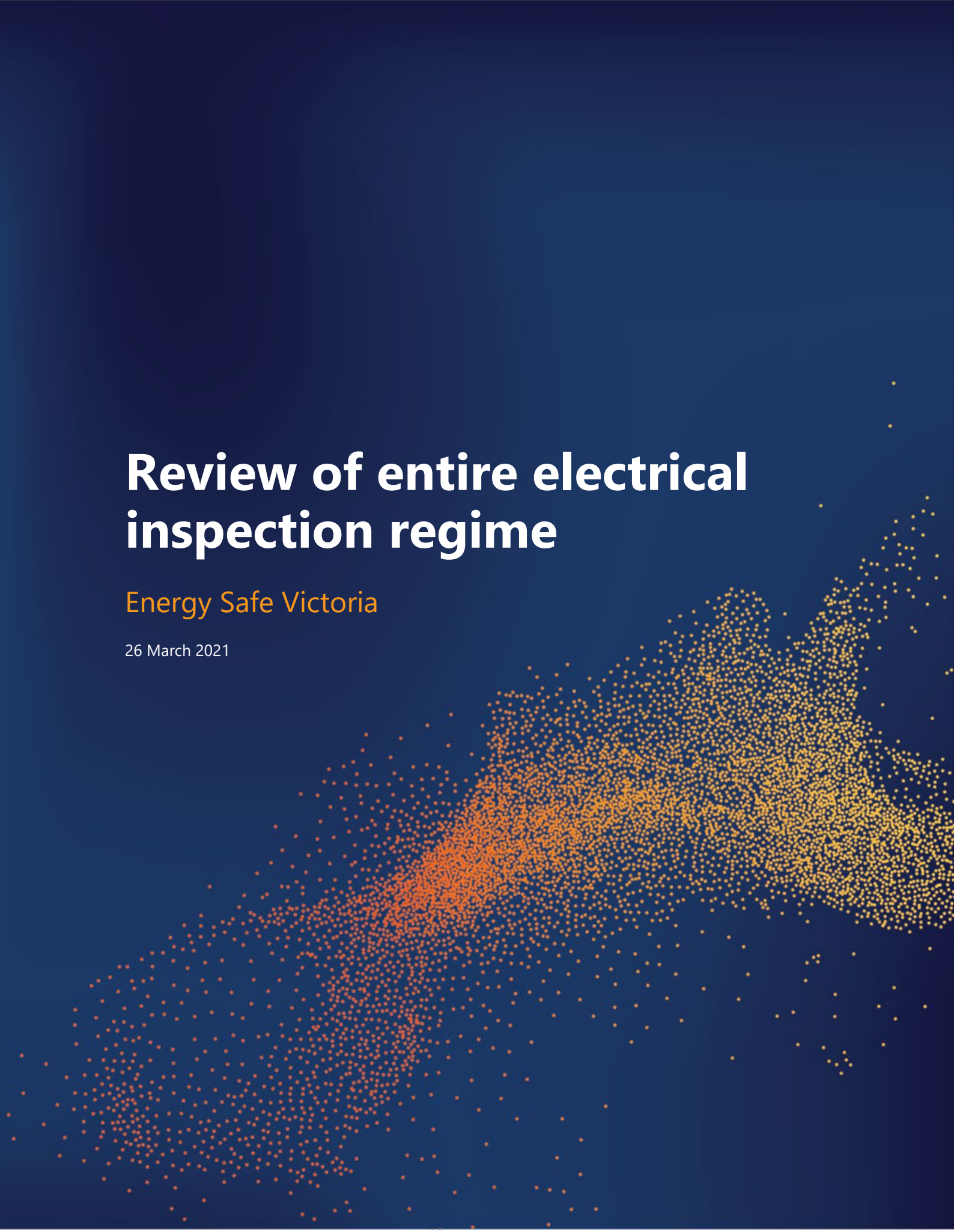
Review of entire electrical inspection regime

Energy Safe Victoria

26 March 2021



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Glossary

Term / acronym	Description of term
COES	Certificate of Electrical Safety
COI	Certificate of Inspection
CPD	Continuous Professional Development
Energisation	Energisation is the process of 'turning on' an electrical installation, allowing energy to flow through the circuit for its intended use.
ESV	Energy Safe Victoria
FY	Financial year. Referring to the calendar period 1st July to 30th June.
IEI	Institute of Electrical Inspectors
LEI	Licensed Electrical Inspector
REC	Registered Electrical Contractor
Solar system	An installed Solar Photovoltaic electrical system

Contents

Executive summary

Nous was engaged by Energy Safe Victoria (ESV) to undertake a review of its electrical inspection regime. The review was in response to high levels of safety issues identified through the Solar Victoria audit program and the concerns there may be other systemic risks present across other parts of the regime. The objective of the review was to identify the key issues underpinning these safety outcomes, and in response, develop a pragmatic set of recommendations.

Licensed Electrical Inspectors (LEIs) are a key part of Victoria's electrical inspection regime, with arrangements unique to Victoria. They are licensed by ESV to inspect all prescribed works, issue Certificates of Inspection on compliant installations, and report defective installations to ESV. LEIs do not work for ESV, they operate independently under licence and are engaged and paid by the licensed electricians and Registered Electrical Contractors (electricians) that perform the installation work.

ESV also has responsibility for auditing a small percentage of prescribed works in the months following installation and LEI inspection. Our examination of ESV audit data indicates that some LEIs provided Certificates of Inspection for installations that were later found to be defective. ~15.9 per cent were defective at the time of audit, of which ~1.7 per cent were unsafe defects and ~14.2 per cent were technical defects.[1] For solar PV systems, the rate of unsafe defects has fallen in recent years. The reporting of defective installations by LEIs to ESV is very low when compared with the findings in subsequent audits. Based on our consultations with ESV, the Certificate of Electrical Safety (COES) data indicates that LEIs only report defects to ESV in 0.1 per cent of all inspections (including both compliant and non-compliant installations)[2].

LEIs may rely on electricians for recurrent work, which may mean they are reluctant to refuse to certify an installation (or trust that it will be rectified soon after inspection). This dynamic can also affect the thoroughness of inspections conducted by LEIs. In addition, stakeholders indicated that some LEIs do not have the necessary experience and skills to identify defective installations, for reasons including the nature of examination and admission requirements, and the limited availability of training and opportunities for ongoing learning and development.

ESV has already taken several steps to improve the efficacy of the regime, for instance restricting the number of assessment attempts prospective LEI candidates can take, engaging in an open tender for its audit contract, making greater use of stronger enforcement levers, and preparing for the commencement of Continuous Professional Development requirements for LEIs from 2023. To further improve the efficacy of the regime in the most cost-effective way with the minimum amount of industry disruption, our primary recommendation is that ESV invest significantly in an independent and dynamic risk-based audit program to provide an unbiased mechanism that identifies safety issues. This would improve ESV's access to on-the-ground intelligence and assist it to more effectively enact a data-driven approach to regulating. We also make several complementary recommendations as summarised in Table 1 overleaf.

[1] Nous analysis of ESV audit data. 2019. Note: in 2019 ESV audited 2 per cent of all prescribed installations.
[2] Consultations with ESV based on ESV's analysis of COES data.

Table 1 | Summary of recommendations

Licensing	Inspections and audits	Regulatory oversight
1. Institute additional training requirements and strengthen LEI assessments 2. Introduce additional risk-based LEI classes 3. Mandate Continuous Professional Development	4. Implement robust, risk-based and data driven auditing 5. Establish a professional institute for LEIs or assist the Institute of Electrical Inspectors (IEI) to increase its effectiveness and reach	6. Use insights derived from improved audits to inform regulatory activities 7. Strengthen enforcement of obligations on LEIs and electricians 8. Improve communications and educative activities

We recommend ESV stage implementation over 12 to 18 months. As ESV accurately baselines and collects more granular data on the nature, location and source of electrical safety issues through an enhanced audit program, it can then make confident decisions on the audit program design and consider further cost-effective reforms to the inspection regime in the longer term.

1 Background to our engagement

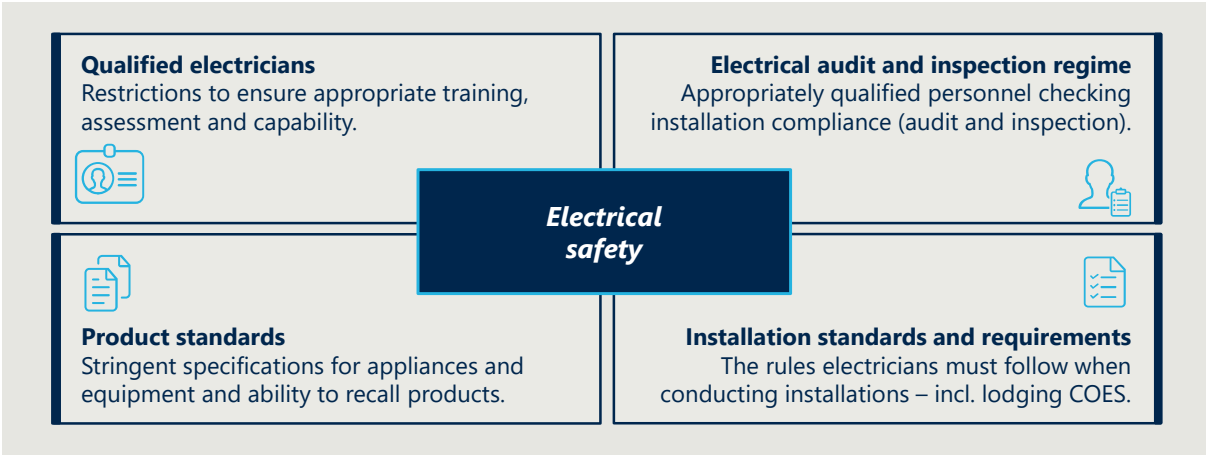
This section first positions an inspection regime within the broader pursuit of electrical safety, before describing Victoria's electrical inspection regime and establishing its key points of difference in comparison with other Australian jurisdictions. It then details the scope of Energy Safe Victoria's (ESV) engagement with Nous and our approach to conducting this review.

1.1 Victoria's electrical inspection regime is one of many mechanisms that govern electrical safety

The contribution of electricity to modern society cannot be understated, from both an economic and social perspective. It powers many productive industries and facilitates many day-to-day activities. However, electrical work and unsafe installations are inherently hazardous. Electricity has the potential to cause serious injuries or death through contact with live electrical parts, or through fires and explosions.[3] Electrical injuries include skin injuries and burns; disruption and damage to the cardiovascular and nervous systems; respiratory arrest; and head injuries, fractures and dislocations due to the severe muscle contractions induced by the current. Electrical networks, installations and appliances have resulted in 14 fatalities[4] and 34 serious injuries[5] over the past five years in Victoria.

Modern governments harness the value of electricity while also taking steps to ensure electrical safety for workers and their customers. The inspection regime is unique to Victoria and is one of many mechanisms that seek to guard against electrical safety risk, as highlighted in Figure 1.

