THE FUTURE TRANSPORT WORKFORCE

A development plan

RACE for 2030

UTS

POWERING AUSTRALIA

ACKNOWLEDGEMENTS

This project received grant funding from the Australian Government through Powering Australia. We gratefully acknowledge the additional support provided by the RACE for 2030 Co-operative Research Centre, and the contribution of time and expertise by the Industry Reference Group and the industry stakeholders who gave their time to contribute insights and expertise to the project. Their contribution is invaluable, although the conclusions are entirely the responsibility of the authors.

RESEARCH TEAM

- Chris Briggs
- Maartje Feenstra
- Josie Toakley
- Elianor Gerrard
- Rusty Langdon

CITATION

Briggs, C., Feenstra, M. Toakley, J., Gerrard, E. and Langdon, R. (2026). Growing an Australian Clean Tech Manufacturing Workforce for Transport. Report prepared for Powering Australia and RACE for 2030 CRC.

ACKNOWLEDGMENT OF COUNTRY

Powering Australia wishes to acknowledge the First Nations of Australia and recognise their enduring connection to Country through culture, people, place and story. We honour the knowledge systems that have sustained these lands and waters for thousands of generations and recognise the vital role of First Nations leadership and self-determination in shaping a just and sustainable future. As Australia undergoes a significant clean energy and industrial transition, we acknowledge the importance of respectful partnership, cultural integrity, and shared purpose to realise the full opportunity of the Clean Energy Transition.

PROJECT CONTEXT

Australia is well placed to take advantage of many clean-tech opportunities by leveraging its global leadership in critical minerals and renewable energy resources. There are also challenges, including fragmentation, a sparse industrial ecosystem, a relatively small workforce, and fierce international competition. Quick and effective action is needed for Australia to build thriving clean-tech industries.

The project aims to contribute to the development of Australia's clean-tech manufacturing sector by:

- Growing Australian manufacturing capability in a way that drives exports and ensures domestic energy security.
- Identifying potential skill shortages and priority actions to provide a suitably skilled workforce for clean-tech manufacturing.
- Growing jobs and providing pathways to secure employment for those in priority cohorts or who are transitioning from carbon-intensive industries.
- Accelerating the commercialisation of Australian technologies related to clean-tech manufacturing.
- Accelerating the path to a decarbonised future.
- Delivering better economic outcomes for First Nations communities.

SECTOR COMPETITIVENESS PLANS (SCPS) – CYAN VENTURES AND DELOITTE

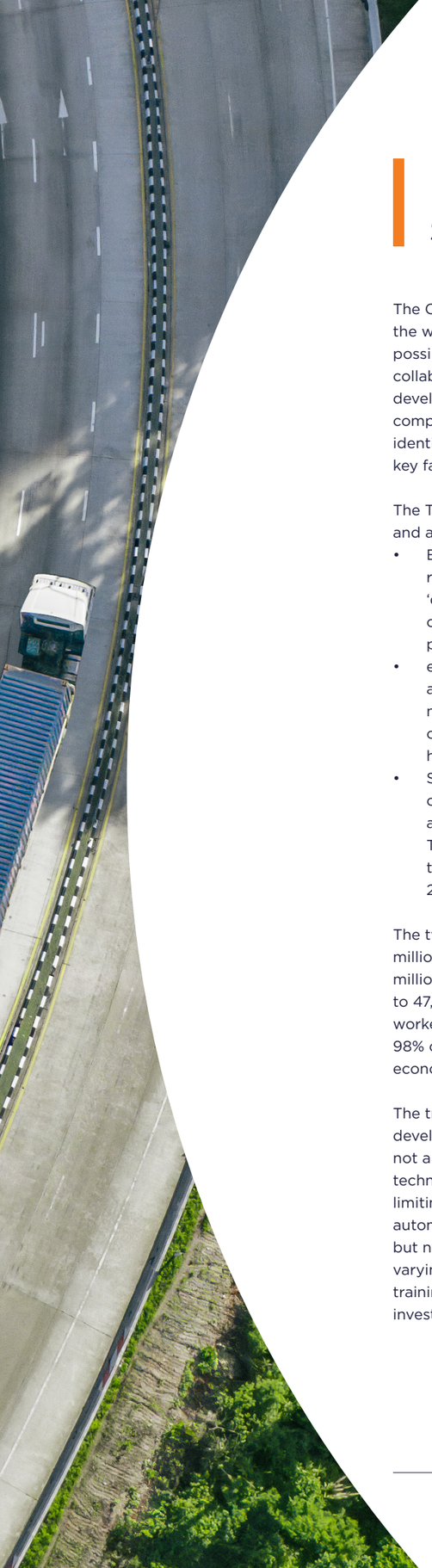
Powering Australia has developed sector competitiveness plans (SCPs) to identify opportunities where Australia has a unique advantage to foster clean-tech manufacturing across six areas:

1. Renewable Energy Generation
2. Industrial Decarbonisation
3. Transport
4. Electricity Transmission and Distribution
5. Carbon
6. And the cross-cutting study of opportunities for First Nations businesses.

Each SCP identifies anchor opportunities based on national need and likelihood of success, outlines workforce requirements, and recommends targeted actions to leverage Australia's strengths and build resilient supply chains.

WORKFORCE DEVELOPMENT PLANS (WDPS) – INSTITUTE FOR SUSTAINABLE FUTURES, UNIVERSITY OF TECHNOLOGY SYDNEY

One of the key challenges to building clean-tech manufacturing in Australia is developing the workforce amidst skill shortages. Responding to this challenge, Powering Australia has partnered with the RACE for 2030 Cooperative Research Centre and commissioned the Institute for Sustainable Futures at the University of Technology Sydney to develop Workforce Development Plans (WDPs). The WDPs aim to profile the workforce requirements for fostering a thriving green industrial base, identify possible workforce challenges and solutions, and set the foundations for innovation and collaboration between industry, government, education, and training providers to develop a robust workforce. They are focused on the anchor opportunities and begin with the workforce requirements identified in the relevant SCP.



Executive summary

The Clean Tech Manufacturing Workforce Development Plans (WDPs) aim to profile the workforce requirements for fostering a thriving green industrial base, identify possible workforce challenges and solutions, and set the foundations for innovative collaboration between industry, government, education, and training providers to develop a robust workforce, supporting the ambitions of the Future Made in Australia comprehensive $22.7 billion investment plan. The WDPs take the anchor opportunities identified by Powering Australia and the expected demand for labour and look at the key factors that influence workforce development.

The Transport Sector Competitiveness Plan (SCP) identified two anchor opportunities and a secondary opportunity for Australia:

- Biogenic LCLF: Low Carbon Liquid Fuels (LCLFs) derived from biomass or waste resources (agricultural residues, forestry waste or dedicated crops) to develop 'drop-in' fuels for existing vehicles, equipment and infrastructure. These fuels could be competitive due to Australia's vast potential for biomass feedstocks and potential for low-cost renewable energy and hydrogen.
- eFuels: LCLFs can be produced from synthetic feedstocks, such as hydrogen and captured carbon dioxide. Development of eFuel facilities could develop new supply chain activity for drop-in fuels based on Australia's abundance of renewable energy resources, which could then feed into low-cost hydrogen production.
- Specialised heavy-duty electric vehicles (EVs): the manufacturing and assembly of EVs for on-road freight trucks and specialist heavy-duty vehicles (e.g. mining) aligns with existing capabilities, local demand, and unique Australian conditions. To underline the scale of the economic opportunity and workforce transition, there were over 500,000 registered heavy trucks (4.5 tonnes+) in Australia in 2024 with very few of them electric.[1]

The two low carbon liquid fuel anchor opportunities could generate between A$200 million and A$1 billion in additional gross value added by 2035, and between A$400 million and $8.6 billion in 2050, along with 3,000 to 21,000 jobs in 2035 and 4,000 to 47,000 in 2050. Direct jobs, the focus of this plan, are projected at 1,500 to 11,000 workers in 2035, falling to 200 to 5,000 in 2050, as construction accounts for up to 98% of the workforce and all facilities are assumed built by 2050. No employment or economic estimates were produced for heavy EV manufacturing.

The transition from diesel to heavy electric vehicles is at an early stage, and workforce development will need to accelerate alongside it. The core production workforce is not a major concern, as manufacturing is late-stage assembly; the key constraint is the technician workforce, especially electricians, who service vehicles, a shortage already limiting heavy EV growth. Three transition pathways exist for the current workforce, automotive electricians, high-voltage electricians, and diesel mechanics and fitters, but none is yet well-defined or catered for by the training system. Uncertain and state-varying licensing and qualification requirements are a fundamental barrier to building training capacity, with Queensland, where regulatory certainty has been paired with investment in training, the furthest ahead.

For biogenic LCLFs and eFuels, the early stage of development means workforce demand is uncertain and closely tied to industry policy, calling for a cautious, demand-driven approach rather than large-scale early training. Labour supply aligns well with chemical manufacturing and the oil and gas sector, but depends on rebuilding the pipeline of chemical and process engineers and overcoming the image problem of chemical engineering as a "gas degree". Most projects are located in regional Australia, where housing, infrastructure and construction labour are place-based constraints, and both pathways will rely on international expertise for niche skills, bioprocess and fermentation for biofuels, and electrolyser installation for eFuels, while demand remains small and uncertain in timing.

Table of contents

Introduction

Transport accounts for over one-fifth of Australian greenhouse gas emissions and with decarbonisation progressing more rapidly in stationary energy, it is projected to become Australia's largest sectoral contributor to greenhouse gas emissions. The transport sector is integral to all sectors of the Australian economy and a large source of economic activity in and of itself. Although the major automakers no longer operate in Australia, there is still an active transport manufacturer sector which is estimated to contribute $12.1 billion to the Australia economy.

The Transport Sector Competitiveness Plan identifies two anchor opportunities and a secondary opportunity as having the greatest potential for Australia to be internationally competitive.

- The two anchor opportunities for the transport sector are biogenic LCLF and eFuels;
- The secondary opportunity identified is heavy electric vehicles, primarily as an import-replacement sector but also some export opportunities based on niche expertise, especially for off-road heavy vehicles in sectors such as mining.

Whilst these sectoral opportunities were considered as likely to develop some time into the future when the SCP was drafted, the current energy crisis has highlighted the vulnerability of Australia to global fuel markets and may be the catalyst for more rapid development than projected even a short time ago. If that is to be the case, workforce development will be an important component of enabling the sector's scaling and development.

This Workforce Development Plan aims to understand the emerging barriers, pathways, opportunities and actions for developing a future workforce to realise these opportunities. Using a combination of literature review, stakeholder interviews, and an Industry Reference Group (IRG), the WDP profiles the current workforce, future demand and workforce changes, the training and employment pathways for developing the workforce and recommendations and actions.

1. Sector competitiveness plans: anchor opportunities for clean-tech manufacturing in transport

The Transport Sector Competitiveness Plan (SCP) [1] identifies two anchor opportunities and a secondary opportunity, based on an assessment of areas where Australia is cost-competitive, there is market differentiation, and opportunity in increasing local resilience and capability is important due to supply chain risks. These include two low carbon liquid fuel (LCLF) opportunities and one opportunity for specialised heavy-duty battery electric vehicles. (BEVs) These opportunities are:

- **Biogenic LCLF:** low carbon liquid fuels derived from biomass or waste resources (agricultural residues, forestry waste or dedicated crops) are an opportunity for Australia to develop a whole new industry supply chain and provide 'drop-in' fuels for existing transport fuel demand in Australia. Drop-in fuels can be substituted for existing fuels, which allows industry to maintain existing vehicles, equipment and infrastructure. These fuels could be competitive due to Australia's vast potential for biomass feedstocks, and potential for low-cost renewable energy and hydrogen.
- **eFuels:** low carbon liquid fuels can be produced from synthetic feedstocks, such as hydrogen and captured carbon dioxide. When the fuel product is liquid, the product is known as a Power to Liquids (PtL) fuel. Development of eFuel facilities provides a similar opportunity as the biogenic fuels with potential development of an entire new supply chain and the provision of drop-in fuels for existing transport demand. Australia has a competitive advantage due to an abundance of renewable energy resources which could feed into low-cost hydrogen production.
- **Specialised heavy-duty BEVs:** manufacturing and assembly of heavy-duty BEVs is a secondary opportunity identified in the SCP. It includes on-road freight trucks and specialist heavy-duty vehicles for mining and defence. This opportunity aligns with existing capabilities, local demand, and unique Australian conditions. To underline the scale of the economic opportunity and workforce transition, there were over 500,000 registered heavy trucks (4.5 tonnes+) in Australia in 2024 with very few electric trucks.[3]

Figure 1: Transport anchor and secondary opportunities.

Anchor opportunities: Specific focus areas within priority value-chains.	**Adjacent value-chain:** Complimentary segments up or downstream from the anchor opportunity.	**Wider supply-chain ecosystem** Supporting services, equipment and feedstock that Australia can deliver competitively to support the achors.

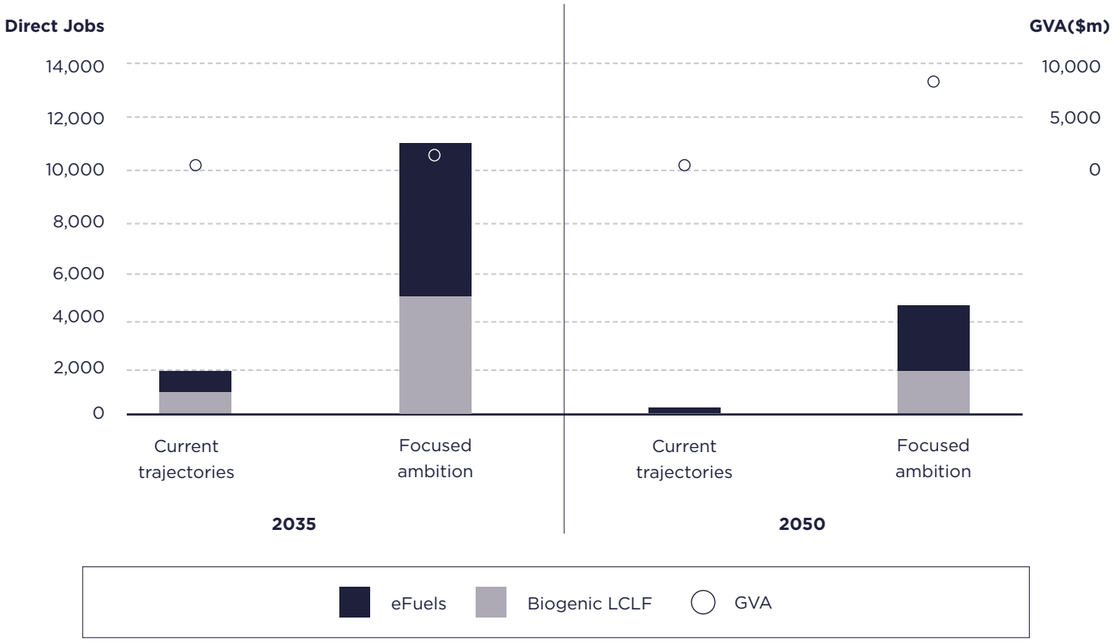
Anchor/leading opportunities	Anchor on significantly large opportunities where Australia can be strongly competitive. This includes: • Biogenic LCLF • eFuels
Secondary opportunity	• Manufacturing and assembly of specialised heavy-duty BEVs
Wider supply chain ecosystem (Non-exhaustive[1])	**Integrate across established value-chains and grow into new areas to improve competitiveness, this may include:** • EV battery repurposing (including second life and recycling) • EV battery packaging and integration in specialised use cases (e.g. mining, defence) • Manufacturing of aftermarket parts and vehicle accessories • Manufacturing of electric vehicle chargers
Secondary opportunity	**Develop the ecosystem of suppliers, services and innovators to further improve competitiveness and grow the opportunity space,** for example: • High-yield oilseed crop feedstocks • Agricultural residues and waste feedstocks • Carbohydrate feedstocks and bagasse • Electrolysers

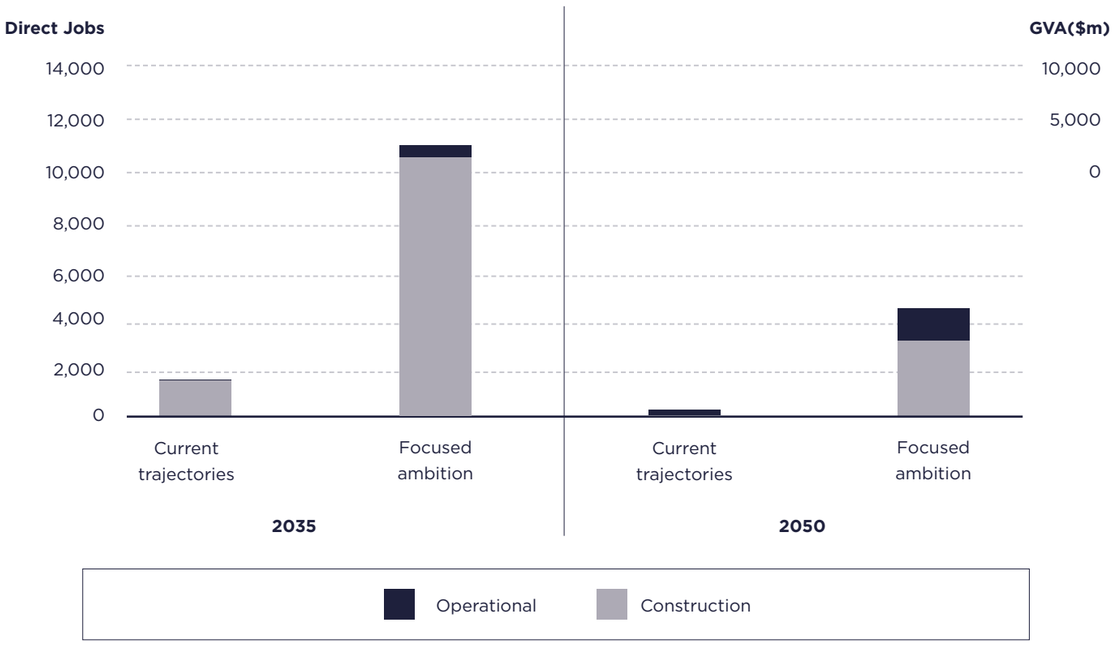
The SCP estimates the economic value and employment of each opportunity based on a lower bound 'Current Trajectory' scenario (modelled on the Australian Energy Market Operator's (AEMOs) Step Change scenario) and an upper bound 'Focused Ambition' scenario (modelled on AEMO's Green Energy Exports scenario) [2]. The two anchor opportunities for LCLFs can generate between A$200 million and A$1000 million additional GVA by 2035, and between A$400 million and $8600 million in 2050, primarily driven by biogenic LCLFs. A correspondingly large range of new jobs is forecast, with new jobs across the economy, including supporting services estimated as 3,000-21,000 in 2035, and as 4,000-47,000 in 2050.

Direct jobs for the anchor opportunities are the focus of this workforce development plan (WDP). The SCP projects between 1,500 and 11,000 additional workers are required in 2035 to construct and operate the new manufacturing facilities, with a workforce requirement between 200 and 5,000 in 2050 (Figure 2). In both scenarios workforce requirements are projected to fall significantly in 2050 compared to 2035, primarily because construction of new facilities is estimated to account for up to 98% of the workforce, and projections assume all production facilities are constructed by 2050.

Sources: [1] Source: Cyan Ventures & Deloitte, Transport Sector Competitiveness plan, 2025. [3]Bureau of Infrastructure and Transport Research Economics (2024) Road Vehicles Australia, https://www.bitre.gov.au/sites/default/files/documents/bitre-road-vehicles-australia--january2024.pdf.

Figure 2: Workforce demand and GVA for transport clean tech manufacturing anchor opportunities





Notes/Sources: [1]Bureau of Infrastructure and Transport Research Economics (2024) Road Vehicles Australia, https://www.bitre.gov.au/sites/default/files/documents/bitre-road-vehicles-australia--january2024.pdf. [2] Data source: Cyan Ventures & Deloitte, Transport Sector Competitiveness plan, 2025

2. Anchor opportunity: biogenic LCLFs and efuels

Biogenic low-carbon liquid fuels (LCLFs) and eFuels are considered longer-term opportunities as illustrated by the modelling projections in the SCP. However, fuel security and soaring costs in the current global crisis may accelerate transition. The Federal Government has announced funding in the 2026 budget to investigate and accelerate low-carbon liquid fuels including $1.5 million allocated for a detailed analysis of demand-side measures for sustainable aviation fuels and renewable diesel alongside the $1.1 billion Cleaner Fuels Program. In this section, the current and future workforce for biogenic low carbon fuels and eFuels is profiled and trends shaping workforce development are identified.

2.1 The existing workforce

The expected growth of the industry is moderate with the projection of Jobs Skills Australia (JSA) for 19% growth in the workforce by 2034. This reflects the challenging development of these novel industries.

The basic chemical manufacturing sector is used as a proxy for the nascent eFuels and biogenic LCLF industries (see Figure 3). Key features of the workforce include:

- Applying the occupational structure of basic chemical manufacturing to LCLF and eFuels, the largest occupations are clerical and support workers, construction, distribution and production managers, chemical, gas, petroleum and power generation plant operators and sales and marketing professionals. Other key occupations are stationary plant operators, industrial mining and production engineers and process workers;
- The only key occupation in shortage is industrial, mining and production engineers;
- The employment projections for each of the occupations are modest by mid-2035 (less than 100).
- The workforce is relatively skilled: almost half of the workforce completed a Diploma or University Degree, around one-quarter has a VET qualification (Certificate III or Certificate IV) and around one quarter of the workforce's highest educational attainment was Year 12 or below
- The current workforce has below average diversity with 24% of the workforce being female and 1.6% First nations workers.
- The median age for the industry is 42, above the median age for the general population (39). This indicates that an ageing workforce could be a barrier in the future. 5% of the workforce is below the age of 24 and 12% above the age of 60.

The basic chemical manufacturing sector is distributed throughout the country, with New South Wales (32%), Victoria (25%), Western Australia (18%) and Queensland (17%) the leading states.

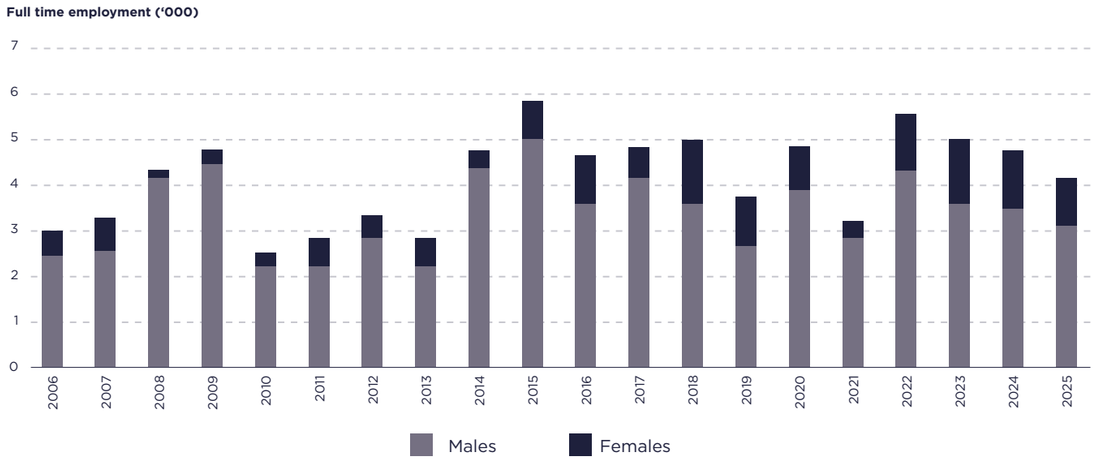
Figure 3: Overview of expected operational workforce profile

Total workforce by state or territory [3]

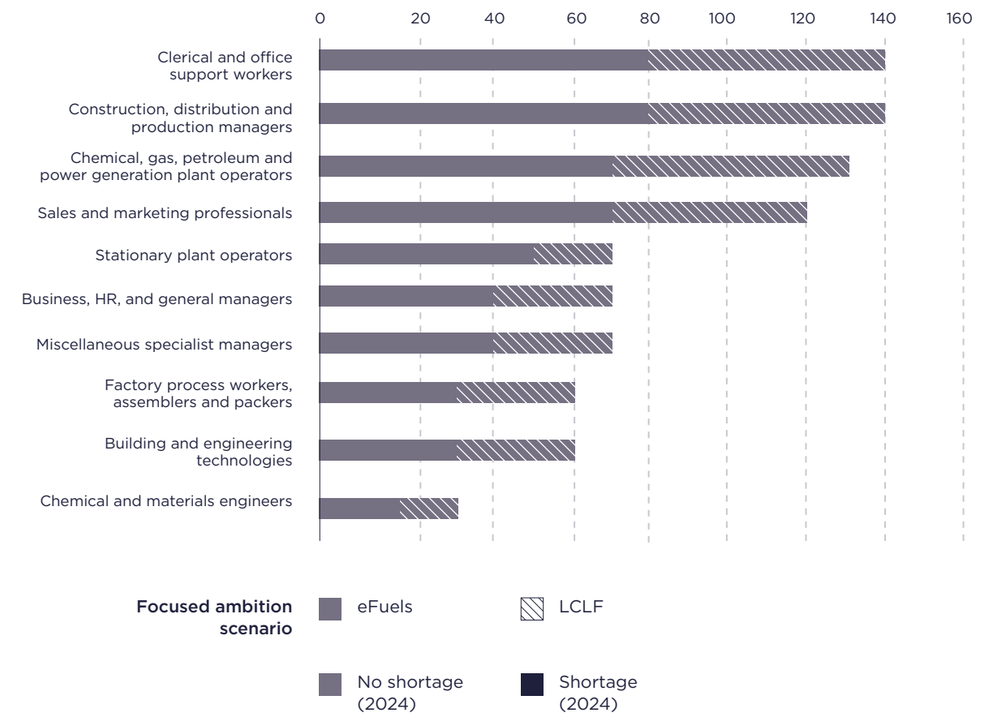
Projected growth to 2035[4]	% Female workforce	% Workforce First Nations [4]
30%	24%	1.61% (3.3% for general workforce)

Median age [3]	% