cable protection work

Work to install, build and repair mechanical cable protection was raised during the Review, due to its potential to pose electrical risk. This can occur when the integrity of the cable insulation is compromised, which typically occurs due to mishandling or incorrect installation.

This risk has the potential to be magnified due to working arrangements, such as subcontracting and the use of labour hire workers. This is because these workers may not always be well-equipped with sufficient knowledge about the risks of faulty mechanical cable protection work.

Section 18(2) of the Act provides that 'electrical work' does not include building or repairing ducts, conduits or troughs (channels) where electrical wiring will be or is installed, if:

- The channels are not intended to be earthed
- Wiring installed in the channels is not energised
- The work is done under the supervision of a person licenced to perform electrical installation work.
- Laying, cutting or sealing underground cables prior to connection (electricity entities)

The Review identified the laying, cutting, or sealing of underground cables that are part of the works of an electricity entity (before the initial connection of the cables to an electricity source) as work that poses safety risks.

As detailed above, the decentralisation of energy generation has increased the number of electricity entities undertaking this work. The profile of these entities has shifted from a handful of government owned corporations to a large and diverse range of private sector businesses. Many of these new private sector businesses may not be well-equipped to manage the risks associated with high-risk electrical work.

While the act of laying, cutting and sealing underground cables prior to their initial connection does not pose significant immediate electrical risk, where the cables are incorrectly laid, cut or sealed, this poses an electrical risk to workers who are later responsible for connecting the cables.

The current definition of 'electrical work' provides several exceptions for electricity entities (as approved by the Department of Energy and Public Works) that do not otherwise apply to other PCBUs carrying out electrical work. Laying, cutting and sealing underground cables as part of the works of an electricity entity before the initial connection of the cables to an electricity source is excluded from being 'electrical work'.

A number of other activities under the Act do not require an electrical licence where the work is carried out on the works of an electricity entity, including:

- Building, under the supervision of an electricity entity, an overhead electric line on structures that do not already carry an energised overhead electric line
- Recovering underground cables that are part of the works of an electricity entity after disconnection from an electricity source
- Altering, repairing, maintaining or recovering an overhead electric line that is part of the works of an electricity entity, if the work is performed under the entity's supervision and:
    - If the line is not on supports holding another electric line—the line has been isolated from an electricity source so that the closure of a switch cannot energise the section of the line where work is being done
    - If the line is on supports holding another electric line—both lines have been isolated from an electricity source so that the closure of a switch cannot energise the section of the line where the work is being done or an adjacent section of the other line.

Historically, these exemptions applied to distribution and transmission entities such as Energex, Ergon and Powerlink. One reason for their exemption is that these 'traditional' electricity entities have the expertise to design, construct, operate and maintain their networks safely. Under the Regulation, these entities are required to have safety management systems in place to comprehensively manage any risks posed by the work they complete.

However, the growing number of renewable energy operations means that the number of PCBUs considered to be an electricity entity has also expanded. Unlike the large 'traditional' energy entities, newer entities may not have the same level of expertise, exposure or experience with electrical safety risks. In addition, because they are not prescribed entities under Queensland's ES Framework, they are also not subject to the same safety management system requirements to comprehensively manage risk.

Despite this, in response to the Discussion Paper, AGL expressed opposition towards legislative responses to improve the safety of workers in relation to the three risk areas of Topic 2. The entity stated that the skillsets of tradespersons currently undertaking work in these areas are sufficient and ensures that these activities are undertaken safely (refer Box L).

Box L: Insights and recommendations provided by AGL in relation to promoting the safety of workers

AGL submitted the following:

> "AGL does not support Options 2 and 3 (legislative responses) to address potential safety concerns, and although the requirement for direct supervision by a licenced electrical worker, or to have works carried out by a licenced electrical worker are onerous, we do not consider that they would have a meaningful effect on mitigating any potential safety risks posed by these categories of works. Tradespersons involved in these works have other specific certifications and expertise in their respective areas and are therefore best placed to safely carry out these works, particular with respect to the second category (laying, cutting, sealing) and third category of work (mechanical cable protection) (…)."
>
> "Rather than requiring an already skilled tradesperson to hold a full electrical licence to undertake these works, AGL recommends further certification or education to cover identified gaps in safety standards. Potential safety risks would be more appropriately addressed through formal or informal training requirements for personnel proposing to undertake the works referred to in the Discussion Paper, in combination with some education and awareness campaigns by the Queensland Government."

4.1.2 Interjurisdictional comparison

Electrical safety legislation is not uniform amongst jurisdictions in Australia. However, the model Work Health and Safety Regulations 2011 (model WHS Regulation) – coordinated by Safe Work Australia – includes prescribed requirements for general electrical safety in workplaces and energised electrical work. While not all jurisdictions have adopted the harmonised WHS legislation, many are closely aligned in their respective electrical safety laws.

Section 146 of the model WHS Regulation provide that the following activities are not electrical work:

- Work that involves connecting electrical equipment to an electricity supply by means of a flexible cord plug and socket outlet
- Work on a non-electrical component of electrical equipment, if the person carrying out the work is not exposed to an electrical risk
- Replacing electrical equipment or a component of electrical equipment if that task can be safely performed by a person who does not have expertise in carrying out electrical work
- Assembling, making, modifying or repairing electrical equipment as part of a manufacturing process
- Building or repairing ducts, conduits or troughs, where electrical wiring is or will be installed if:
    - the ducts, conduits or troughs are not intended to be earthed
    - the wiring is not energised
    - the work is supervised by a [licensed or registered] electrical worker

- Locating or mounting electrical equipment, or fixing electrical equipment in place, if this task is not performed in relation to the connection of electrical equipment to an electricity supply
- Assisting a [licensed or registered] electrical worker to carry out electrical work if:
    - the assistant is directly supervised by the [licensed or registered] electrical worker
    - the assistance does not involve physical contact with any energised electrical equipment
- Carrying out electrical work, other than work on energised electrical equipment, in order to meet eligibility requirements in relation to becoming a [licensed or registered] electrical worker.

Under the New South Wales Work Health and Safety Regulation 2011 (NSW), the definition of 'electrical work' is currently consistent with the model definition. However, a Discussion Paper published by the New South Wales Government in November 2022 proposed changes to the definition of 'electrical work' in response to risks posed by emerging technologies.

Box M: Outcomes of NSW Discussion Paper.

The 2023 NSW Review Report made several recommendations in relation to the "electrical work" definition contained in the *Gas and Electricity (Consumer Safety) Act 2017 (NSW)* (G&E Act).[71]

The review concluded there were opportunities to refine, provide clarification and future proof existing definitions relating to electrical work in the *G&E Act)*. The Review proposed feedback should be considered in addition to further consultation with industry in fine tuning the definitions of electrical installation, electrical installation work and electrical equipment to ensure there are no unintended consequences.

South Australia and the Australian Capital Territory also adopted the 'electrical work' definition in the model WHS Regulation in their respective work health and safety regulations. Victoria, Tasmania, and the Northern Territory all depart from the model WHS Regulation while maintaining similar intent.

The model WHS Regulation contains a part on electrical safety (Part 4.7), however Queensland did not initially adopt this part of the model WHS Regulation. At a later stage, Queensland modified the 'electrical work' definition in the Act to achieve alignment with the model definition.

5.2 Objective of government action

The overall objective of the Queensland Government in relation to electrical safety under Topic 2 is:

- To reduce electrical risks to workers, industry and the community from work in relation to electrical technologies while minimising regulatory burden
- To encourage technological growth and innovation – particularly of electrical technology contributing towards government renewable energy targets – while maintaining an effective and efficient ES Framework, preventing risk to life and property.

5.3 Discussion Paper options

The Discussion Paper sought feedback on three options in addition to the Status Quo that proposed to meet government objectives and respond to problems identified for the 'electrical work' definition. These are canvassed in Table 16.

Table 16: Topic 2 - options overview

Options	Description
Option 1	Status Quo (no legislative change)

[71] NSW Government. (2023). Statutory Review Gas and Electricity (Consumer Safety) Act 2017.

Option 2	Increase supervision requirements for certain activities excluded from the electrical work definition (legislative response)
Option 3	Expand the definition of electrical work by reducing scope of existing exclusions (legislative response)
Option 4	Education and awareness (non-legislative response)

5.4 Results of Discussion Paper consultation

To inform decision making on Topic 2, stakeholders were asked a series of questions presented in the Discussion Paper concerning:

- The identified problem and the associated impact on their activities
- Views on a licensing regime and preferred options (if any) for reform.

Questions pertaining to Topic 2 are outlined in Box N.

Box N: Stakeholder Questions (Topic 2)

- How are you, your organisation, the workforce and the community affected by the issues posed by the changing landscape of electrical work? To what extent?
- How many workers have been impacted by the identified hazards or are exposed to such hazards and might be exposed in the future? Which workers/ businesses/ households are impacted by the problem?
- Which are the key industries in which these tasks take place and how large are they?
- Do you agree with the assessment of the issues identified with the changing nature of electrical work, are there any other elements to the issue that you think have not been captured? If possible, please share examples of your experience with these issues.
- What practical impacts – including costs and benefits – would each option have on you, your organisation, the workforce and the community? Please share examples of impacts and experiences of impacts, where possible.
- In relation to the following three risks considered, which of the four options do you think is best and why?
    - Fixing, mounting and locating of renewable energy generation and storage technology (such as solar PV panels)
    - Mechanical cable protection work,
    - Laying, cutting or sealing underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source.
- Do you have suggestions for other options to address the issues identified? Please provide examples (including costs) on the impacts of your suggested options, including how it would ensure the workforce is electrically safe and conduct electrically safe work.
- The Review identified risks with the locating mounting and fixing of energy generation and storage electrical equipment. Do you agree that the risks identified are limited to this equipment? If not, what do you consider the scope of these risks to be?
- The Review identified risks from the laying, cutting or sealing of underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source (section 18(2)(j) of the Act). Other exclusions for electricity entities also exist in section 18(2) of the Act. Has the decentralisation of energy generation had a similar impact on the risk profile of these exclusions? Please provide examples where possible.

The answers to these questions and additional comments in the written submissions determined the level of support or opposition for each option among the different categories of stakeholders.

It should be noted that submissions were nuanced in nature and many of the positions represented by stakeholders were provided alongside specific conditions and caveats. The most common caveats provided for Topic 2 include the following:

- Support for an increased supervision requirement on the condition that supervision ratios and practice reflect the financial risk (cost burden) and do not unduly threaten the commercial viability of businesses. In addition, respondents noted that supervision requirements need to be better defined
- Support for an increased supervision requirement but noting concerns with the scope of what is being proposed
- General support for supervision requirement but noting entity supervision through reliable engineering or managerial methods may have not been considered.

Table 17 captures stakeholders' overarching position based on the overall sentiment provided in their submissions. It should also be noted that some stakeholders provided their opinion on the options but did not directly state a preferred option.

Table 17: Stakeholder alignment to options

Topic 2- Changing landscape of electricity and the workforce				
Locating, mounting and fixing of energy generation and storage technology				
Option 1 – Status Quo	Option 2- Legislative change (Supervision)	Option 3 – Legislative change (License)	Option 4 – Awareness and Engagement	Preferred Option not indicated
• Peak body (1) • Non-prescribed electricity entity (1) • Individual - licensed electrical worker (1)	• Peak body (3) • Prescribed electricity entity (1) • Non-prescribed electricity entity (1) • Skills and training organisation (1) • Government Department or Regulator or Statutory Agency or Authority (1)	• Union (1) • Prescribed electricity entity (1)	• Individual (2) • Peak body (4)	• Prescribed electricity entity (1)
Total: 3	**Total: 7**	**Total: 2**	**Total: 6**	**Total: 1**
Laying, cutting and sealing of underground cables prior to connection by electricity entities.				
Option 1 – Status Quo	Option 2- Legislative change (Supervision)	Option 3 – Legislative change (License)	Option 4 – Awareness and Engagement	Preferred Option not indicated
• Prescribed electricity entity (1) • Non-prescribed electricity entity (1)	• Government Department or Regulator or Statutory Agency or Authority (1) • Prescribed electricity entity (1)	• Union (1)	• Individual (1) • Peak body (1)	• Prescribed electricity entity (1) • Individual (1)
Total: 2	**Total: 2**	**Total: 1**	**Total: 2**	**Total: 2**

Topic 2- Changing landscape of electricity and the workforce				
Mechanical cable protection				
Option 1 – Status Quo	Option 2- Legislative change (Supervision)	Option 3 – Legislative change (License)	Option 4 – Awareness and Engagement	Preferred Option not indicated
• Prescribed electricity entity (2) • Non-prescribed electricity entity (1) • Individual – licensed electrical worker (1) • Electrical contractor (1) • Peak body (3)	• Non-prescribed electricity entity (1) • Government Department or Regulator or Statutory Agency or Authority (2) • Peak body (3)	• Union (1)	• Individual (2) • Peak body (1)	• Prescribed electricity entity (1) • Individual (1)
Total: 8	**Total: 6**	**Total: 1**	**Total: 3**	**Total: 2**

As per Table 17, the narrow majority of stakeholders who responded to Topic 2 were broadly in support of a supervision requirement (i.e., Option 2) when it came to the first risk area (locating, mounting and fixing of energy generation and storage technology). There was no distinct preference which emerged regarding the second risk area (laying, cutting and sealing of underground cables prior to connection by electricity entities), however maintaining the Status Quo was the preferred Option for the third risk area (mechanical cable protection).

The thematic analysis on the written submissions identified the common themes and specific arguments expressed by stakeholders. Common themes relating to each option under Topic 2 are summarised in Table 18.

Table 18: Topic 2 identified themes

Option 1	Option 2	Option 3	Option 4
• Maintaining the Status Quo	• Skills shortage • Supervision requirement • Supervision requirement (risk area 1) • Supervision requirement (risk area 2) • Supervision requirement (risk area 3)	• Skills shortage • Expand the definition of ‘electrical work’ • Expand the definition of ‘electrical work’ (risk area 1) • Expand the definition of ‘electrical work’ (risk area 2) • Expand the definition of ‘electrical work’ (risk area 3)	• Education and awareness

In general, the thematic analysis provided the following insights:

Cost burden (overarching theme): Most stakeholders highlighted that any legislative change (Options 2 and 3) will increase the cost burden on businesses and industry.

Option 1: Generally, support for maintaining the Status Quo was split evenly between those in favour and those against. However, most respondents acknowledged the existence of the issue and desired some form of action in response.

Option 2: Overall, written submissions responding to Option 2 highlighted that:

- Increased supervision requirements will add further pressure on the existing skills shortage related to licensed electrical workers in Queensland.
- Many stakeholders suggested there is a need for additional information / clarification regarding the specific supervision requirements proposed before any legislative change is implemented.

Option 3: Submissions highlighted that expanding the definition of 'electrical work' will add further pressure on the existing skills shortage related to licensed electrical workers in Queensland. Overall, most respondents showed a preference to expand the definition of 'electrical work' (aligned to the three key risks areas identified in the Discussion Paper), albeit with significant caveats. These caveats included considerations for cost pressure, the level of regulatory intervention and the overall workforce requirements.

Option 4: Several respondents expressed some level of preference for a government-led education and awareness campaign to inform the community about the changing landscape of electricity and workforce safety.

Based on the insights provided and the evidence collected during consultation, the suitability of options is discussed in the following section.

5.5 Issues raised during public consultation

As presented in the section above, the Thematic Analysis identified a range of stakeholder concerns associated with the suitability and feasibility of the options identified for Topic 2. In particular, the concerns can be categorised into three groups, including:

- commercial viability
- definition of options
- problem identification.

These are detailed in the sections below.

Commercial viability

As detailed previously, written submissions highlighted significant concerns and issues with the commercial viability for businesses and industry in responding to the proposed options under Topic 2, suggesting that any legislative change would be accompanied by disruption to business and, consequently, the workforce.

The key themes raised in consultation relating to commercial viability were that increased supervision, or a licencing requirement, would add further pressure on the existing skills shortage for licensed electrical workers. Feedback also indicated the changes canvassed would not deliver measurable improvements to safety.

It should be noted that commercial viability aspects do not act as a guiding principle for the safety regulator.

Definition of options

Overall, a range of stakeholders held the view that there was insufficient consultation with industry groups and other stakeholders when forming and defining appropriate options in the Discussion Paper. Some stakeholders noted a lack of clarity relating to the options presented and that more engagement with industry was necessary before implementing regulations that could severely impact the industry.

Submissions received identified general concerns with the complexity and workability of the ‘electrical work’ definition. The submissions suggested the definition in its current form is causing a degree of confusion and uncertainty for workers and industry and warrants consideration. This was coupled with feedback that the existing definition of ‘supervise’, be also further clarified before considering the need for further changes.

The abovementioned points make assessing the economic outcomes of Options 2 and 3 particularly challenging. Consultation also identified that the other areas of work not captured by the Discussion Paper present a comparable risk profile to those captured within the Discussion Paper. Finally, submissions indicated that the complexity of the existing definition is challenging to apply. This would suggest that a more informed review of the definition is required.

Problem identification

Written submissions highlighted concerns relating to the problem identification process relating to Topic 2.

Submissions did not provide evidence of electrical safety concerns to justify expanding the definition in any of the three risk areas, as proposed by the recommendations explored in the Discussion Paper. Where submissions supported the case for legislative change, evidence was not provided of electrical safety issues to support the position. Furthermore, submissions emphasised that any regulatory changes should be supported by data-driven decisions. For this reason, the public consultation process and the proceeding assessment have identified that the overall problem definition was insufficient and requires further refinement.

Finally, in the absence of a clear definition of ‘supervision’, the current framing of one of the legislative options is deemed not suitable, as the impacts of the option was unable to be accurately assessed.

As such, an economic analysis has not been undertaken on Topic 2.

5.6 Recommended options and next steps

Submissions indicated that a sufficient case for legislative change as proposed by the Review does not exist. For this reason, results of the stakeholder consultation and thematic analysis on the written submission in response to the Discussion Paper support **Option 1: Status Quo** as the preferred option for all three sub-topics explored in Topic 2. In summary, submissions highlighted a:

- concern that legislative change would not deliver measurable improvements to safety while adding further pressure on the existing skills shortage for licensed electrical workers
- an absence of a clear definition of ‘supervision’ which poses interpretation challenges in order to appropriately assess the impacts of the legislative supervision options canvassed
- lack of data supporting problem identification
- complexity with the current definition of electrical work.

While some stakeholders supported Options 2, 3 and 4, these views were in the minority and were provided without accompanying evidence. Ultimately, the majority of stakeholders believed that the proposed options for change would not effectively address the issues and problems associated with the definition of ‘electrical work’.

On the basis that submissions did not provide a sufficient case for legislative change as proposed by the Review, the proposed course of action is Option 1 (Status quo).

However, submissions did indicate the definition of ‘electrical work’ would benefit from additional clarity. Relatedly, submissions also identified an absence of a clear definition of ‘supervision’ which poses interpretation challenges.

Noting concerns around lack of clarity in the existing ‘electrical work’ and ‘supervision’ definitions, it is proposed that a working group comprised of key industry and union stakeholders be established to explore definitional change. This working group will be able to consider improvements to the 'electrical work' definition to ensure it is fit for purpose and contemporaneous. Outcomes from this

working group would be able to be considered for incorporation in a future package of legislative reform.

6 Topic 3: Electrical safety and electric vehicles

6.1 Problem identification

Electric vehicles

An EV is a vehicle with a motor powered by electricity rather than a fossil fuel, such as petrol. There are currently four main types of EVs:

- Battery Electric Vehicles (BEVs): fully electric, powered by a battery that is connected to an external charging outlet when charging the battery; does not use any other source of fuel.
- Plug-in Hybrid Electric Vehicles (PHEVs): powered by a combination of fuel and battery. Can be connected to an external charging outlet to recharge a battery as well as refuelling a fuel tank.
- Fuel Cell Electric Vehicles (FCEVs): use a fuel cell rather than a battery cell, or in combination with a battery or supercapacitor to power the vehicle. The most common are typically fuelled by hydrogen.
- Non-Plug-In Hybrid Electric Vehicles (HEVs): in place of an external charging outlet, electricity generated by the HEV's braking system is used to recharge the battery, termed 'regenerative braking', which is also used in BEVs, PHEVs and FCEVs.

For the purpose of this paper, 'EVs' refers only to motorcycles, cars, trucks and buses. Excluded from consideration in this Part are:

- E-scooters and e-bikes
- Electric mining vehicles
- Hydrogen-powered EVs
- Marine vessels
- Aircrafts
- Trains and trams.

6.1.1.1 Scope: propulsion components of an EV

The options explored in this paper only consider the components forming the propulsion of an EV, being:

- The motor
- Lithium-ion battery that powers the motor.

Non-propulsion components that are not in scope include:

- Electrical components powered by a petrol-powered internal combustion engine (ICE), such as headlights, starter motors, heating, ventilation and air conditioning (HVAC).
- Other electrical components of the vehicle (e.g., an outlet socket) powered by a lithium-ion battery.

The scope of this paper aligns with the Review, which does not seek to amend the current exclusions for these electrical parts of vehicles or amend the current requirements in the ES Framework legislation for a 'restricted electrical work licence' for working on non-propulsion components operating above ELV.

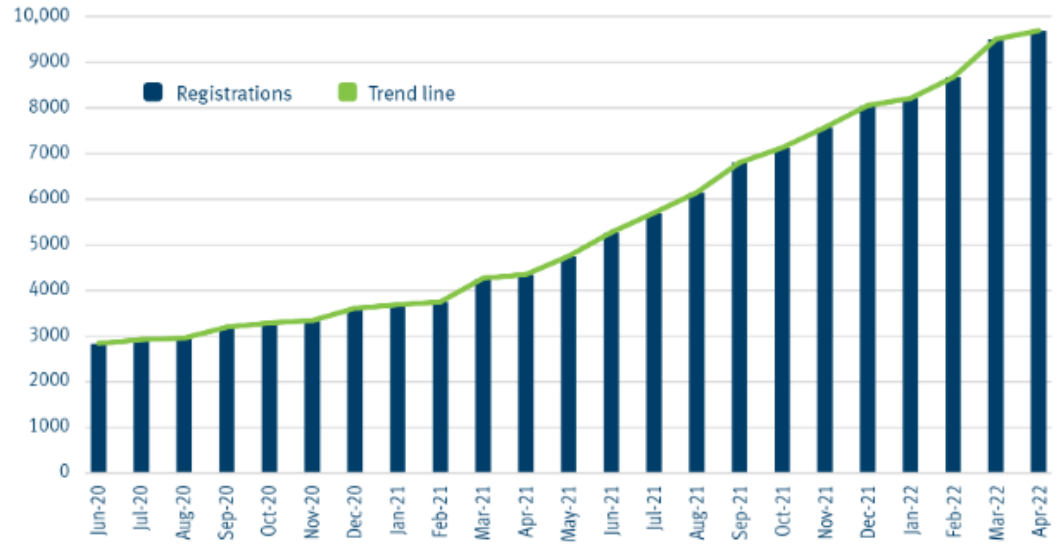
It should be noted that lithium-ion batteries can form part of the propulsion components as well as supplying power to non-propulsion components. However, it is the intention that the current licence requirements for working on non-propulsion components remain, irrespective of whether the battery is the same one that provides propulsion to the vehicle.

Changing landscape for vehicles

With improvements to efficiency and developing electricity infrastructure, the growth in uptake of EVs is increasing substantially. Trends indicate a steady increase of registrations of EVs over the last

three years.[72] In Queensland, as presented in Figure 14, EVs are becoming increasingly popular, with 9,701 BEVs registered in April 2022 (including passenger cars, light vans, motorcycles, buses and trucks).[73]

Figure 14: BEVs registered in Queensland (snapshot as of 30 April 2022), Source [74]



Registered battery electric vehicles include passenger cars, light vans, motorcycles, buses and trucks. Registration data includes private ownership, commercial fleet, and commercial dealership registrations.

Source: Queensland Government (2022). Queensland's Zero Emission Vehicle Strategy.

This trend is predicted to continue with State and Federal Governments offering and implementing a myriad of initiatives to encourage and support the growth of the electric cars in Australia, many of which feature in Queensland's Zero Emission Vehicle Strategy 2022-2032 and the QEJP. These include:[75]

- 50 percent of new passenger vehicles sales to be zero emission vehicles by 2030
- 100 percent of new passenger vehicle sales to be zero emission vehicles by 2036
- 100 percent of eligible QFleet passenger vehicles to be zero emissions vehicles by 2026
- Every new TransLink funded bus added to the fleet to be a zero-emission bus from 2025 in South-East Queensland and from 2025-2030 across regional Queensland.

Homeowners are now able to consider their home as an energy generation and storage hub, whereby their rooftop solar (PV panels) can generate energy that is stored in a home BESS for later use. The residence's PV panels, or BESS can be used to charge an EV.

Advancement in technology means that bidirectional charging (where an EV can both draw from and contribute to the electricity grid) may also grow in prevalence. Some providers, such as the Volkswagen Group, Ford and Volvo, already support bidirectional functionality. Tesla has also indicated bidirectional charging will be a reality with its products by 2025. Although further steps in infrastructure and design are required before these technologies become commonplace, it does

[72] Queensland Government. (2022, 03 16). Retrieved from Queensland's Zero Emission Vehicle Strategy: https://www.qld.gov.au/transport/projects/electricvehicles/zero-emission-strategy
[73] Ibid.
[74] Ibid.
[75] Electric vehicle snapshot April 2022. (2022, 04 30). Retrieved from https://www.qld.gov.au/transport/projects/electricvehicles/zero-emission-strategy/electric-vehicle-snapshot-april-2022

indicate that these changes are coming. It should be noted that battery chargers are already covered under the Act.

For those who do not have home charging, the number of commercial charging stations are increasing, both commercially at locations such as shopping centres and workplaces, as well as publicly through the Queensland Electric Super Highway, which will deliver 55 fast charging stations throughout Queensland.[76] The development of this infrastructure will assist in the uptake of these vehicles.

Electrical safety considerations

Safety risks arising from a lithium-ion battery at present include: the risk of physical injury or death through fire, explosion, toxic gases, electric shocks, arc flashes or exposure to battery electrolytes. These risks are increased by factors such as impact from collision, incorrect charging and faulty products.

These risks pose a threat to both persons, including life threatening burns and death, as well as damage to property. Risks presenting from EVs can occur in several settings, including in:

- Domestic settings (e.g., a house)
- Workplace settings (e.g., while work is being undertaken on a car)
- Public settings (e.g., public roads).

With further technological developments, there is the possibility of new and unanticipated electrical risks. For example, with the growing possibility of bidirectional EVs, the vehicle sector is increasingly tied to other equipment being used and installed in the home.

Currently, many EVs in Queensland are new and well within their original warranty period and, therefore, consumer relationships with OEMs are strong.

However, as EVs age, the growth of purchases in the second-hand market will change the degree to which vehicle owners are involved with OEMs. This is expected to lead to growth in work for mechanics outside of OEMs. It may also lead to more vehicle owners working on their own vehicle EVs (whether on propulsion components or otherwise). Therefore, there is a possibility that the risk profile for work on vehicle EVs may evolve in the years ahead.

In light of this, in response to the Discussion Paper, a number of stakeholders highlighted the important roles OEMs will continue to play to help to ensure the safety of the workforce and consumers (refer Box O).

[76] Queensland Government. (2022, 05 25). Queensland's Electric Super Highway powers up out west. Retrieved from The Queensland Cabinet and Ministerial Directory: https://statements.qld.gov.au/statements/95209

Box O: The roles of OEMs in maintaining workforce and consumer safety

The Motor Trades Association of Queensland (MTAQ) submitted the following:

> "Since the initial release of Hybrid Electric Vehicles (HEV) and subsequent EVs, Original Equipment Manufacturers (OEM) and importers have stipulated that only trained and qualified technicians may work on electrified products. Training was developed and delivered by the OEM to ensure the safety of the workforce and consumers. The OEM training courses build on the automotive specific electrical systems knowledge technicians gain during their apprenticeship, adding high voltage personal safety, workplace safety, the identification of high voltage system components, the importance of following depowering procedures and the use of the correct diagnostic equipment and tooling. This training, coupled with the safety systems engineered into the vehicles, has resulted in ensuring there has not being any deaths attributed to electrocution in the automotive industry to date."

REVORA submitted the following:

> "EVs unlike ICE vehicles will have a lower incidence of mechanical and electrical repair and maintenance due in most part the significant reduction in moving and wearing parts. This is evidenced by Tesla's decision not to provide a schedule servicing guidelines. In the event parts and servicing is required on an EV the complexity of the components in an EV will highly likely require return to the OEM for repair. With software flashing and initialisation these parts are not typically interchangeable by those without access to specific tooling (computers)."

NECA NFIA MEA submitted the following:

> "EV's have many fewer moving parts than conventional ICE vehicles, have sealed components, and are designed to be "plug and play" for maintenance and repair, with OEM's providing diagnostic software and excellent product training and manuals, just as they currently do for ICE vehicles."

The Australian Construction and Mining Equipment Industry Group (CMEIG) submitted the following:

> " (…) Competency-based OEM training and government-recognised certification and licensing can address the ability of our technical workforce to safely work on hybrid and battery electric earthmoving machines."

The Queensland Resources Council (QRC) submitted the following:

> "Globally, organisations within the resources sector, such as ICMM and GMG have established specialist working groups comprising of representatives from mining companies, original equipment manufacturers (OEMs), original technology manufacturers (OTM), researchers, academia, regulators and industry associations who collaborate to share expertise and create guidelines that address common industry challenges such as the recently released publication of GMG's Electric Mine Working Group *Recommended Practices for Battery Electric Vehicles in Underground Mining*. These specialist working groups in recognition of the pace of technological transformation have established processes to ensure practices and guidelines remain contemporary and relevant."

6.1.1.2 Voltages of EVs

EVs currently use lithium-ion batteries that operate at DC voltage and above ELV. It is projected that the voltage of EVs will continue to increase as higher voltage batteries support faster charging and longer distance travel.

For example, common electric passenger cars, such as a Tesla, tend to operate in the 350-400V range.[77] However, the Hyundai IONIQ 5, Genesis G80 EV and Kia EV6 are among those that can charge up to 800V.[78] By comparison, lead acid batteries (not powering the motor) in ICE vehicles operate at 12V.

The voltage of EVs differs greatly based on the class of vehicle. For example, electric motorcycles have a significantly lower voltage (48-52V) compared to that of an electric heavy truck (800-900V). The difference in voltage can be attributed to the weight and size of the vehicle.

In comparison, the Act captures electrical equipment commonly used in domestic settings (such as televisions, fridges and ovens) which operate at LV. Work on these pieces of electrical equipment is typically undertaken under either an electrical fitter licence or a restricted electrical licence for specific types of electrical equipment.

Table 19: Comparison of voltage for EV classes

Electric motorcycles	48 to 52V
Electric cars	200 to 800V
Electric passenger buses	380 to 800V
Electric heavy trucks	800 to 900V
Electric mining vehicles	3000V+

Note: the level of voltage identified in the above table is for discussion purposes only, and vehicle models can operate at different voltages even within the same class of vehicle.

Incidents and queries

It is difficult to predict the extent of risks posed by EVs as they increase in number. Most incidents involving EVs at this time appear to occur during the charging of batteries or following a collision. Neither of these events are within the scope of either the WHS or ES reporting frameworks. As a result, there is little data on the frequency of incidents available to ESO. Existing analysis has relied on media accounts and the work of organisations.

Under the WHS framework, PCBUs are expected to report incidents of this nature as they occur in a workplace. However, OIR believes there is a lack of understanding of notifiable incident requirements and underreporting is likely.

Of the queries OIR received from this sector in response to the Discussion Paper, many are in relation to whether the work relating to the battery and/or vehicle charging device is licensed electrical work; however, as part of the Thematic Analysis conducted on the written submissions, it was found that a number of stakeholders also highlighted a lack of incidence data (refer Box P).

[77] 400v vs 800v what's the difference? Electric car battery voltage explained. (n.d.). Retrieved from carsguide: https://www.carsguide.com.au/ev/advice/400v-vs-800v-whats-the-difference-electric-car-battery-voltage-explained-88101

[78] Sigal, P. (2022, 04 16). EV industry seen shifting to 800-volt architectures. Retrieved from Automotive News: https://www.autonews.com/technology/ev-industry-seen-shifting-800-volt-technology

Box P: EV Incidence Data

Eleven written submissions highlighted a lack of evidence regarding incidents of serious injury or death resulting from work being performed on EVs. While some respondents remarked upon a lack of incidents in general terms, a portion of stakeholders cited the lack of incidence data as justification for maintaining the status quo (or Option 1).

In line with this, one individual included submitted the following:

> "I contend that there is no problem as such. There have been no cases of electrocution from workshops repairing EVs. EVs have built-in safety features to prevent this."

The MTAQ submitted the following:

> "In somewhat of a paradox, the Discussion paper recognises there is no evidence of injuries as a result of automotive technicians working on EVs, and yet makes recommendations based on a range of assumptions and potential risks that will fundamentally change and negatively impact the automotive industry and its consumers."

Australian Automotive Dealer Association (AADA) submitted the following:

> "The AADA does not agree that there are problems with the current system and fails to see any evidence presented so far that demonstrates problems exist."

Some submissions broadly referred to the risks associated with lithium-ion batteries however none of the submissions identified additional incidence data related to work on EVs.

Enhancing electrical safety

Steps are being taken by both industry and government to recognise and mitigate risks presented by EVs to enhance electrical safety.

A desktop review of EVs for sale in Queensland indicates that the industry provides clear safety instructions to purchasers of EVs at the time of purchase and provides a detailed owner's manual to refer to post-purchase. Manuals typically include a dedicated EV battery section that highlights risks and provides guidance on what to do should there be a technical issue or an emergency.

Clearly, companies that manufacture and import EVs have an incentive to ensure safety is paramount. However, standards differ from manufacturer to manufacturer, including assumptions the industry may make about country-specific infrastructure and the implications of this for safety.

Government has taken steps to raise community awareness on EV safety in Queensland. In October 2021, the Department of Transport and Main Roads introduced an EV label for EVs, hybrid vehicles and hydrogen fuel cell vehicles. This assists first responders and the community to know that the vehicle is an EV in order for them to more safely manage an emergency situation.

QFES has also released guidance regarding EV accidents and incidents. This guidance material includes directions to community to:

- Ensure that EV remote ignition keys are at least 30 meters away from the vehicle, as these can inadvertently start the vehicle.
- Not charge a vehicle after an accident/incident until it has been inspected and approved by a technician.
- Ensure damaged EVs are kept in an open area at least 30 metres from other vehicles, buildings, and/or other exposures.[79]

[79] Queensland Fire and Emergency Services. (n.d.). Electric Vehicle Fire Safety. Retrieved from https://www.qfes.qld.gov.au/safety-education/battery-and-charging-safety/electric-vehicle-fire-safety

The government also requires that when installing charging equipment, steps are taken to ensure the charging cable and/or unit is electrically compliant and installed by an electrician as outlined in the Wiring Rules, Appendix P Guidance for Installation and Location of Electrical Vehicle Socket-Outlets and Charging Stations. The act of plugging in an EV to a charging station is not regulated under the ES Framework.

However, there is a need to consider practices related to EVs in domestic settings. This includes safe charging processes, such as not running extension leads that are designed for indoor use across public pathways to EVs parked in a street, charging leads sitting in water or obstructing fire protection installation. The parking and storage of an EV may also impact fire safety measures within a structure, however, changes to regulation outside of the ES Framework, such as the National Construction Code (for new buildings), are likely required to address this issue.

6.1.1.3 Workers

Note: 'workers' here refers to those undertaking work on the EV, and not those operating an EV for the purpose of work (e.g., bus or truck driver).

Workers are exposed to risks in two separate situations:

1. general maintenance of an EV
2. repairing damaged propulsion components of an EV.

Risks to workers are currently addressed through job training and the use of personal protective equipment (PPE). These mitigation measures should be consistent with the requirements under the WHS Act and ES Framework. Under the WHS Act, duties include a PCBU's responsibility to ensure that, as far as is reasonably practicable, workers are provided a safe work environment, including the provision of training and instruction, and supervision.[80] Furthermore, under section 30(1) of the Act, a PCBU must ensure the person's business or undertaking is conducted in a manner that is electrically safe. Section 30(2)(c) clarifies that *"if the person's business or undertaking includes the performance of work, whether or not electrical work, involving contact with, or being near to, exposed parts, ensuring persons performing the work are electrically safe."*

Training in Queensland

Currently in Queensland, work undertaken on ICE and EVs is largely carried out by motor mechanics and OEMs. Similar to other trades, an apprenticeship pathway exists for motor mechanics and auto electricians. Between 2019-20 and 2020-21,[81] the number of people commencing an apprenticeship pathway for motor mechanics has grown by over 40 percent. In 2021-22, there were 4,591 commencements of automotive-related apprenticeships and traineeships.[82]

Risks are being mitigated in these workplaces through the development and delivery of independent training specific to work on EVs. This includes the provision of training specific to a brand. For example, Tesla provides its own EV training to its technicians. This training among OEMs is considered to be of high quality. However, it is unclear whether smaller mechanic businesses in Queensland will be competitive in providing services for EVs and, if so, how they will access specialist training. Smaller businesses face the additional challenge that they typically service a wider range of vehicles than those of one manufacturer.

Non-accredited training is widely used by the automotive industry. As an example, MTAQ provide micro-credentials, such as the HEV/BEV Light and Commercial Vehicle Technician Safety Micro-credential, that explores the safety aspects and risks associated with the high voltages used in

[80] Section 19 of the WHS Act.

[81] DESBT Apprentice and Trainee Participation Activity Data and Statistics, accessed 7 February 2023.

[82] Department of Youth Justice, Employment, Small Business and Training. (2023, 02 21). Apprentice and trainee participation activity data and statistics. Retrieved from https://desbt.qld.gov.au/training/docs-data/statistics/training-performance/apprentices-trainees

electric drive vehicles.[83] TAFE Queensland also launched an EV training facility in 2022, providing training for the automotive industry on EVs, including additional training for apprentices and post-trade training for tradespersons.

In June 2022, the Automotive Retail, Service and Repair Training Package added a qualification (AUR32721 - Certificate III in Automotive EV Technology) which will likely be adopted as an apprenticeship pathway for motor mechanics in the near future. In response to the Discussion Paper, a number of submissions suggested that the current training and pathways available to the workforce is sufficient to ensure safety for EV related work (refer Box Q).

Box Q: Industry training and pathways

Additional detail included in written submissions on the current training and pathways available has been noted below:

TESLA submitted the following:

> "We believe that the combination of robust workplace training and existing trade qualifications specific to EV automotive repairs are sufficient to ensure the continued safety of the workforce. Currently all Tesla auto-mechanics operating in Queensland are certified to the following courses:
>
> - AUR30620 – Certificate III in Light Vehicle Mechanical Technology; and
> - AUR32721 - Certificate III in Automotive Electric Vehicle Technology.
>
> AUR32721 provides specialist EV training for auto-mechanics across 16 core units. This provides specialist training for auto mechanics on servicing EVs. All Tesla auto-technicians currently have, or will have, this specialist training."

The MTAQ submitted the following:

> "The automotive industry has designed and implemented a graduated approach to preparing and training the automotive workforce on EVs. This commences with non-accredited EV training on awareness and safety for automotive workers that work around or near EVs, and nationally recognised accredited training, delivered by registered training organisations, for automotive technicians to de-power, find and rectify faults and re-power EVs safely and to industry and manufacturers standards.
>
> MTA Queensland is currently offering a series of industry recognised micro credentials to help address the workforce development needs relating to the emergence of EVs. These credentials, funded by the Queensland Department of Youth Affairs, Employment Small Business and Training, offer training in:
>
> - Hybrid EV/EV Driver/Operator Safety
> - EV Micro Mobility and Outdoor Power Equipment Technician Safety
> - Hybrid EV/EV Light/Commercial Vehicle Technician Safety, and
> - Hybrid EV/EV Heavy Vehicle and Mobile Plant Technician Safety.
>
> In preparing the future workforce, automotive apprentices are already provided training in electrical theory that supports them to service and repair electrical systems that drive all modern vehicles. This includes elements related to electrical safety.
>
> As EV sales rise, the pathway for new entrants will be the recently nationally endorsed AUR32721 - Certificate III in Automotive Electric Vehicle Technology qualification, which contains the AURETH101 - Depower and reinitialise BEVs that is also embedded in the AURSS00063 - Battery Electric Vehicle Diagnose and Repair Skill Set. The AUR32721 -

[83] MTAQ. (n.d.). MICRO-CREDENTIALS. Retrieved from https://www.mtaq.com.au/micro-credentials/

Certificate III in Automotive Electric Vehicle Technology qualification, already available as an apprenticeship, will become the standard pathway for future EV automotive technicians.

For automotive technicians, electrical theory and electrical safety is delivered in their apprenticeship that allows them to service and repair electrical components related to modern vehicles. These technicians will also receive EV specific de-power, fault find and repair and repower units of competency to work on servicing and repairing EVs."

Accordingly, MTA Queensland also recommended the need to recognise and standardise training currently available in the sector:

"To build on the comprehensive approach being implemented by the automotive sector, MTA Queensland recommends a staged approach by the ESO:
a. reject the recommendations of the Review and Discussion Paper relating to EVs

b. recognise that in late 2023, the Motor Trades Association Queensland (MTAQ), in collaboration with the Queensland Department of Employment, Small Business and Training will be delivering a series of workshops across Queensland under the *Building Business Capability for Hybrid Electric Vehicle/Electric Vehicle Project* to help businesses transition to working of EVs, including WHS practices

c. ESO in its guidance to the automotive industry recommends the completion of industry endorsed EV micro credentials to ensure all automotive technicians and apprentices have an awareness of the safety requirements of EVs

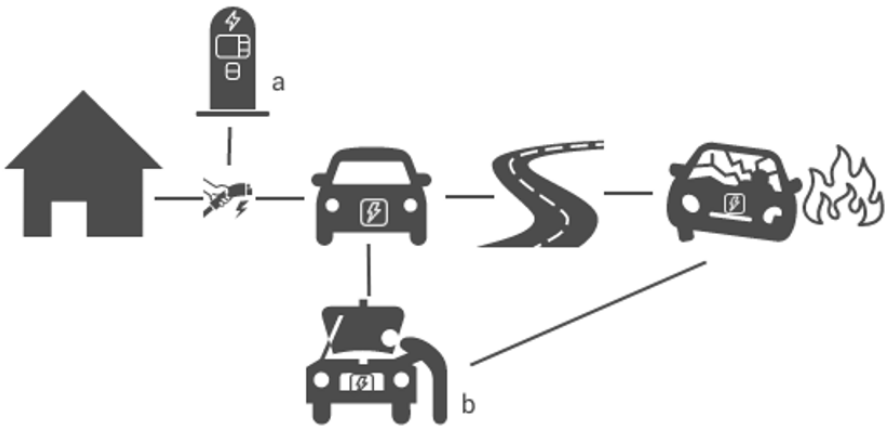
d. ESO supports the development of skills for automotive technicians by requiring the completion of the AURETH101 - Depower and reinitialise BEVs or skill set AURSS00063 - Battery Electric Vehicle Diagnose and Repair for those workers already working on EVs

e. ESO, in collaboration with the automotive sector, design a restricted electrical licence for qualified automotive technicians as a precursor to working on EVs."

Regulatory considerations

An important implication in not having a licensing framework for particular work on EVs is that government does not therefore have responsibility for the development, delivery, record keeping and oversight of training. This is not to assume that government automatically undertakes these responsibilities better than the private market, but it is to note that, without a licensing framework, the community must be confident that these elements are being properly managed. The consideration of the regulatory options begins with an understanding of the multiple regulators concerned with vehicles and what activities are out of scope for the ES Framework. Figure 15 indicates two points of risk at which such regulatory intersection could be considered.

Figure 15: EV points of regulatory intersection



***a**: The installation of EV charging stations is already regulated under the Act. However, the day-to-day operation of a charging station, for example plugging in the charging cord to the EV, remains the task of the vehicle operator.*

***b**: Indicates persons working on EVs. As discussed above, WHS Act duties and the general duty under the Act apply to workplaces. The workplace is an area where ESO could provide oversight of through the introduction of some form of licensing. The options explored below focus on mitigating risks encountered when working on EVs. Consideration is also given as to what role ESO, and the WHS Regulator more broadly, could play outside of a licensing framework.*

Current regulatory framework

Under section 14(2) of the Act, any equipment forming a part of a unit providing for the propulsion of a vehicle is explicitly excluded from the definition of 'electrical equipment', and therefore excluded from being regulated under ES Framework.

Section 14 Meaning of *electrical equipment*

"(2) Electrical equipment does not include any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that is part of a vehicle if:

(a) the equipment is part of a unit of the vehicle that provides propulsion for the vehicle, or

(b) the electricity source for the equipment is a unit of the vehicle that provides propulsion to the vehicle."

Examples of things that, under subsection (2), are not electrical equipment include:

- The headlights of a vehicle
- Ignition spark plugs of a motor vehicle
- The interior lighting system of a vehicle, if powered from a battery charged by the engine that drives the vehicle or by the vehicle's movement.

Examples of things that are not prevented by subsection (2) from being electrical equipment include:

- Interior lighting or a socket outlet in a caravan, if the lighting or outlet is operated by a low voltage generating set or connected to low voltage supply
- A refrigeration unit in a food delivery vehicle operating at low voltage from a source separate from the propulsion unit for the vehicle.

The exception to this general situation is for mining vehicles under section 73 of the Act. For the last 20 years, electric mining vehicles have been subject to a full licensing requirement. However, as technology changed over this time, the Regulation could now be interpreted as capturing trucks and buses. Given its inconsistency with longstanding policy intent, section 73 is not currently being enforced.

Section 73 Work involving electric motor forming part of vehicle

"(1) A person must not perform work on an electric motor forming part of a vehicle unless—

(a) the person is a licensed electrical worker; and

(b) the work performed is work that the person would be authorised to perform on the electric motor under the person's electrical work licence if the electric motor were electrical equipment.

Maximum penalty—40 penalty units.

(2) If a business or undertaking includes the performance of work on an electric motor, a person conducting the business or undertaking must ensure that, in the conduct of the business or undertaking, a person does not perform work in contravention of subsection (1).

Maximum penalty—40 penalty units.

(3) In this section—

electric motor means an electric motor that is electrical equipment within the meaning of section 14(1) of the Act but is not electrical equipment under the Act because of the operation of section 14(2) of the Act.

Vehicle does not include a car or motorbike under the *Transport Operations (Road Use Management) Act 1995.*

Work, on an electric motor, means work on the electric motor that would be electrical work if the electric motor were electrical equipment."

Given that EVs are not captured under the ES Framework, the powers of the ESO and the Minister, in terms of recalls, inspection and compliance powers, do not apply.

Interjurisdictional analysis

Currently, no Australian jurisdiction specifically licenses work on EVs. However, both NSW and WA have existing licensing requirements for motor mechanics more generally. Recognising the growing prevalence of EVs, NSW released a consultation paper in November 2022 seeking feedback on proposed light and heavy EV licences. While no legislation has been announced, it is indicative of growing interest in the management of safety risks associated with EVs.

6.1.1.4 Federal regulation

The Federal Government administers the *Road Vehicle Standards Act 2018* (Cth) (RVS Act). The RVS Act is incrementally implementing nationally consistent standards[84] for motor vehicles including EVs.[85] The RVS Act regulates the entry of road vehicles into Australia and provides tools such as authorised vehicle verifiers, as well as a framework to recall road vehicles.

The Federal Government also administers the Australian Design Rules; national standards for vehicle safety, anti-theft and emissions.[86] In early 2023, the Federal Government consulted on proposed requirements for electric powertrain safety and hydrogen fuelled vehicle safety related performance.[87] The outcome of this consultation is yet to be released. The purpose of such standards would be to address the following safety concerns for road users, first responders and the community:[88]

- Direct contact with high voltage live parts and battery electrolyte leakage in EVs in the event of a vehicle crash
- Compressed hydrogen storage systems in the event of a vehicle crash
- Specific components for compressed hydrogen systems, including safety protection with automatic shut-off valves for hydrogen-fuelled vehicles.

Australian standards are also relevant in this space, as they assist in establishing a standard of work for EVs.[89] However, standards are not mandatory unless called up in legislation.

Furthermore, the Australian Government released its *Motor Vehicle Service and Repair Information Sharing Scheme* (the Scheme), which will come into effect on 1 July 2022 and seek to improve

[84] Department of Infrastructure, Transport, Regional Development, Communications and the Arts. (n.d.). Road Vehicle Standards laws. Retrieved from https://www.infrastructure.gov.au/infrastructure-transport-vehicles/vehicles/road-vehicle-standards-laws
[85] Section 5 of the *Road Vehicle Standards Act 2018* (Cth).
[86] Department of Infrastructure, Transport, Regional Development, Communications and the Arts. (n.d.). Australian Design Rules. Retrieved from https://www.infrastructure.gov.au/infrastructure-transport-vehicles/vehicles/vehicle-design-regulation/australian-design-rules
[87] Department of Infrastructure, Transport, Regional Development, Communications and the Arts. (n.d.). National safety standards for electric and hydrogen-fuelled vehicles. Retrieved from https://www.infrastructure.gov.au/have-your-say/national-safety-standards-electric-and-hydrogen-fuelled-vehicles
[88] Ibid.
[89] Australian Standard AS 5732:2015 Electric vehicle operations – Maintenance and repair.

access to vehicle safety information.[90] The Scheme is supported by the Australian Automotive Service and Repair Authority and the ACCC and provides access to car service and repair information for repairers and registered training organisations. This Scheme is not open to individuals who repair their own vehicles, although car manufacturers are not prevented from sharing information with consumers.[91] In response to the Discussion Paper, the ACCC provided additional information in relation to access and application of the Scheme within their submission (refer Box R).

Box R: The Motor Vehicle Service and Repair Information Sharing Scheme

The ACCC submitted the following:

"The ACCC also notes under the CCA [*Competition and Consumer Act 2010*], the Motor Vehicle Information Scheme (MVIS) requires data providers (generally vehicle manufacturers) to supply scheme information to repairers and registered training organisations at a price that does not exceed the fair market value. The ACCC is responsible for broad oversight and enforcement of the Motor Vehicle Information Scheme. While not a licencing regime, the Scheme requires individuals to meet training and competency criteria to receive access and use information relating to a high voltage or electric propulsion system in a vehicle covered by the Scheme. This ensures repairers are suitably trained to safely depower, isolate and re-initialise a high voltage battery installed in an EV.

The Motor Vehicle Information Scheme only applies to passenger vehicles and light goods vehicles other than omnibuses, manufactured on or after 1 January 2002. It does not apply to 2 or 3 wheeled vehicles, farm, construction or heavy vehicles, motor homes or buses."

Box S provides an example of how the EVs have been treated within the electrical safety legislation internationally.

Box S: Finland Case Study – Electrical Safety Act amendments concerning EVs

A submission to the Discussion Paper identified that Finland was an example where the sole requirement for electricians to work on EVs was removed in 2017.[92]

Section 56 of the *Electrical Safety Act 2016* (Finland) provides that electrical work on the power system of EVs suitable for road use would not be captured under requirements for performing electrical work if the person concerned is adequately familiar with the electrical system of the vehicle model in question and dangers arising from electricity.[93]

6.2 Objective of government action

The overall objective of the Queensland Government in relation to electrical safety under Topic 3 is to:

- Minimise the risk of harm to persons and property by balancing regulation with industry self-regulation, in line with the purpose of the Act
- Encourage a transition to a net-zero economy while minimising risk to persons and property presented by EVs, in line with the purpose of the Act.

[90] Australian Competition & Consumer Commission. (n.d.). Motor vehicle information scheme (MVIS). Retrieved from https://www.accc.gov.au/by-industry/cars-and-vehicles/motor-vehicle-information-scheme-mvis
[91] Ibid.
[92] Linja-aho, V (2020) Electrical accident risks in electric vehicle service and repair – accidents in Finland and a review on research, Rethinking Transport, Conference Paper 2020.
[93] Ministry of Economic Affairs and Employment, Finland. (n.d.). Electrical Safety Act. Retrieved from https://tukes.fi/documents/5470659/6372489/sahkoturvallisuuslaki-1135-2016-EN.pdf/d274f714-a446-4448-9abe-d95bfc7ff3a6/sahkoturvallisuuslaki-1135-2016-EN.pdf?t=1526843294000

6.3 Discussion Paper options

The Discussion Paper sought feedback on three options that proposed to meet government objectives and respond to problems identified for inclusion of work on propulsion components of EVs within the scope of the ES Framework (refer Table 20).

Table 20: Options overview

Options	Description
Option 1	Status Quo (no legislative action) • Work on EVs is not regulated under the ES Framework.
Option 2	Legislative change. • Capture work on electric motors within the definitions of 'electrical equipment' and 'electrical work', for the purposes of a licensing requirement.
Option 3	Awareness and Education. • Produce an awareness and education campaign to address concerns regarding EVs generally, including work.

6.4 Results of Discussion Paper consultation

To inform decision making on Topic 3, stakeholders were asked a series a of questions presented in the Discussion Paper concerning:

- The identified problem and the associated impact on their activities
- Views on a licensing regime and preferred options (if any) for legislative reform.

The Discussion Paper questions pertaining to Topic 3 are outlined in Box T.

Box T: Stakeholder Questions (Topic 3)

- How are you, your organisation, the workforce or community affected by the problems identified and to what extent?
- Do you agree with the assessment of the problem identified, and are there additional risks presented by EVs that have not been identified? If yes, what are they and can you provide examples of these issues?
- What practical impact, including the costs and benefits, would the options proposed in the Discussion Paper have on you, your organisation, the workforce or the community? Please provide examples where possible.
- What is your preferred option and why would it be best for you, your organisation and your stakeholders?
- If a licensing framework was introduced:
    - Should any specific type of vehicle be excluded for the requirement (e.g., motorcycles, cars, buses, trucks)? If so, what are they and why?
    - Is a restricted licence (specified training) or full licence (full apprenticeship) suitable? If so, why?
    - Should the licence type be determined based on the type of vehicle? If so, what would you suggest and why?
    - What types of work or occupations should be excluded from a licensing requirement? Or alternatively, what types of work or occupations should have specific licensing requirements (e.g., on-road works, general maintenance and check-ups, and/or removal and disposal)?
    - Are there any elements under the Act which should not apply? Which sections and why?
    - Are there situations in which a disconnect and connect restricted licence for performing work on non-propulsion components of a vehicle would be appropriate?
- Do you have suggestions for other options to address the problems identified? Please provide examples (including costs where appropriate) of your suggested options, including how it would ensure the workforce are electrically safe and conduct electrically safe work for community safety.

The responses to these questions, along with additional comments in the written submissions, determined the support or opposition for each option among the different categories of stakeholders.

It should be noted that submissions were nuanced in nature and many of the positions represented by stakeholders were provided alongside specific conditions and caveats. The most common caveats provided for Topic 3 related to a restricted electrical licence, include the following:

- Support for a restricted electrical licence pertaining to only certain types of EVs
- Support for a restricted electrical licence which leverages existing skills development processes
- Support to explore a restricted electrical licence which is specific to the vehicle repair industry
- Consideration of a restricted electrical licence only when combined with education and awareness.

Table 21 provides a high-level overview of stakeholder support for each option under Topic 3. The table below captures stakeholders' overarching position and overall sentiment provided in their submissions. It should be noted that some stakeholders provided their opinion on the options but did not directly state a preferred option. As shown below:

- Option1: the majority of stakeholders who responded to Topic 3 were broadly in support of maintaining the Status Quo (Option 1)
- Option 2: while only 13 stakeholders presented some level of support for Option 2, the majority of these supported a requirement for restricted electrical licence work but with caveats that further research and consideration is required
- Option 3: a large share of stakeholders supporting this option noted that it should be on the basis of legislative change occurring.

Table 21: Stakeholder alignment to options

Topic 3 - Electrical safety and electric vehicles			
Option 1 – Status Quo	**Option 2 - Legislative change**	**Option 3 – Awareness and Education**	**Preferred Option not indicated**
• Individual – licensed electrical worker (2) • Individual (1) • Peak body (6) • Peak Body - automotive (10) • Advocacy group (2) • Union (1) • PCBU (2) • Non-prescribed electricity entity (1)	• Government Department or Regulator or Statutory Agency or Authority (4) • Individual – licensed electrical worker (1) • Peak body (2) • Union (1) • Skills and training organisation (2) • PCBU (2) • Prescribed electricity entity (1)	• PCBU (3) • Individual (3) • Peak body (4) • Peak body – automotive (4) • Prescribed electricity entity (2)	• Peak body (3) • Government Department or Regulator or Statutory Agency or Authority (1)
Total: 25	**Total: 13**	**Total: 16**	**Total: 4**

The thematic analysis identified common themes and specific arguments expressed by stakeholders. Common themes relating to each option under Topic 3 are summarised in Table 22.

Table 22: Topic 3 identified themes

Option 1	Option 2	Option 3
• Insufficient consultation • EVs as an existing technology • Insufficient incidence data	• Current landscape of EV training • General licenced electrical workers and EVs • Costs of legislative action • International best practice	• Education and awareness

In general, the thematic analysis provided the following insights for each option:

- **Option 1:** Respondents submissions identified the following justification for maintaining the status quo:
    - some respondents noted that there was insufficient consultation during the overall problem and identification process.
    - that a lack of incidence data would suggest that legislative change may not be justified.
    - EVs are an existing technology to which the industry has adequately adjusted, as demonstrated through absence of data and development of training courses.
    - legislative change would likely create disproportional challenges for the EV workforce and consumers, including through increased regulatory costs for complying the with the electrical safety framework.

    - legislative change would be inconsistent with international best practice, and that any legislative change should be in line with other more established EV markets.

- **Option 2:** Within the written submissions responding to Option 2:
    - One (1) stakeholder directly supported a full licensing requirement. This stakeholder supported the requirement of a full licence on the basis that the work of installing, servicing and maintaining complex components should be undertaken a fully licenced electrical worker. Whilst other submissions more generally were found to be in opposition to general licensed electricians undertaking work on EVs.
    - Other submissions received indicated some support for the introduction of a restricted electrical licence. Twelve submissions favoured a restricted electrical licence, with a further seven nominating a restricted electrical licence as a secondary option to maintaining the status quo. The 12 stakeholders identified that the existing landscape of EV training could be used to support a restricted electrical licence regime. However, it should be noted that support for a restricted electrical licence requirement was strongly caveated. Some of the caveats included:
        - further detailed research and consideration from government, industry and the broader community.
        - be designed specifically for the needs of the EV industry.
        - should only be attainable by automotive mechanics.
    - Further, some submissions recognised that whilst work on EVs may benefit from regulatory oversight, the administration of a licensing regime would be more appropriate under a different framework (i.e., not the electrical safety framework).

- **Option 3:** Several written submissions expressed support for investment in an awareness and education initiative. The majority of submissions also noted that any legislative change should be supported by a comprehensive education and awareness campaign concerning electrical safety and EVs. Other submissions also noted that any education and awareness campaign should be undertaken with industry contribution and that the public should be made aware that only appropriately qualified automotive technicians should undertake work on EVs. One submission noted that there is no tangible benefits to this option and the government and industry will only incur unnecessary costs as EV automotive technicians already have the required skills.

The overall positioning of stakeholders, as well as the outputs of the thematic analysis, have been used to validate the option structure presented within the Discussion Paper. Based on these insights, the suitability of options identified through the Discussion Paper are discussed in the following section.

6.5 Issues raised during public consultation

As presented in Section 6.4, consultation yielded a range of stakeholder insights associated with the feasibility and suitability of the options identified for Topic 3. These stakeholder insights can be grouped into the following categories:

- Commercial viability
- Problem identification.

These categories are discussed in more detail below.

Commercial viability

The submissions from stakeholders and the subsequent thematic analysis suggest that Options 2 and 3 (under Topic 3) are not appropriate solutions.

The primary concern among stakeholders is the potential increased economic cost of any legislative change combined with the limited perceived economic and financial benefits. Stakeholders indicated that Option 2 would exacerbate the current labour shortage associated with appropriately qualified electrical workers that would restrict the uptake of EVs state-wide without providing any measurable safety benefit.

It should be noted that in itself, commercial viability is not a guiding principle for the safety regulator.

Problem identification

The consultation process highlighted a range of issues concerning the problem identification process and definition. These issues include:

- **Lack of sufficient data and evidence**: Stakeholders were unable to provide any safety related insights and data in support of the identified problems defined during public consultation. They also emphasised the lack of sufficient evidence of electrical safety incidents relating to work on EVs.
- **Lack of support for legislative action**: In addition, the majority of stakeholders responding to the Discussion Paper indicated that legislative action is not required as they consider EVs to be an established technology with world quality industry standards, training, and safe work practices which successfully safeguard the EV workforce.

Additionally, it should be noted that consultation suggested that a state-based legislative approach would pose significant issues. Introducing electrical licensing requirements would mean Queensland is the only jurisdiction to require electrical licences to work on electric vehicles. Given transport touches on all elements of the economy and is a component of almost everyone's personal and work lives, such a regulatory variation would be completely unworkable and justifiable only in the most extreme cases of risk.

This is more than a concern for its impact on the economy, it would also present a concern for implementation in terms of achieving the desired safety improvements. Restrictions of this nature can incentivise unsafe practices to avoid unworkable regulatory requirements. It should be noted that Queensland is one of the most decentralised populations in the country. Safety requirements embedded in licensing regimes need to consider both rural and urban communities.

On this basis it is proposed that any future regulation should be performed at a federal level and that in the meantime, the propulsion parts of EVs should remain outside the scope of the ES Framework in Queensland. The cost impacts of such a regulatory change were not further explored on the basis of the evidence.

Feedback provided strong evidence that industry-wide training was currently effective in ensuring competency for those working on electric vehicles and managing electrical risks. However, feedback also suggested that direct involvement of electrical licensed representatives had not been broadly included in the consideration of electrical safety training. There is obvious benefit in ensuring those with specialty knowledge and experience are providing input on training requirements for an industry that is rapidly growing and diversifying.

6.6 Recommended option and next steps

Overall, the results of the stakeholder consultation and thematic analysis support **Option 1: Status Quo** as the preferred option. Supporting this, stakeholders highlighted:

- The existing standards and procedures already mitigate the identified risk associated with work on EVs
- There was insufficient industry consultation supporting the identified problem, which led to options that failed to provide sufficient benefits or imposed significant costs.

While some stakeholders provided an element of support for Options 2 and 3, these views were in the minority. Ultimately, the majority of stakeholders believed that the current system and procedures effectively mitigated electrical safety risks and that any changes would be costly, with limited safety benefits. Those that supported further licensing requirements did not provide data to contradict the evidence-based argument that a high level of safety was being achieved under the Status Quo. Therefore, maintaining the Status Quo is the preferred option.

While it is recommended that the Status Quo is maintained, it was identified through further consultation that the training provided to motor mechanics in relation to the electrical safety risks of working on

electric vehicles has not been considered by electrically licensed experts. To ensure the training motor mechanics receive on electrical risks is technically accurate and up to date with the latest technologies, a roundtable has been established to further consider how safety can be improved for those who work on electric vehicles. Examples of potential considerations may include a review of particular courses covering electrical safety to ensure motor mechanics are educated about electrical risks. The outcomes of this roundtable will be referred to relevant Commonwealth forums for national consideration. The roundtable will be chaired by the Commissioner for Electrical Safety with participation from industry stakeholders such as the Electrical Trades Union, Motor Trades Association Queensland, Victorian Automotive Chamber of Commerce, Australian Manufacturing Workers' Union, Master Electricians Australia, National Electrical and Communications Association, the Electric Vehicle Council, and Motor Trades Association Institute. National consideration of these outcomes is critical for consistency across states and territories and because training and units of competency fall within Commonwealth remit.

Appendix

A.1 Abbreviations

Table A1: Table of abbreviations used throughout the Decision Paper

Term	Definition
AADA	Australian Automotive Dealer Association
AC	Alternating current
ACCC	Australian Competition and Consumer Commission
BESS	Battery Energy Storage System
BEVs	Battery Electric Vehicles
CEC	Clean Energy Council
CMEIG	Construction and Mining Equipment Industry Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSQ	Construction Skills Queensland
DC	Direct current
DEE	Dangerous electrical event
DIY	Do it yourself
EESS	Electrical Equipment Safety System
EFW	Economic Freedom of the World
ELV	Extra Low Voltage
EQ	Energy Queensland
ERAC	Electrical Regulatory Authorities Council
ES Framework	Electrical safety framework
ESO	Electrical Safety Office
ETU	Electrical Trades Union
EV	Electric vehicle
FCEVs	Fuel Cell Electric Vehicles
HEVs	Hybrid Electric Vehicles
HV	High voltage
HVAC	Heating, ventilation and air conditioning
ICE	Internal combustion engine
kW	Kilowatt
LV	Low voltage
MEA	Master Electricians Australia
Model WHS Regulation	The model Work Health and Safety Regulation~~s~~ 2011
MTAQ	Motor Trades Association Queensland
MVIS	Motor Vehicle Information Scheme
MW	Megawatt
NECA	National Electrical & Communications Association
NFIA	National Fire Industry Association of Australia

Term	Definition
NPV	Net present value
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OIR	Office of Industrial Relations
OTM	Original technology manufacturers
PCBU	Person Conducting a Business or Undertaking
PHEVs	Plug-in Hybrid Electric Vehicles
PV	Photovoltaic
QBP	Qualified Business Person
QEJP	Queensland Energy and Jobs Plan (2022-2025)
QFES	Queensland Fire and Emergency Services
QGBRP	Queensland Government Better Regulation Policy
QRC	Queensland Resources Council
QTP	Qualified Technical Person
REL	Restricted Electrical License
RVS Act	*Road Vehicle Standards Act 2018* (Cth)
SEI	Serious electrical incident
the Act	*Electrical Safety Act 2002* (Qld)
the Commissioner	The Commissioner for Electrical Safety
the Commissioner's Report	2020 Improving Electrical Safety in Queensland: A Report by the Commissioner for Electrical Safety
the Minister	The Minister for Education, Minister for Industrial Relations and Minister for Racing
The QRF Report	Construction Skills Queensland - Queensland's Renewable Future Report (2022)
the Regulation	Electrical Safety Regulation 2013 (Qld)
the Regulator	Electrical Safety Office
the Review	Review of Queensland's Electrical Safety Act 2002
the Reviewer	Independent Reviewer
the Scheme	Motor Vehicle Service and Repair Information Sharing Scheme
V	volts
WHS Act	*Work Health and Safety Act 2011* (Qld)
WHS framework	Work health and safety framework
Wiring Rules	AS/NZS3000:2018 Electrical installations

A.2 In scope recommendations - Review of Queensland's *Electrical Safety Act 2002*

Recommendation 1: It is recommended that modernising the scope of the Act to ensure new and emerging energy generation and storage technologies are incorporated, whether or not they are connected to the grid or stand-alone in nature, by including in the definition of electrical equipment/electrical installation:

a) solar PV modules, designed to be connected to other solar PV modules and when connected be of a combined voltage of greater than extra low voltage; and
b) battery cells, when connected to other cells for the purpose of storing and releasing power of a combined voltage of greater than extra low voltage.

Recommendation 2: Review the electrical safety risks presented in electric vehicles (EVs) and consider their inclusion in the scope of regulation by the Act. It is further recommended that the Electrical Safety Office engage with other relevant Queensland and Australian regulators as needed to ensure appropriate scope and to avoid both regulatory gaps and duplication.

Recommendation 4: To ensure the Act keeps pace with technological change, consider creating a general category of exception to the "extra low voltage" threshold for the definition of "electrical equipment", to reflect risk to life and property by ELV electrical equipment.

Recommendation 5: For solar PV panels falling within the definition of electrical equipment (see Recommendation 1), consider ensuring that the resultant "electrical work" ' definition is amended as needed to require:

a) all connections and testing of PV module cabling as well as earthing and bonding work be performed by competent licensed electrical worker/s; and
b) installation of cabling to be carried out by a licensed electrical worker or an unlicensed person assisting a licensed electrical worker and working under their direct supervision; and
c) the mounting, fixing, and locating of solar PV modules and arrays to be carried out by competent persons under the direct supervision (Recommendation 16) of a licensed electrical worker (Act s 18(2)(f)).

Recommendation 6: Consider including within the definition for Electrical Work that the electrical aspects of air conditioning / mechanical services work is electrical work and the tasks of fixing, installation of brackets/mounting of equipment and mechanical cable protection is ancillary to the complete installation.

Recommendation 7: Ensure the installation of mechanical protection for cables, including but not limited to conduit (both plastic and metal), cable racks and trays, skirting, troughs etc., and the installation of cabling into these protection components is the work of licensed electrical workers or to be performed under the direct supervision of a licensed electrical worker. Associated with this work is earthing and bonding work, to be defined as electrical work (recommendation 5) and must only be performed by competent licensed electrical worker/s.

Recommendation 8: For EVs (or parts thereof) falling within the definition of “electrical equipment” (see Recommendations 2 and 4), consider requiring:

a) appropriately licensed electrical workers to carry out the electrical work on the electrical components when the vehicle is serviced and or repaired, to ensure the safety of owners/operators and community; and
b) appropriately licensed electrical workers carry out the electrical work on the electrical components of the vehicle when an EV requires on-road break-down work to ensure safety of owners/operators, the community and first responders.

Recommendation 13: Clarify that off-grid systems are captured within the meaning “electrical equipment” and are therefore within the definitions of Serious Electrical Incident and Dangerous Electrical Event (Act, ss 11-12), giving rise to duties to notify the Regulator and otherwise respond to such incidents (Regulations, Part 14).

Recommendation 17(a)&(c): Consider clarifying miscellaneous requirements related to supervision, by:

a) inserting the word “direct” before “supervision” in section 18(2)(e)(iii); and,
c) requiring direct supervision for a person directly assisting the licensed electrical worker in the laying, cutting or sealing underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source (s 18(2)(j)).

Recommendation 74(c): Consider clarifying and enhancing standards that apply to electrical installations (Regulations, Part 6), including by considering:

c) ensuring there is a legislative basis in the Act for regulations concerning work involving water equipment (s 72), and, if it is to be maintained, work involving electric motors (s 73).

A.3 List of submissions

The Office of Industrial Relations received 78 submissions to the Discussion Paper. To maintain confidentiality and privacy, only those who agreed to be named and published are reflected below.

Submissions to the Discussion Paper can be viewed on the Office of Industrial Relations website.

Table A2: List of submissions

No.	Name
1	ANONYMOUS
2	ANONYMOUS
3	ANONYMOUS
4	NIGEL GIBSON
5	ANONYMOUS
6	ANONYMOUS
7	CHILDREN'S HEALTH QUEENSLAND HOSPITAL AND HEALTH SERVICE
8	ANONYMOUS
9	ANONYMOUS
10	ANONYMOUS
11	POWINS PTY LTD
12	ANONYMOUS
13	ANONYMOUS
14	JEFFREY BARKER
15	MOTOR TRADES ASSOCIATION QUEENSLAND
16	ANONYMOUS
17	MOTOR TRADES ASSOCIATION OF AUSTRALIA
18	ANONYMOUS
19	MASTER BUILDERS
20	MASTER ELECTRICIANS AUSTRALIA
21	RESOURCES SAFETY AND HEALTH QUEENSLAND
22	REVORA PTY LTD
23	PETER CHALMERS
24	ANONYMOUS
25	GRAHAM LLOYD-JONES
26	ANONYMOUS
27	ANONYMOUS
28	AUSTRALIAN AUTOMOTIVE AFTERMARKET ASSOCIATION
29	NATIONAL FIRE INDUSTRY ASSOCIATION OF AUSTRALIA
30	ENERGY SAFE VICTORIA
31	QUEENSLAND BUS INDUSTRY COUNCIL AND THE BUS INDUSTRY CONFEDERATION
32	ANONYMOUS
33	ANONYMOUS
34	FEDERAL CHAMBER OF AUTOMOTIVE INDUSTRIES

No.	Name
35	AUSTRALIAN MANUFACTURING WORKERS' UNION
36	NATIONAL ELECTRICAL AND COMMUNICATIONS ASSOCIATION, MASTER ELECTRICIANS AUSTRALIA AND THE NATIONAL FIRE INDUSTRY ASSOCIATION OF AUSTRALIA
37	CONSULTATIVE COMMITTEE FOR WORK-RELATED FATALITIES AND SERIOUS INCIDENTS
38	ANONYMOUS
39	AUSTRALIAN AUTOMOTIVE DEALER ASSOCIATION
40	ANONYMOUS
41	AUSTRALIAN CONSUTRUCTION AND MINING EQUIPMENT INDUSTRY GROUP
42	JOHN HOLLAND PTY LTD
43	ANONYMOUS
44	ELECTRICAL TRADES UNION
45	ENERGY SKILLS QUEENSLAND
46	HEAVY VEHICLE INDUSTRY AUSTRALIA
47	AGL
48	TESLA MOTORS AUSTRALIA
49	ANONYMOUS
50	ANONYMOUS
51	CLEAN ENERGY COUNCIL
52	ANONYMOUS
53	MICHAEL KNIGHT
54	POWERLINK
55	ENERGY QUEENSLAND
56	ELECTRIC VEHICLE COUNCIL
57	BOATING INDUSTRY ASSOCIATION LTD
58	ANONYMOUS
59	AUSTRALIAN COMPETITION AND CONSUMER COMMISSION
60	CHAIR OF THE AUSTRALIAN REPAIR NETWORK
61	ANONYMOUS
62	ANONYMOUS
63	ANONYMOUS
64	BHP MITSUBISHI ALLIANCE
65	MEND IT, AUSTRALIA
66	ANONYMOUS
67	ANONYMOUS
68	ROSS
69	ANONYMOUS
70	AIR CONDITIONING AND MECHANICAL CONTRACTORS' ASSOCIATION OF AUSTRALIA LIMITED
71	CONSUMER ELECTRONICS SUPPLIERS' ASSOCIATION

No.	Name
72	SET MARITIME & ELECTRICAL (Prepared by Mark Smith)
73	Ai GROUP
74	ANONYMOUS
75	INSTITUTE OF AUTOMOTIVE MECHANICAL ENGINEERS
76	QUEENSLAND RESOURCES COUNCIL
77	QUEENSLAND WATER DIRECTORATE
78	ANONYMOUS