Figure 1 | Mechanisms governing electrical safety



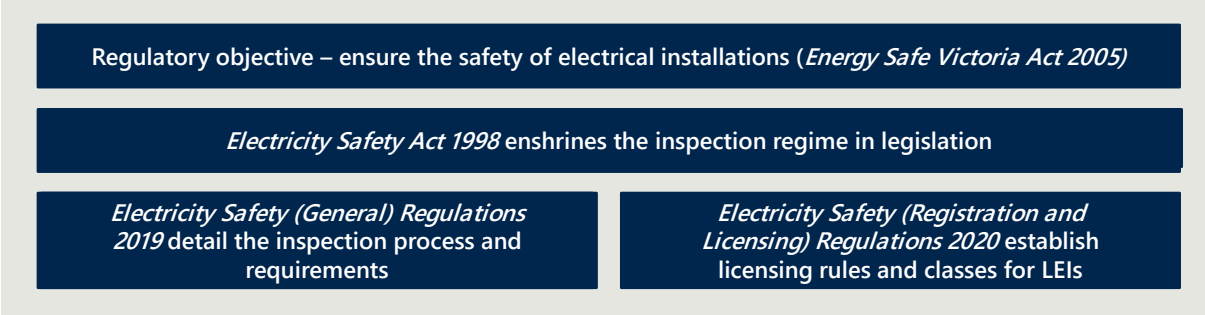
1.2 About Victoria's electrical inspection regime

ESV was established under the Energy Safe Victoria Act 2005 for the purpose of achieving the regulatory objectives as specified in the Electricity Safety Act 1998, which includes ensuring the safety *of electrical*

[3] Electricity Safety (General) Regulations 2019, *Regulatory Impact Statement*, prepared by Regulatory Impact Solutions Pty Ltd.
[4] Electrical Regulatory Authorities Council, Electrical Fatal Incident Data 2018-2019.
[5] Electricity Safety (General) Regulations 2019, *Regulatory Impact Statement*, prepared by Regulatory Impact Solutions Pty Ltd.

installations. This is the governing objective of the inspection regime. It is supported by three other legislative instruments, as depicted in Figure 2 below.

Figure 2 | Victorian electrical inspection regime's legislative instruments



We have structured our review using the following analytical framework which arranges responsibilities and activities delivered within the regime into three groups, illustrated in Figure 3. This is followed by a more detailed discussion of each component and the supporting legislative instruments.

Figure 3 | Analytical framework for this review

Licensing

ESV is responsible for licensing electrical inspectors, as provided by the *Electricity Safety (Registration and Licensing) Regulations 2020*. ESV has the power to issue a licence to a person who has demonstrated qualifications, experience, competence and proficiency in matters for their relevant class of electrical inspection work, and may require them to complete a practical examination. These regulations establish a G – general class, as well as three specialised classes, specifically H – hazardous, V – high voltage, and M – medical (installed in patient areas).

In carrying out its regulatory obligations, ESV imposes a mix of experience and assessment requirements on prospective LEIs. Prospective G Class inspectors must have:

- usually five years of experience as a licensed electrician; and
- pass three assessments[6] and demonstrate their understanding of appropriate standards and regulations.

To obtain a licence for the specialised classes (H, V and M), ESV requires prospective inspectors to demonstrate their competency in that class of works, through:

- on-the-job training with an existing inspector of that class;
- at least ten examples of the candidate conducting those inspections under supervision;

[6] For the G-class licence: The G Class Theory, Safe Approach and G Class Practical.

- a supporting reference from an existing inspector in that class; and
- additional training or qualifications in that class.

Inspection and audit

LICENSING ····· INSPECTION AND AUDIT ····· REGULATORY OVERSIGHT

LEIs are licensed by ESV to inspect electrical installations, issue Certificates of Inspection[7] on compliant installations, and report defects to ESV when installations are non-compliant. LEIs do not work for ESV, they operate independently under licence and are engaged and paid by the licensed electricians and Registered Electrical Contractors (electricians) that perform the installation work.

LEIs must assess whether *prescribed works* comply with the wiring methods described in the *Electricity Safety (General) Regulations 2019* and the Australian Standards *AS/NZS 3000 Wiring Rules 2018*. These regulations define prescribed works as those that are more complex and of high risk to life and/or property, including consumers' mains, main earthing systems, consumers' terminals, electrical wiring in hazardous areas, high voltage installations, solar systems, and electrical equipment in patient areas, amongst others.

LEIs are required to note on the Certificate of Electrical Safety (COES) if it appears to be unsafe, notify the Responsible Person (e.g. electrician) of any defects they identify, and note any defects on the Certificate of Inspection which is provided to ESV. LEIs are not required to report defects on the customer's (e.g. homeowner, building owner etc.) COES if the defect is rectified at the time of inspection. However, in this case the defects must still be reported on the Responsible Person's copy of the COES, the LEI's copy, and in the copy lodged to ESV (*Electricity Safety (General) Regulations 2019 Reg. 260*).

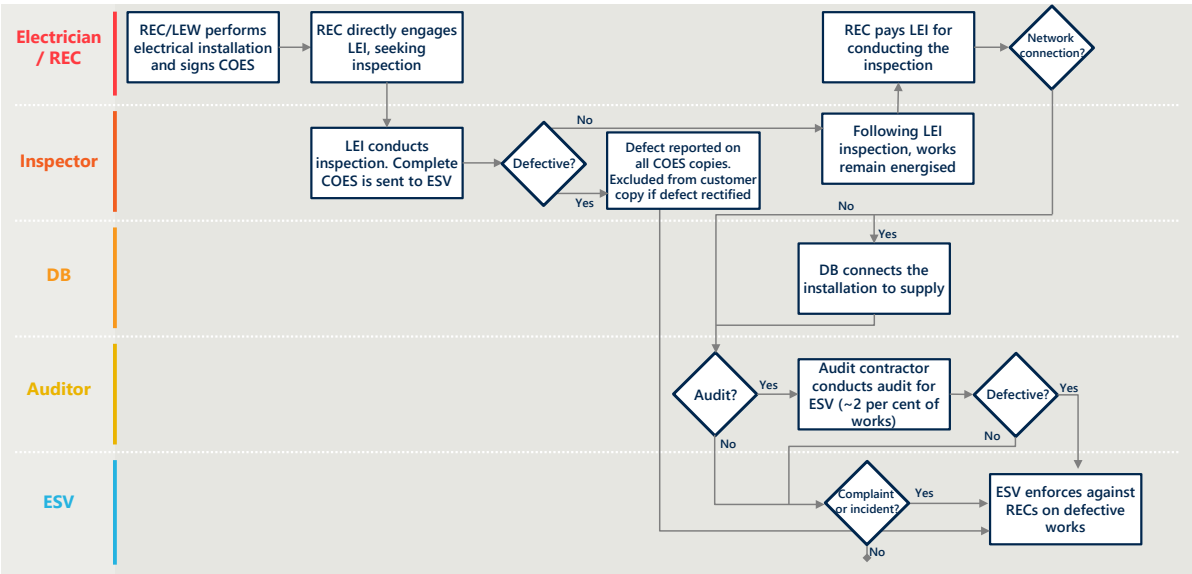
ESV also has responsibility for auditing a small percentage of prescribed works in the months following installation and LEI inspection. This responsibility is outsourced. Under the terms of the contract, there is a focus on non-prescribed works (around 8 per cent) and a small amount of prescribed works (around 2 per cent). Under the contractual terms, the auditor is required to feed data back to ESV through monthly audit reports, including the rate and nature of identified defects.

A process map that visually depicts the intended end-to-end process is provided in Figure 4 for G Class prescribed works.

For the purposes of this report, we define *inspections* as checks that occur pre-energisation[8] of the electrical installation. We define *audits* as checks that occurs in the weeks or months following energisation.

[7] A prescribed COES has two components: (1) a certificate of compliance, signed by the electrical worker (REC) when the job is tested and compliant and (2) a certificate of inspection signed by the LEI after testing and inspection verifying compliance.
[8] Energisation is the process of 'turning on' the electrical installation, allowing energy to flow through the circuit for its intended use.

Figure 4 | Process for inspection and audit of prescribed electrical work



Regulatory oversight

LICENSING ····· INSPECTION AND AUDIT ····· REGULATORY OVERSIGHT

ESV is responsible for regulatory oversight of the regime. This includes:

- *Monitoring* the performance of the inspection regime, including the level and nature of safety risk in electrical installations, and the conduct of electricians and LEIs.
- *Education and industry engagement*, such as presenting at industry conferences, issuing the ESV Magazine, responding to questions posed by electricians and LEIs about the *AS/NZS3000 Wiring Rules*, and communicating changes to standards.
- *Enforcement* of obligations on LEIs and electricians, including the rectification of defective work and issuing infringement notices with penalties, as provided in the *Electricity Safety Act 1998*. This can involve conducting investigations and site visits, following up defects reported to them through LEIs or the contractor auditor.

1.3 Victoria's inspection regime is unique

Victoria's inspection regime has changed considerably over the past 30 years. Previously, the State Electricity Commission of Victoria (SECV) directly employed electrical inspectors. In 1994 the SECV was disaggregated into multiple retailer, generation, and network companies. Following the disaggregation, part of the responsibility for electrical inspections was transferred to the five DBs. In 1998 the Office of the Chief Electrical Inspector was formed and in 2005 merged with the Office of Gas Safety to form ESV. It was at this time that the regulatory roles and responsibilities as described in the subsection above were formed.

Victoria's current arrangements are unique in comparison with other Australian jurisdictions. Victoria is the only jurisdiction where inspectors operate independently under licence and are engaged and paid by the licensed electricians and Registered Electrical Contractors that perform the installation work. Victoria also stands out in comparison with other jurisdictions for its high emphasis on pre-energisation inspections

and lower emphasis on post-energisation audits. A brief description of two other regulatory regimes and a comparison of who conducts pre-energisation inspections across jurisdictions is provided in Figure 5 below. This provides a high-level summary, noting that some parameters can be defined differently between jurisdictions.

Figure 5 | Inspection regimes in other jurisdictions

Case studies of other regimes

Tasmania

The electrical regulator delivers an audit-focussed regime. The electrician energises the electrical installation without an independent or peer inspection. The audit service provider (currently Techsafe Australia) conducts robust audits after the works have been completed and energised. Techsafe currently conducts audits on approximately 45 per cent of all 'notifiable works', which is a medium-to-high risk category of electrical works similar to 'prescribed works' in the Victorian regime.

Western Australia

The network operator (equivalent to a distribution business in Victoria) is responsible for electrical inspections. The network operator, Western Power or Horizon Power (both government owned), is required to establish and deliver inspections of new or alteration electrical work to ensure their safety. The network inspect a sample of all installations, varying from 10 to 100 per cent of installations based on the perceived risk of the electrical contracting company or electrician.

Inspections across jurisdictions

	VIC	NSW	QLD	TAS	ACT	NT	SA	WA
Who inspects the installation before energisation?	LEI (and DB during new connections)	*No inspection*	Regulator (appointed auditor)	Regulator (contracted auditor)	DB	DB	DB	DB

1.4 Nous was engaged to review the inspection regime

Nous was engaged by ESV to undertake a review of the electrical inspection regime. The review was in response to safety issues identified through the Solar Victoria audit program and the concerns there may be other systemic risks present across other parts of the regime. The objective of the review was to identify the key issues underpinning these safety outcomes, and in response, develop a pragmatic set of recommendations.

This report focusses on the actions and recommendations to improve the entire inspection regime and address identified key issues. It follows an interim report that focussed on developing immediate (some temporary) recommendations to address safety issues in solar installations in the short-term.

The review scope was limited to the inspection regime

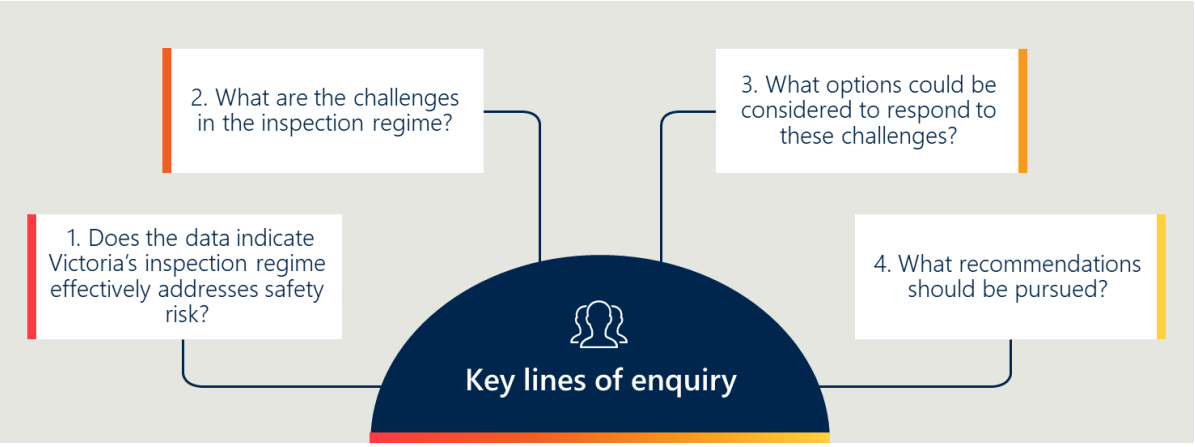
As highlighted in section 1.1, the inspection regime is just one of several factors designed to protect the safety of electrical installations. Other factors that influence the safety of electrical installations may include the availability and quality of electrician training, installation standards such as the mandate to install a rooftop isolator in Australian solar systems, and product standards. Given our scope was to review the inspection regime, we did not review or analyse the effectiveness of these other factors.

Key lines of enquiry and an analytical framework guided our review

The review was structured by four key lines of enquiry. Given the regulatory objective of the inspection regime is to ensure the safety of electrical installations, our guiding questions focused on safety outcomes and recommendations that could be developed in response. By *safety risk* we refer to the level and nature

of issues in electrical installations that do not meet relevant standards and guidelines that could increase the likelihood of serious injury or fatality. This report details our findings and analysis on these questions. The key lines of enquiry and their corresponding sections of our report are set out in Figure 6 below.

Figure 6 | Key lines of enquiry



Throughout questions 2-4, we draw on an analytical framework as set out in Figure 7 and introduced in section 1.2, to further guide and structure our analysis. It helps us ensure that our analysis of the current state, and our consideration of options and recommendations, appropriately captures all important factors.

Figure 7 | Analytical framework

We conducted desktop analysis and engaged key stakeholders

Throughout this engagement we:

- Conducted desktop analysis on a suite of public documentation, ESV publications and jurisdictional benchmark data, including those listed in Appendix A.
- Engaged with stakeholders across the industry in a one-on-one or small group format, including regulators in other jurisdictions, as documented in Appendix A.
- We covered topics including but not limited to the role and performance of LEIs, the nature of the relationship between LEIs and electricians, the nature of the relationship between LEIs and ESV, and short- and long-term opportunities to improve safety outcomes.
- Held workshops with ESV, a group of industry stakeholders and a group of government stakeholders, to present findings and stress test options to ensure that the resulting recommendations were robust and pragmatic.

Summaries of the key data and documents, stakeholders consulted, and workshops conducted as part of this review are provided in Appendix A.

2 Victoria's inspection regime could more effectively address safety risk

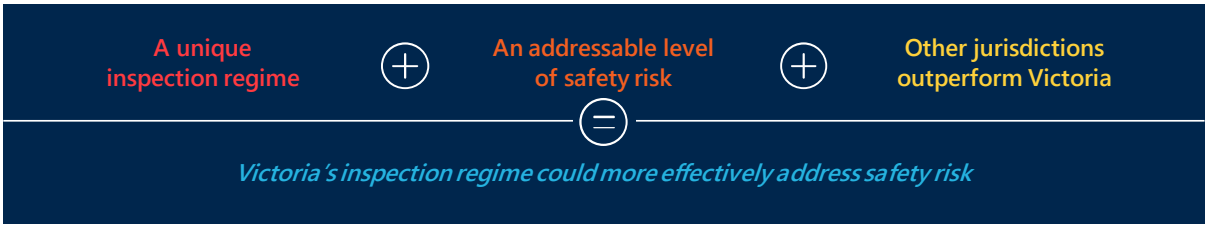
In this section we answer our first line of enquiry, **does the data indicate Victoria's inspection regime effectively addresses safety risk?**

In doing so, we make two key findings.

1. Some jurisdictions outperform Victoria on safety outcomes.
2. There is an addressable level of safety risk in Victoria.

When the two findings of this section are combined with the finding in section 1, that Victoria's inspection regime is unique, we can conclude that there are opportunities for Victoria's inspection regime to more effectively address safety risk. A visual summary of this conclusion is provided in Figure 8.

Figure 8 | Visual summary of our conclusion



Throughout this section, we provide the detail that supports these findings. Our finding that an addressable level of safety risk exists in Victoria is supported by our analysis of the outcomes of several audit programs. Our finding that some jurisdictions outperform Victoria on safety risk is supported by our analysis of jurisdictional benchmarks on these same indicators.

We are aware that the causal relationship between the inspection regime and safety outcomes is complicated by the existence of:

- Many mechanisms for safety risk reduction beyond the inspection regime as highlighted in section 1.
- Other possible variables that differ between jurisdictions, such as definitional interpretations of safety risk measures, audit checklists and practices, and government incentive programs impacting demand.

Limited accurate and available data on the state of safety risk further complicates the capacity for this review to conclude any causal relationships. The gaps and limitations of data are noted and explicitly outlined in this report. Although this data can at times be of limited assistance to ESV in its regulatory activities, it does provide general insight into the operations, practices and trends within industry and the level of safety risk in Victoria as compared to other jurisdictions.

With consideration of the data challenges, the review draws on the available evidence. Where feasible, multiple data sources are used to mitigate the risk of drawing conclusions on the basis of a single dataset. Multiple sources enable the review to draw broad conclusions on the regime where the various data sources indicate consistent trends and findings.

2.1 There is an addressable level of safety risk in Victoria.

Audit findings from ESV, the Clean Energy Regulator and Solar Victoria programs indicate the existence of an addressable level of safety risk in Victorian electrical installations. By *addressable level of safety risk,* we mean that the current level of safety risk can be reduced by enhancing a range of regime measures including: increased independent audits through ESV, improved training, licensing, CPD and enforcement.

ESV audits of prescribed work highlight defects

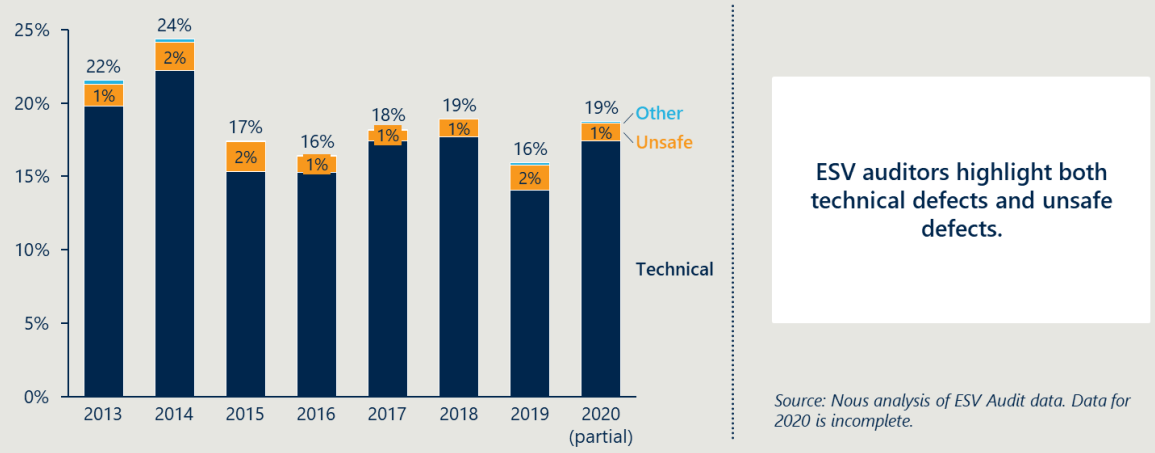
As described in section 1.2, ESV through its contractor audits a small proportion of prescribed work each year (~2 per cent) which provides insight into the level of safety risk in prescribed installations. There are two types of issues with electrical installations which are used in this report to assess the quality of electrical works and the safety of installations.

Technical defects – These are issues in the electrical installation which do not comply with the appropriate legislation, regulations and standards. These defects include lower risk issues (e.g. clerical issues with certificates), and higher risk issues (e.g. incorrect mapping of underground services and labelling of equipment).

Unsafe defects – These are issues in the electrical installation which are non-compliant, as well as issues posing a significant and imminent risk to life or property and non-compliance with legislation, regulations and standards intended to protect from electric shock[9].

Figure 9 demonstrates that safety risk persists despite prescribed works having been inspected by LEIs. Over the last eight years, identification of unsafe defects has been between 1 and 2 per cent, in addition to a significant number of technical defects.

Figure 9 | ESV audit results of prescribed work



Audits of solar systems (prescribed work) found 1 in 3 are defective

Solar systems are one type (but not the only type) of prescribed installation. There is more data and information on the quality and compliance of solar systems as they are inspected and reported by two other entities as part of government programs external to ESV.

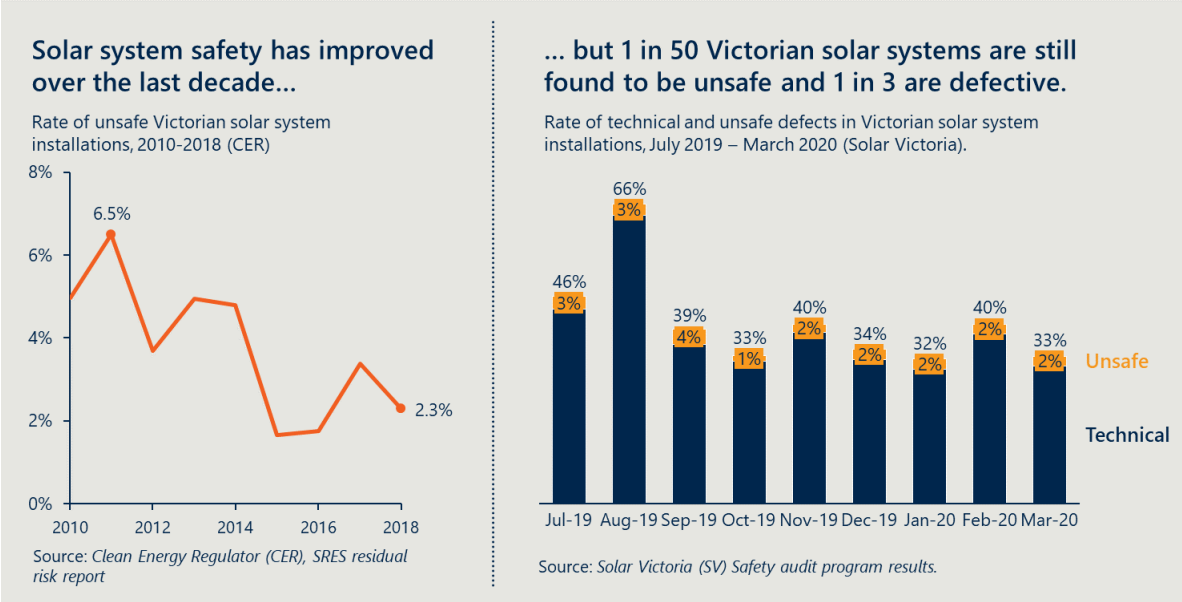
[9] ESV uses the following criteria to classify unsafe defects: (1) Immediately unsafe: the ability for a person to make contact with exposed metal that may be live or may become live when energised where only one action is required by a person or animal to come into contact with those live parts; and (2) Any requirements of the Legislation and/or Standards intended to protect persons and livestock from electric shock hazards that may arise from the use of an electrical installation.

1. Solar Victoria conducts thorough inspections on approximately 5 per cent of solar systems installed under the Victorian Government's Solar Homes program.
2. The Clean Energy Regulator conducts audits on approximately 1.5 per cent of installations under the Federal Government's Small-scale Renewable Energy Scheme program.

The Solar Victoria and Clean Energy Regulator data shows that Victoria has made progress in reducing unsafe defects in solar systems from 6.5 to around 2 per cent of installations over the last decade[10]. Nonetheless, there is still an addressable level of safety risk. This is depicted in Figure 10.

Figure 10 presents two graphs, drawing on two different datasets. The figure on the left draws on CER data, which provides a multi-year view of unsafe defects in solar installations. The figure on the right draws on Solar Victoria data, which provides detail on technical and unsafe defects at a monthly interval. There are some differences in the definition of 'unsafe' between these two audit programs, nevertheless both data sets indicate there remains an addressable level of safety risk in Victorian solar systems (which are one type of prescribed work which is inspected by LEIs).

Figure 10 | Electrical installation safety in Victorian solar systems



2.2 Some jurisdictions outperform Victoria on safety risk

The performance of other states demonstrates that safety can be improved further in Victoria. Most other jurisdictions focus their effort on independent post-energisation audits, where the Victorian regime predominantly relies on pre-energisation inspections as a key checkpoint for prescribed installations.

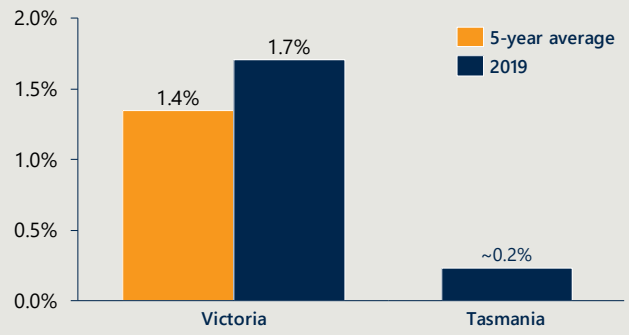
Tasmania's audit driven regime performs well when compared with Victoria

Due to the unique nature of each jurisdiction's safety regime, benchmarking the exact level of defects for Victoria's prescribed works is not possible. However, the Tasmanian electrical regulator has informed us of the level of unsafe defects identified in their post-energisation audits carried out by TechSafe, and we have compared this against the rate of unsafe defects identified in TechSafe's Victorian audits of prescribed works. The data, as demonstrated in Figure 11, shows that Victoria's rate of unsafe defects is on average

[10] CER audit program, see Figure 10.

1.4 per cent over the last 5 years, and 1.7 per cent in 2019, compared to Tasmania's annual estimate of 0.2 per cent.

Figure 11 | Rate of unsafe defects in Victoria and Tasmania for prescribed work



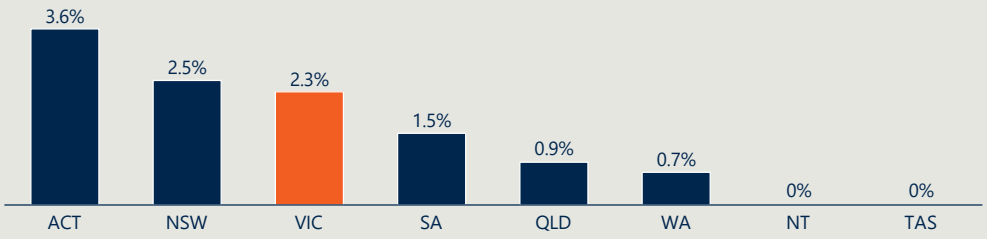
Victoria has 7-8.5 times more unsafe installations than Tasmania (by percentage of installations).

Source: Nous analysis of ESV Audit data for prescribed works (2% of installations). Consultations with Consumer Building and Occupational Services (CBOS Tasmania).

Similarly, the safety of Victoria's solar installations could improve

The performance of other jurisdictions shows that Victoria has an opportunity to further address electrical safety risks in solar installations. Solar systems are one type (but not the only type) of prescribed installation. Victoria's performance against other jurisdictions in 2018 is highlighted in Figure 12. The Clean Energy Regulator audit program is nationally consistent and thus the comparison comes with a high degree of credibility.

Figure 12 | Rate of unsafe solar system defects by state / territory (2018 audits)



Source: *Clean Energy Regulator (CER), SRES residual risk report*

3 Licensing does not guarantee a high level of LEI competence

LICENSING ····· INSPECTION AND AUDIT ····· REGULATORY OVERSIGHT

In this section, we address our second line of enquiry as it pertains to the licensing element of the regime, **what are the challenges in the inspection regime?**

We find that licensing practices do not always ensure high LEI competency levels and robust inspections. Requirements around admission, licence classes, and ongoing learning and development could all be strengthened. These issues are outlined below, as are two factors largely outside ESV's control that compound their impacts.

Admission requirements could more stringently screen for capability

As outlined in section 1.2, ESV imposes a mix of experience and assessment requirements on prospective LEIs. For the General class, the restrictions may not be stringent enough to consistently guarantee high LEI competence and ensure that highly qualified and experienced electricians are transitioning into the LEI role. In particular:

- **There is no explicit requirement for prerequisite training.** Admission does not require formal inspection qualification or training in the skills required to be an inspector prior to undertaking the assessment. Throughout our consultations with LEIs we heard that the training that does exist is focused on the objective of passing the test, rather than developing the skills required to be successful in the role. Simply being an electrician for any length of time does not provide the necessary capability and experience that an LEI requires to perform the role. Some electricians spend their entire career focused on one type of installation work and may never refer to any standards or regulations as part of their day-to-day job.
- **Stakeholders suggested that assessment is not challenging enough.** Stakeholders expressed the view that the assessment process, including the content in the test itself, is too easy and undermines the importance of the LEI role in ensuring electrical safety. They noted the exam was just like re-taking the A-Grade exam, which does not prove the breadth and depth of experience needed to become a highly competent LEI.

"The LEI assessment is about as hard as retaking your A-Grade" – Industry stakeholders and LEIs

By contrast, as outlined in section 1.2 there are three specialised licence classes making up a small proportion of overall prescribed certificates, namely Class H (hazardous), Class V (high voltage) and Class M (medical, patient areas). The licensing protocols are stricter for the specialised classes, including requirements for on-the-job training and additional training or qualifications specifically pertaining to that class. We consistently heard throughout consultations with ESV and industry that there are limited safety issues in these specialised categories, despite their higher risk and complexity, so it is likely that the more stringent LEI barriers to entry for these classes are driving positive safety outcomes.

The design of licence classes is not always sufficiently restrictive

The G-class licence provides a broad remit to inspect nearly all prescribed works. This remit enables the regime to rapidly adapt to new demand and technologies and ensure the continued and timely

certification of installations. For example, inspections have not been a bottleneck in delivering the high volume of solar systems through the Victorian Solar Homes program.

However, the downside is that LEIs are not restricted to inspecting the types of works for which they have specifically demonstrated competency. Of particular prominence at the time of writing are solar PV installations. G-class inspectors are licensed to inspect and certify solar systems despite the absence of any requirement to undertake training, assessment or to demonstrate experience specifically relating to solar PV. This means an LEI that has no prior experience with the installation of solar panels is able to sign off the safety of solar installations. This may be a contributing factor to the addressable level of safety risk identified in solar audits, as described in section 2.

Ongoing learning and development is not mandated

Stakeholders noted that technology within the electrical sector is moving at a fast pace, with new devices being introduced to market (e.g. solar panels, inverters, switches) on a regular basis. Stakeholders observed that LEI attendance at industry forums, workshops, and meetings that aimed to educate the sector on these new technologies and how they should be installed was very low when compared with electricians. The general sentiment of consulted stakeholders was that LEIs typically lag behind industry in learning and having a deep understanding of new approaches and technologies in the sector. There are not any mandated requirements for inspectors to undertake Continuous Professional Development, although we do note that legislation has now been amended for this purpose, anticipated to take effect from 2023.

"The electrical trade is ahead of the inspectors" – Industry stakeholders

Issues are compounded by factors largely outside of ESV's direct control

It is also worth noting that the impact of the factors described above is compounded by two factors mostly outside of ESV's control:

1. **The availability of inspector training is limited.** There was a consensus among the eight consulted LEIs that opportunities are limited for both the formal Certificate IV in Electrical Inspection and other courses provided by the private training market. The implication is that if prospective or existing LEIs would like to voluntarily upskill, such as on inspection processes or new technologies, they may have difficulty finding a course to suit their needs. A key challenge for re-establishing the Certificate is providing certainty of a student pipeline to education providers.
2. **There is an absence of a strong pipeline of prospective LEIs.** Over half of the active LEIs are over 50 years old.[11] Consultations with stakeholders described the ageing cohort of inspectors as highly trained and skilled ex-SECV inspectors. If a significant portion of technical expertise leaves the industry over coming years, the impact of the issues described above could be accentuated.

[11] Ellis Jones consulting for Future Energy Skills. (2019). Licensed Electrical Inspector research report.

4 Inspections and audits are not providing ESV with the actionable data it needs to further improve electrical safety

LICENSING ····· INSPECTION AND AUDIT ····· REGULATORY OVERSIGHT

In this section, we address our second line of enquiry as it pertains to the inspection and audit element, **what are the challenges in the inspection regime?**

Although ESV audit data and Certificate of Electrical Safety (COES) data may be of limited assistance to ESV in guiding its broad range of regulatory activities, these sources provide insights into the operations, practice and trends within industry. Our examination of ESV audit data indicates that some LEIs provided Certificates of Inspection for installations that were later found to be defective. ~159 in 1,000 installations were defective (15.9 per cent) at the time of audit, of which ~1.7 per cent were unsafe defects and ~14.2 per cent were technical defects.[12] The reporting of defective installations by LEIs to ESV is very low when compared with the findings in subsequent audits. Based on our consultations with ESV, the COES data indicates that LEIs only report defects to ESV in 1 in 1000 inspections (0.1 per cent).[13] Using the assumption that the ESV audited sample is representative of all installations across Victoria, this suggests that LEIs only report 0.6 per cent of all defective installations to ESV and 6 per cent of unsafe defects.[14]

. The commercial relationship that exists between an LEI and electrician creates a risk that inspections are not impartial or free of conflict or bias. LEIs may rely on electricians for recurrent work, which may mean they are reluctant to refuse to certify an installation (or trust that it will be rectified soon after inspection). This dynamic can also affect the thoroughness of inspections conducted by LEIs. In addition, stakeholders mentioned other contributory factors, including the low price of inspections (described in a following subsection), and some LEIs not having the necessary skills and experience for the reasons outlined in section 3.

Stakeholders, including electricians, also noted examples where LEIs played a valuable advisory function, offering guidance and assurance, allowing them to remedy potential issues before they occur. LEIs and peak bodies indicated this cohort is more prevalent across the complex, higher-risk work and specialised licence classes. Electricians appreciated advice on complex installations that they do not perform regularly.

Our review also found that ESV's current audit program is of limited scope and overly focused on non-prescribed work, as discussed in a subsection below.

Commercial pressures drive down price and quality of inspections

The inspection regime allows electricians and LEIs to negotiate an agreed price, rather than establishing a minimum or mandated inspection price. The market price for a prescribed inspection has settled to $65 on average[15], which we heard from LEIs is particularly low especially after factoring in travel costs. By

[12] Nous analysis of ESV audit data. 2019. Note: in 2019 ESV audited 2 per cent of all prescribed installations.
[13] Consultations with ESV based on ESV's analysis of COES data.
[14] Of the 159 in 1000 (15.9 per cent) defective installations, 1 would be reported to ESV, which is 0.6 per cent. Of the 17 in 1000 (1.7%) of unsafe defects, 1 would be reported to ESV, which is 6 per cent.
[15] Electricity Safety (General) Regulations 2019, Regulatory Impact Statement, prepared by Regulatory Impact Solutions Pty Ltd.

comparison, carbon monoxide inspections undertaken by qualified plumbers average about $220.[16] Stakeholders suggested that the low price contributes to 'corner cutting' on both sides of the market:

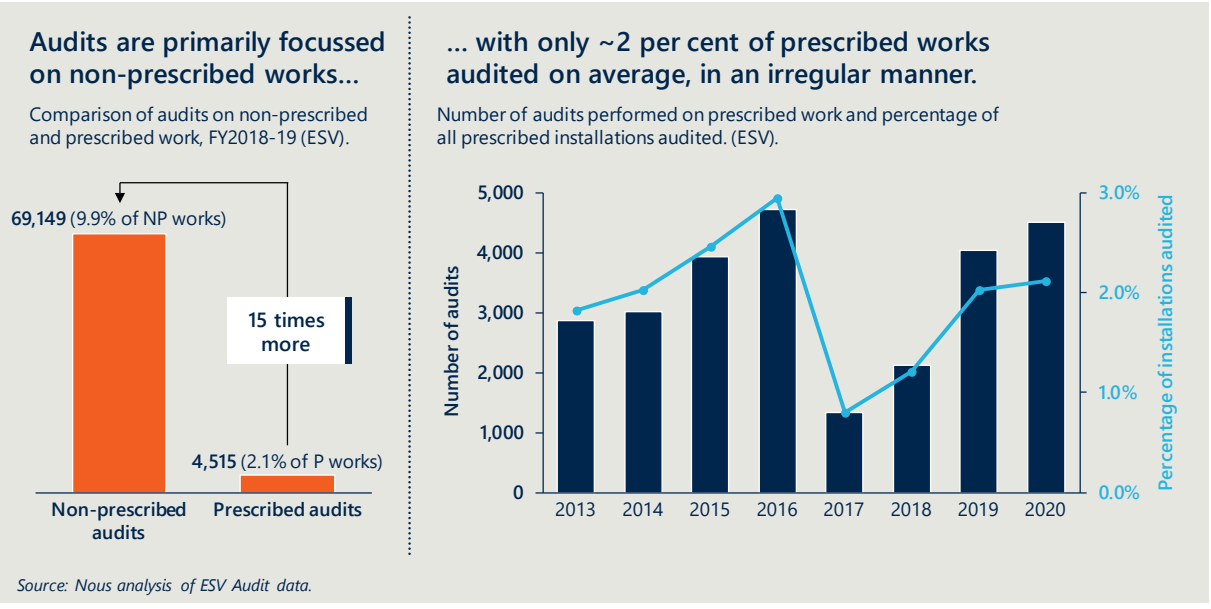
- **Stakeholders suggested that some electricians are willing to pay a low price for inspections of dubious quality, sometimes seen as a mere 'tick the box' exercise.** Stakeholders suggested that this is particularly evident for solar works. Industry stakeholders reported that retailer margins have been heavily compressed, with fierce competition on price between solar retailers for work under the Solar Homes program. This is reportedly flowing through to tighter margins imposed on electrical contractors which are then pressured into engaging LEIs at the lowest cost possible.
- **Stakeholders suggested that some LEIs are willing to accept that low price even if it compromises the robustness of the inspection**. We heard from stakeholders that some LEIs are willing to take steps to make a low inspection price financially viable. They suggested that this includes not climbing on the roof for solar PV installations, or conducting 'drive-by' inspections.

The current ESV audit program does not sufficiently interrogate the safety of prescribed works

Although ESV audits are independent, there are several reasons why the current program is not optimally designed to address safety risk. These reasons are discussed below, drawing comparison where relevant to the more robust Solar Victoria audit program.

1. **The ESV audit program focuses on non-prescribed works rather than prescribed works.** The number of prescribed audits depends on spare auditor capacity, after a quota of non-prescribed audits has been filled. Figure 13 below shows that in FY19 about 15 times more non-prescribed works were audited than prescribed works, and that over the last eight years only about 2 per cent of prescribed works on average were audited. The rationale is that prescribed works have an extra line of defence through the LEI inspection, but as established above, the commercial relationship between LEI and electrician creates a risk that inspections are not free from bias. Therefore, the ESV audit program's focus on non-prescribed works means that the inherently riskier prescribed works are subject to the least independent checks (an ESV audit).

Figure 13 | Comparison of prescribed and non-prescribed auditing



Source: Nous analysis of ESV Audit data.

[16] Based on five online, blind quotes for Victoria.

2. **ESV audits are not producing actionable insights.** ESV audits are much cheaper and smaller in scope when compared with Solar Victoria. They can play a role in assisting with general insight into operations, practices and trends within industry and the level of safety risk in Victoria. However, the scope is not sufficient to produce specific actionable insights that can inform regulatory decision making (e.g. key trends in issues, proponents, geographies, types of installations). By contrast, although stakeholders raised some concerns that Solar Victoria's audit findings may be over-reaching, they do produce findings and results that would be useful for a regulator to inform and guide its core functions. The key driver of the robustness and scope of the audits is the contractual arrangement in place with the provider. In this case, the same provider is producing a very different level of analysis for ESV and Solar Victoria due to the negotiated price and scope.
3. **The ESV audit program is not data-driven and risk-based**. The ESV audit program facilitates random audits, rather than data-driven and risk-based audits. This makes it difficult for auditors to hone in on common areas of safety risk. By contrast, under the Solar Victoria program approximately 60 per cent of audits occur on high-risk installations, 30 per cent on medium-risk installations and 10 per cent on low-risk installations. Solar Victoria also ensures that every program participant, both retailer and installer, is subject to at least one annual audit.

5 ESV's low maturity in monitoring and enforcement has affected its reputation

LICENSING ····· INSPECTION AND AUDIT ····· REGULATORY OVERSIGHT

In this section, we address our second line of enquiry as it pertains to the regulatory oversight element, **what are the challenges in the inspection regime?**

We find that ESV's access to on-the-ground intelligence and its data-use practices restrict it from monitoring the inspection regime as effectively as it otherwise could. Further, ESV's industry reputation is hampered by its lenient use of enforcement measures, and its inability to consistently answer queries from industry players in an accurate and timely manner.

ESV's data access and practices hinder its monitoring of the inspection regime

ESV has limited access to on-the-ground intelligence, and its internal practices could be more effectively designed to make the most of the information it does have available to it. This limits ESV's ability to make strategic decisions with confidence. For example, a more data-sophisticated regulator would be in a better position to confirm if the current definition of prescribed work accurately covers the more complex and higher risk installations, and suggest regulatory change if desirable. ESV's ability to effectively target regulatory activities and choose appropriate remedial actions is also hindered, for instance heavy enforcement for fraudulent activity, and targeted educational materials to overcome common sources of industry uncertainty. The two key causes are outlined below:

1. **The design of the inspection regime means ESV cannot access the on-the-ground intelligence it needs to have a clear picture about the extent and nature of electrical safety risk.** In particular:
    - *LEIs are not consistently reporting defects to ESV*. As explained in section 4, defect reporting data suggests that LEIs only report 0.6 per cent of all defective installations to ESV and 6 per cent of installations with unsafe defects.[17]
    - *The ESV audit program does not produce actionable insights for ESV*. As highlighted in section 4, the focus on non-prescribed works, the absence of risk-based targeting, and the limited scope per audit, all contribute to an audit data source that ESV cannot comfortably rely on for continuous improvement of the regime.
    - *Distribution Businesses (DBs) gather more data than they are required to share*. DBs are required to report reverse polarity issues to ESV but are not required to report on other less severe but nonetheless important issues of safety risk they might uncover when connecting installations to supply.
    - *ESV does not regularly conduct on site visits*. ESV enforcement officers are not routinely out on-the-ground at the time of an inspection or installation, meaning ESV officers are not reporting back first-hand knowledge of industry trends, common issues and insights on safety risk.
    - *ESV has needed to rely on the Solar Victoria audit program data*. Given the shortcomings identified above with access to data, ESV's most reliable source of information is now the Solar Victoria audit

[17] Of the 159 in 1000 (15.9 per cent) defective installations, 1 would be reported to ESV, which is 0.6 per cent. Of the 17 in 1000 (1.7%) of unsafe defects, 1 would be reported to ESV, which is 6 per cent.

program, which provides insightful and timely information to ESV, but only on the solar subset of prescribed works.

2. **ESV practices do not maximise the utility of the information it has available**.

Despite ESV's limited access to data, there are opportunities to better use the data it does have available. More could be done to streamline processes for examining and identifying trends from COES data, for instance. Although the Certificates contain very minimal defect reporting, they contain trends and irregularities that could be more proactively identified. This would assist ESV's targeting of regulatory activities, its selection of sites to visit, and its oversight of electricians and LEIs.

Over the last 12 months, ESV has made gains in this respect through the recently established renewables team, drawing on Solar Victoria's timely data to help guide its enforcement and education activities. For instance, we have heard of up to five LEIs returning their licences to ESV in the last year due to concerns that ESV would uncover their non-compliant behaviour relating to solar installations.

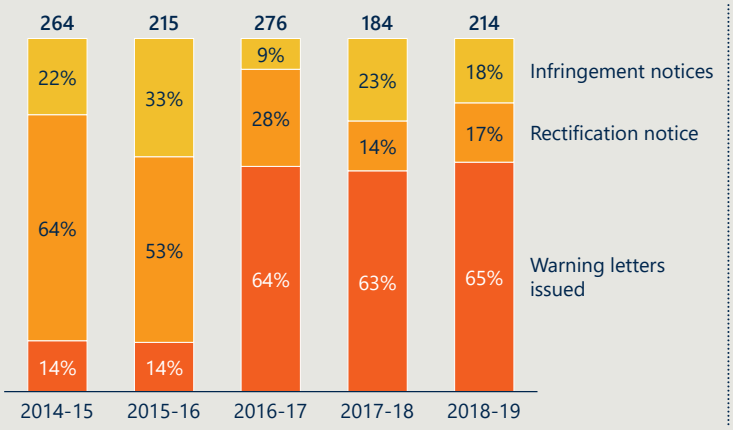
ESV could enhance its industry reputation

Our consultations with a range of industry stakeholders revealed that ESV is not highly regarded by industry. ESV's historic enforcement practices have been regarded as lenient and not visible. As an educator, ESV is perceived as unable to satisfactorily address industry questions and concerns in a consistent manner.

"ESV is a toothless tiger" – Industry stakeholder

On the enforcement side, ESV has a wide-range of enforcement powers available, including the ability to prosecute, issue infringement notices with penalties, rectification notices and warning letters. However, Figure 14 shows that warning letters have been by far the most predominant lever used over the last five years. Consultations also revealed that ESV conducts minimal site visits. The result is that industry players have not typically viewed the threat of ESV action as a strong deterrence to non-compliance. Nevertheless, we understand through consultations with ESV that this trend has changed over recent months, with ESV issuing more infringement notices and commencing prosecution proceedings.

Figure 14 | ESV's severity of enforcement over time



Warning letters have outweighed infringement notices in recent years, significantly more than pre FY17.

Although we understand this trend has recently reversed with ESV issuing more infringement notices and prosecuting, including against LEIs themselves.

Source: Nous analysis of ESV Annual report data (various years)

On the education and industry engagement side, ESV has lost some credibility across the industry due to its inability to answer queries from electricians and LEIs about wiring rules and regulatory requirements in a timely, consistent and accurate manner. Consulted LEIs reported the industry no longer sees ESV as the first port of call for advice and clarification. Instead, some stakeholders suggested that industry bodies are fulfilling this role more effectively.

6 We recommend increased auditing, professionalised LEIs and complementary changes

In this section, we address our third and fourth key lines of enquiry:

- **What options could be considered to respond to the challenges?**
  We developed and tested multiple reform options with stakeholders before finalising recommendations as part of this review. Appendix B contains a summary of options considered.
- **What recommendations should be pursued?**
  We build on the insights extracted from the development and testing of these options to then propose a series of eight recommendations, designed to address the challenges identified across all three elements of our analytical framework. In the sections that follow we also detail the impact of the recommendations on key players, offer key risks and mitigation strategies, and provide an implementation plan to guide staged delivery.

6.1 Eight recommendations span the entire regime

The recommendations are designed to capture the best elements and approaches across the options we considered, as well as including additional practical interventions and changes. Table 2 summarises our eight recommendations which are explained in detail over the following pages. These recommendations have been designed to directly address the challenges identified throughout sections 3-5.

Table 2 | Recommendations across analytical framework

Component	Recommendation
Licensing	1. Institute additional training requirements and strengthen LEI assessments 2. Introduce additional risk-based LEI classes 3. Mandate Continuous Professional Development
Inspections and audits	4. Implement robust, risk-based and data driven auditing 5. Establish a professional institute for LEIs or assist the IEI
Regulatory oversight	6. Use insights derived from improved audits to inform regulatory activities 7. Strengthen enforcement of obligations on LEIs and electricians 8. Improve communications and education activities

These recommendations will provide ESV with improved data to review the efficacy of the regime with a level of specificity not currently available. ESV should periodically assess the regime for efficacy against its objectives and consider appropriate interventions and reform to overcome challenges. Following the implementation of the recommendations, and with the benefit of 12-18 months of detailed data from audits, further reforms to the inspection regime could be considered, in particular options 1 and 3 as set out in Appendix B.

Table 3 | Licensing recommendations

Recommendation	Description
1. **Institute additional training requirements and strengthen LEI assessments**	In addition to the current expectation of five years of experience as a licensed electrician (or equivalent), candidate LEIs should be required to demonstrate that they have undertaken appropriate formal training as prescribed by the regulator. Training should include risk-based assessments and tailored content based on their proposed specialty through electives. This would have the effect of revising the process of obtaining a G-class licence to be closer to the screening required for specialised classes. ESV should support the industry in the development and delivery of this training. LEI assessments should be better tailored to the activities and responsibilities of LEIs as independent inspectors and technical advisors. At the same time, the complexity of assessments should be increased to align with the importance of the role and to more effectively screen for capability of candidate LEIs.
2. **Introduce additional risk-based LEI classes**	At a minimum, ESV should pursue an additional class for renewable systems (e.g. solar systems), by seeking amendments to the *Electricity Safety (Registration and Licensing) Regulations 2020*. This recommendation complements Nous' recommendations in the interim solar report. The assessment required to acquire the licence should verify competent technical experience and knowledge pertaining to solar PV installations, along with best-practice inspection processes.
3. **Mandate Continuous Professional Development**	ESV should mandate Continuous Professional Development (CPD) to ensure LEIs maintain and build competency in their areas of practice. CPD should promote new and sustained competence and understanding across: • Existing and emerging technologies • Standards, regulations, and installation requirements • Established and emerging areas and approaches to installation work. ESV is already pursuing regulatory change to require LEIs to undertake CPD. Our recommendation is intended to confirm the merits of this approach and suggest it be continued and implemented. The Regulatory Impact Statement[18] for this change aligns with Nous' recommendations and outlines similar priority areas. As part of this recommendation, ESV should periodically review LEIs' CPD plans and logbooks to ensure it is being satisfactorily completed. In cases where LEIs are found to be not completing CPD, ESV should apply appropriate remedial action to support compliance, including licence suspension for sustained breaches.

[18] Electricity Safety (General) Regulations 2019, *Regulatory Impact Statement*, prepared by Regulatory Impact Solutions Pty Ltd.

Table 4 | Inspection and audit recommendations

Recommendation	Description
4. **Implement robust, risk-based and data driven auditing**	The current auditing contract has concluded and ESV has engaged in an open tender to fulfil the revised auditing regime in coming years. ESV is already seeking to improve the efficacy and efficiency of the audit program. We recommend that the new audit program contain the following characteristics: • **Uses data driven, risk-based audit sampling methodology**. The works elected to be audited and the overall percentage of works to be audited should be dynamic and vary based on the complexity and risk of installation type, geography, the electrician or LEI and any other factors ESV determines influence risk. The methodology should ensure: all electricians and LEIs are audited at least once a year; more audits are conducted where the characteristics of the installation or the electrician or LEI indicate a higher risk or are aligned to industry trends of higher risk works; retain a random auditing component. • **Audits a higher percentage of prescribed work**. A greater proportion of works should be audited than is currently the case, to ensure issues are identified by ESV. The actual percentage of works audited should be dynamic and vary based on risk-based sampling. • **Revises audit scope to reflect the importance of auditing on safety**. The scope of the audits conducted should be expanded, to ensure a more thorough inspection level of detail. ESV should develop audit checklists for key types of work, which include priority items nominated as high-risk and common defects based on data from the regime. • **Audit program is appropriately funded.** Prescribed installations are typically more complex and will require more expertise and time on site to audit to the necessary level of detail to ensure the installation is compliant and safe. • **Screen for auditors of high competence.** Rigorous audits are founded on effective and well-incentivised auditors. ESV should ensure that all auditors have appropriate experience and qualifications, either through contractual arrangements or recruitment screening.
5. **Establish a professional institute for LEIs or assist the IEI**	To cement the LEI role as an independent, attractive and highly-professional industry, ESV should assist where necessary to help establish a professional institute. The institute may be developed from existing professional bodies such as the Institute of Electrical Inspectors (IEI) or the National Electrical and Communications Association (NECA), or may be developed as a new organisation. A professional institute would play a central role in key matters such as: • Devising a code of conduct defining the overarching LEI objective to protect electrical safety and outlining the principles that should shape LEI engagement with electricians. • Promoting the attractiveness of the industry, including LEI career pathways that harness the value some electricians place on the LEI advice and assurance function. Opportunities for LEIs to commercialise their utility and knowledge beyond prescribed work and to build reputation for leading knowledge on specialised installations should be identified. • Assisting in the development and quality assurance of new and improved training requirements and assessment content (as provided in recommendation 1). • Assisting in the development, quality assurance and delivery of CPD requirements (see recommendation 3) to ensure the materials and sessions are insightful and relevant. This could include holding network events with guest speakers to aid development of members.

Recommendation	Description
	• Quality assuring the services LEIs provide by documenting systems and internal processes for LEIs to follow to ensure best practice and to mitigate mistakes. • Ensuring that training and assessment strikes the right balance between being stringent enough to guarantee a professional and highly-qualified industry, but not so burdensome as to drive a shortage of LEIs through overly-restrictive barriers to entry. • Engaging with industry bodies (such as the National Electrical and Communications Association, the Electrical Trades Union and the Clean Energy Council) to promote, inform and enhance the knowledge and progression of the LEI profession. • Providing advocacy for LEIs and lobbying relevant bodies for funding, support and legislative or regulatory change if required. • Communicating to members that ESV will conduct more rigorous auditing of prescribed installations and will pursue enforcement against LEIs for failure to meet regulatory obligations.

Table 5 | Regulatory oversight recommendations

Recommendation	Description
6. **Use insights derived from improved audits to inform regulatory activities**	ESV should enhance its focus on data-driven evidence and decision-making. To do so, ESV should further develop its sources of data by actively pursuing opportunities to gather more and richer primary-sourced data, and to draw more secondary-sourced data from existing actors and processes. The expansive audit program described in recommendation 4 will be a primary source of data, but other avenues will continue to be available, for instance ESV should: • Encourage greater adoption and use of electronic COES to capture more real-time installation data. • Work with distribution businesses to support their reporting of installations which were found to be unsafe through their inspections and testing. • Increase on-the-ground activities such as spot-checks and ride-alongs, ensuring Officers report back information to the wider organisation. ESV should use its data sources to proactively identify trends in safety risk and to better target the enforcement and education levers that are highlighted in recommendation 7 and recommendation 8. ESV should also review the efficacy of the regime and consider appropriate interventions and reform to answer strategic regime questions, such as: • Are inspectors adding value and are safety benefits proportionate to their cost burden on industry and ESV? • Is the definition of prescribed works useful? Is it appropriately risk-based? • Should there be additional LEI specialist classes beyond the renewables class? • What drivers contribute most to defect rates? Is competency of licensed electricians adequate?

Recommendation	Description
	If the data does not demonstrate that inspections are driving a material reduction in safety risk, ESV should consider transitioning to other models, some of which are posed in Appendix B.
7. **Strengthen enforcement of obligations on LEIs and electricians**	Where an electrician performs defective work which is certified as compliant by an LEI, the enforcement response and remedial action should be proportionate, in order to compel the correct behaviours in both electricians and LEIs. ESV should utilise all enforcement levers and be more targeted in its remedial actions. A greater onsite presence will also drive benefits to enforcement by demonstrating that ESV is actively keeping the industry 'in check', eroding perceptions that electricians or LEIs can 'run the risk'. To support this shift, ESV should prepare and distribute communications to both LEIs and electricians around the intention to ramp up enforcement against both parties.
8. **Improve communications and educative activities**	Improving ESV's communications and educative activities is a low-risk investment with potential to influence safety rates in installations. Three key changes are recommended: • Increase the quantity and quality of outbound technical communications to industry, filling the market need for technical support. The new ESV Connect platform provides an attractive medium for ESV to disseminate this information. • Provide more responsive and insightful advice when engaged by industry. When responding to questions and enquiries ESV should endeavour to provide accurate, consistent, timely and actionable advice to LEIs and electricians on technical matters and interpretations of standards. • Support and lead development of education materials and training delivery relevant to key risks and common shortfalls in electrical installations. All initiatives under this recommendation are strengthened through recommendations 4 and 6, as effective use of rich data will enable targeted and more effective education.

6.2 Recommendations will impact key players

The key impacts of the recommendation package on the main players are outlined below.

- **ESV** will work with the Department of Environment, Land, Water and Planning (DELWP) to seek minor regulatory amendments to the *Electricity Safety (Registration and Licensing) Regulations 2020* to institute a renewables licence class. ESV will deliver a more robust and data-driven audit program, increase its emphasis on data-driven activities, and undertake consistent and appropriate remedial action against both electricians and LEIs for failure to comply with regulatory obligations.
- **Electricians** will continue to be obliged to engage inspectors for prescribed installations. They will engage and pay for LEIs directly. Electricians will not know at the time of installation whether their work will be comprehensively audited by ESV.
- **LEIs** will form part of a professional industry, with more stringent licensing requirements and the need to demonstrate continued professional development.

6.3 There are risks that need to be mitigated

This recommendation package gives rise to several risks. Three are described in Table 6, along with corresponding mitigation strategies.

Table 6 | Key risks and mitigation strategies

	Risk	Mitigation strategy
Driving desired behaviour relies on monitoring and enforcement	To identify and deter poor practices and behaviours, an effective audit program is necessary but not sufficient. It must be coupled with similarly effective monitoring of actors and enforcement in the case of non-compliance.	ESV should visibly and consistently undertake enforcement on both electricians and LEIs in the case of defective installations. The additional data ESV will have available from the enhanced audit program should help ESV to perform this role more effectively.
Workforce capability and capacity	ESV will require multiple new auditors to deliver the enhanced audit program and internal technical experts to support ESV communications and education activities. This capacity may not be freely available in the market, particularly given LEIs will continue to inspect all prescribed works, and that the LEI pool is ageing and many LEIs may exit the workforce.	ESV should make strategic sourcing decisions regarding insourcing our outsourcing, to effectively engage and maintain the levels of competency and capacity needed. Regarding auditors, ESV may look to target existing LEIs to transition to these roles at ESV. Regarding technical expertise, ESV could pursue demand management techniques to reduce the capacity required to serve industry questions and enquiries effectively.
Inspectors are unable to source required training	Recommendation 1 calls for a requirement of LEIs to undertake formal training before taking assessment to become an LEI, but the private market to offer this training is limited. To be worthwhile, the training must be tailored specifically for the needs of LEIs.	A commitment from ESV mandating pre-admission training requirements could give providers confidence of increased demand, enhancing their business case to offer the course. ESV should work closely with training providers and industry to develop the course, seeking to leverage training materials and units from existing electrical training resources to decrease the burden of developing brand new content and curriculum.

6.4 Implementation will be critical

This subsection firstly describes how our recommendations are consistent with other inflight changes and provides a high-level implementation plan to guide staged delivery.

Inflight changes should be considered during implementation

Our recommendations to improve the inspection regime will not be rolled out in isolation. ESV has many other concurrent reforms and regime changes inflight, in addition to interim recommendations provided by Nous to address short-term concerns in solar system safety.

ESV is taking several steps to improve safety performance in the sector

ESV is delivering several initiatives and reforms which were inflight at the time of this review. Key scheduled or ongoing initiatives and a brief description of how they fit with our proposed recommendations are outlined in Table 7.

Table 7 | Current or proposed (prior to the review) changes to the regime

Initiative	Description	Consideration
CPD	Legislation has been amended to mandate CPD, with these changes to come into effect in 2023.	Recommendation 3 mirrors and supports this initiative.
Restricting repeated attempts at LEI assessment	ESV recently revised its policy and procedures relating to repeated attempts at LEI assessments. Under the policy, the candidate is limited to four assessments per year and a minimum of 60 days between attempts.	This initiative was considered in the development of the complementary changes in recommendation 1.
Renegotiation of auditing contract	ESV is engaging in an open tender to fulfil the revised auditing regime in coming years.	ESV should consider a short contracting arrangement, to enable ESV to revisit the audit contract following consideration of audit changes proposed in recommendation 4.
Enforcement approach and processes	ESV has recently made greater use of stronger enforcement levers. ESV is also developing a standardised approach to enforcement through processes to limit individual or managerial discretion on enforcement and to systematise decision making.	This initiative is aligned directly with recommendation 7. Further utilisation of enforcement levers will strengthen and improve the efficacy of other components of the recommendation package.
Renewables Team	Following rapid uptake in solar PV and other renewable technologies, a three FTE team has been established under the Electrical Installation Safety team.	The Renewables team is leading ESV's use of data through its access to timely Solar Victoria reports. Recommendation 6 proposes increased use of data, which is consistent with the current activities of the Renewables team.
ESV Connect	In FY19, ESV launched an industry-facing platform to support licensing and certificates, incorporating electronic Certificates of Electrical Safety (COES).	ESV Connect provides a useful platform for ESV to disseminate information to industry, as proposed in recommendation 8. Electronic COES provide more timely data access, which could help strengthen recommendation 6.

Interim solar system recommendations

Nous developed an interim report outlining short-term recommendations to improve safety outcomes in solar system installations. The recommendations were designed to provide 'quick-wins' and demonstrate a measurable positive impact within six to twelve months of implementation. A summary of the three interim recommendations is provided in Table 8, alongside a brief description of how they fit with the proposed package.

Table 8 | Summary of interim solar system recommendations

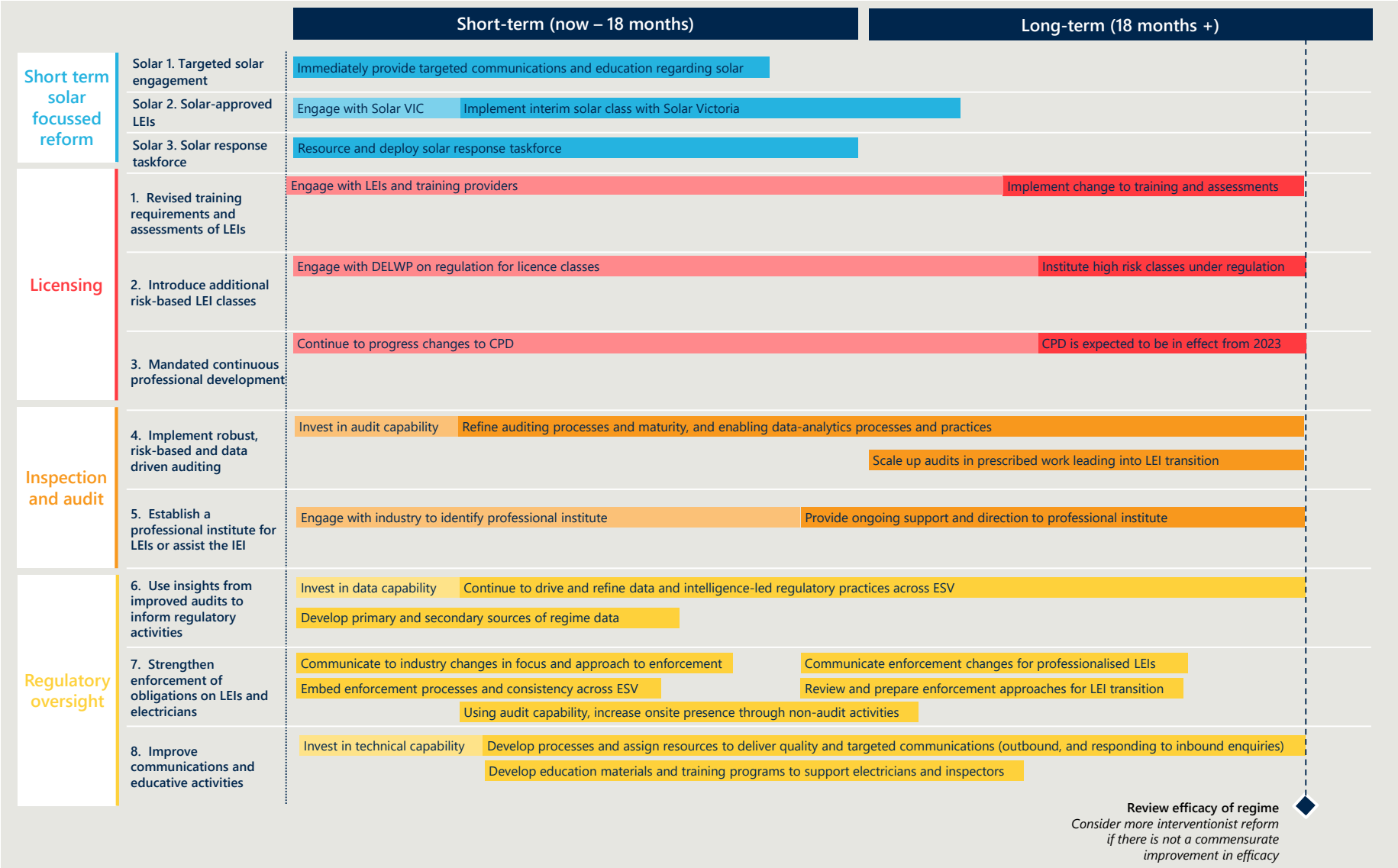
Interim recommendation	Description	Consideration
1. Targeted solar engagement	ESV should provide targeted information and materials to electricians and LEIs on the highest risk and most prevalent issues in installations. This information should be primarily disseminated through existing channels (magazine, email, etc.). Additionally, ESV should engage deeply with industry on solar, in webinars, conferences, and similar events.	This initiative is low investment, low regrets and is complementary with the direction of the recommendations. ESV can use this initiative to begin to develop and refine data-driven and targeted communications competencies, which will form foundational capacity to deliver the wider recommendations effectively.
2. Solar-approved LEIs	ESV should introduce an additional assessment requirement of inspectors before they are permitted to certify renewable system installations (solar as a minimum). In the short-term, this requirement should be developed in partnership with Solar Victoria and applied in the Solar Homes program.	This initiative is a low-cost temporary intervention which is proposed to be replaced by a more robust solution in long-term recommendations. In the long-term, changes to regulations are recommended (recommendation 2) to define additional risk-based LEI classes. Under this long-term recommendation, the classes can be administered and managed independently without Solar Victoria.
3. Solar response taskforce	Building on the recently established Renewables Team, ESV should resource a taskforce to analyse the rich Solar Victoria data to identify high-risk electricians and LEIs. Using this analysis, this taskforce should follow up with targeted desktop and physical audits and spot-checks, and then respond with regulatory levers (education and enforcement) as appropriate.	This initiative is complementary to the objectives of the recommendations. The taskforce will provide ESV with a targeted pilot which ESV can use to develop and refine key competencies and processes to be a more data-driven, contemporary, and risk-based regulator.

There are no dependencies, however implementation should be staged

The recommendations and associated changes can be progressed concurrently. The recommendations are designed to work together as a package to enhance performance and efficacy of other recommendations.

There are no dependencies between the eight recommendations so there are no strict staging requirements for implementation. Put differently, no reform needs to be enacted and assessed, before decisions are made about whether other recommendations should be pursued. That said, implementation of major recommendations should be progressively implemented and communicated well in advance to minimise disruption and embed changes in industry and secure stakeholder support. Stages of implementation are shown in a high-level implementation plan in Figure 15 overleaf.

Figure 15 | High-level implementation plan



Appendix A Sources of information

The following tables summarise the sources of information which informed the review:

- key data and documents (Table 9);
- stakeholders consulted (Table 10); and
- workshops conducted (Table 11).

Table 9 | Key data and documents

Category	Sources
Legislative instruments	*Energy Safe Victoria Act 2005* *Electricity Safety Act 1998* *Electricity Safety (General) Regulations 2019* *Electricity Safety (Registration and Licensing) Regulations 2020*
ESV publications	Regulatory Impact Statement – Electricity Safety (General) Regulations 2019 Regulatory Impact Statement – Electricity Safety (Installations) Regulations 2009 ESV Annual Reports
Data	Solar Victoria audit data ESV audit data ESV inspection data
Other papers and data	Institute of Electrical Inspection (IEI), Position Paper, 2020 Clean Energy Regulator, SRES Residual Risk Report, 2018 Clean Energy Regulator, Statistical Analysis of CER Inspection Sample for Non-Compliant SGUs, 2018 Electrical Regulatory Authorities Council, Electrical Fatality Data, 2018-19 Ellis Jones consulting for Future Energy Skills, LEI Research Report, 2019

Table 10 | Stakeholders consulted and format of consultation

Category	Stakeholder	Interview(s)	Workshop(s)
Government	Energy Safe Victoria	4	4
	Department of Environment, Land, Water and Planning	1	1
	Solar Victoria	2	1
	Office of the Minister for Energy, Environment and Climate Change (Vic)	0	1
Industry	LEIs	8	1
	Institute of Electrical Inspectors (IEI)	1	1

Category	Stakeholder	Interview(s)	Workshop(s)
	National Electrical and Communications Association (NECA)	1	1
	Electrical Trades Union (ETU)	1	1
	Master Electricians	1	1
	TechSafe Australia	1	0
	Electrical Inspections Victoria	1	0
Interstate regulators	Tasmanian Department of Justice	2	0
	Queensland Office of Industrial Relations	1	0
Distribution businesses	Powercor	1	0
	Ausnet	1	0

Table 11 | Workshops conducted as part of the review

Engagement	Stakeholders	Objectives
Multiple client workshops	• ESV stakeholders	• Testing preliminary findings and filling gaps • Considering key questions around the inspection and audit regime
Draft findings and reform options	• ESV • DELWP • Solar Victoria • Office of the Minister for Energy, Environment and Climate Change (Vic)	• Presenting draft findings and recommendations • Considering important feedback from the group
Industry stakeholder workshop	• ESV • Institute of Electrical Inspectors (IEI) • National Electrical and Communications Association (NECA) • Electrical Trades Union (ETU) • Master Electricians	• Fact-based stress test to understand the benefits and risks of reform options • Discussing options to understand the implications for different stakeholder groups

Appendix B Options considered

We initially constructed and considered six potential reform options, as outlined in Table 12 below. After further analysis and consultation, these six options were not directly recommended and the final eight recommendations were made. As highlighted in section 6.1, the final recommendations will provide ESV with improved data to review the efficacy of the regime with a level of specificity not currently available. ESV should periodically assess the regime for efficacy against its objectives and consider appropriate interventions and reform to overcome challenges. Following the implementation of the recommendations, and with the benefit of 12-18 months of detailed data from audits, further reforms to the inspection regime could be considered, in particular option 1 and 3.

Table 12 | Reform options considered

Reform option	Assessment
1. Remove inspections, replace with audits	This option was considered because audits have demonstrated in other states and through Solar Victoria's internal audit program that they can be effective in promoting compliance. This option was not recommended at this time because: • **A 'line of defence' would be removed.** Greater trust and responsibility would be placed on electricians to ensure installation safety, despite the industry being accustomed to the additional check provided by LEIs before energisation. • **It would have a significant impact on the LEI workforce.** LEIs would be well suited for audit positions given their transferrable skills, but there would not be enough work to guarantee all existing LEIs a position.
2. Insource inspections to ESV	This option was considered because insourcing inspections would provide ESV complete control over the quality and scope of electrical inspections and provide full inspection independence. This option was not recommended for the following reasons: • **High cost.** This model would require a significant increase to the price of a COES and/or amendments to other cost-recovery arrangements. • **It would have a significant impact on the LEI workforce.** Existing LEIs would no longer be able to run their own business in the same way that they currently do, however there could be a small number of inspection companies whom ESV engages via contractual arrangements. • **It would requires capability development within ESV.** Success of this option is dependent on ESV effectively acquiring and integrating a high level of competency to train and manage an inspector workforce or effectively embedding contract management capability within ESV.
3. Improve ESV auditing and tailor the LEI role	This option was considered because robust and independent audits would provide ESV with additional data to address and reduce safety risk in installations. Tailoring the LEI role by formalising the advisory function and removing the obligation to report defects to ESV would place all regulatory responsibility for electrical installation safety back on the regulator. This option was not recommended at this time because **the quality of data is currently insufficient to support this option**. Limitations on the current available data cannot dispel all concerns about unintended consequences of such a change to the LEI role. To be able to manage this risk, a robust audit program would need to be up and running, as well as enhanced data-driven decision-making across ESV, and a deep understanding of the risks across electrical installations. If this was the case, LEIs reporting defects to ESV would arguably no longer be required and instead LEIs could simply provide advice to electricians, perform final checks and sign-offs.

Reform option	Assessment
4. Distribution business conducts inspections	This option was considered because distribution businesses (DBs) are aligned to ESV's safety objectives, are often already involved in prescribed works and may be able to deliver high quality inspections. This option was not recommended on the basis of: • **No stakeholder support - concerns of excessive burden on industry.** Stakeholders raised concerns that DBs would be overly burdensome on industry through imposing unreasonably strict safety and quality standards. • **Inspections are not DBs core business.** Following privatisation, DBs effectively argued that inspections are not part of their core business. Overturning this position and gaining support of DBs to fulfil an inspection role could be difficult. • **DBs may not have capability and capacity.** DBs may no longer have the capacity and inhouse capability to effectively transition into this role.
5. LEIs are allocated through a central dispatcher	This option was considered because it removes the ability for electricians to select LEIs, which could help to remedy the stakeholder concern that some inspections are not free from bias. Consultation revealed that this model is not supported by industry on the basis that it would be **highly disruptive to both LEIs and electricians, but without a proportional increase in positive safety outcomes**. Additional reasons why this option was not recommended include: • **The model breaks down outside of metropolitan Victoria.** Regions have a very limited supply of LEIs, so the same LEIs and electricians will work together regardless. It is not viable from a cost perspective to have metropolitan-based LEIs travelling to regional areas to conduct inspections. • **It restricts competition and associated benefits.** High quality LEIs who distinguish themselves on expertise and customer service may lose market share and poor LEIs could inversely be rewarded. • **The allocation model must overcome various, significant complexities.** It would be difficult and complex for a dispatcher to fairly price and allocate work to LEIs; manage supply and demand; and navigate market complexities (incl. LEI location/travel, level of expertise and rate of pay, inspection capabilities, work preferences, and works pipeline/availabilities). • **It may hinder the advisory role that some LEIs perform**. Some electricians value the LEI advisory role, but a dispatcher arrangement introduces a new intermediary that may splinter existing relationships and reduce the prevalence of the advisory role.
6. LEIs charge a mandated price for inspections	This option was considered because a mandated price would ensure LEIs are sufficiently compensated to perform their role, which could increase inspection rigour. This option was not recommended because: • **There may be minimal impact on critical incentive issues**. Increasing compensation enables inspectors to complete full inspections but does not incentivise them to do so. Irrespective of price, electricians are better off when there are no reported defects – disincentivising LEIs from reporting against their customers (and inspecting thoroughly). • **It may reward non-compliant LEIs.** Some electricians may continue to engage the same LEIs at an inflated rate if they continue to not consistently identify and report defects.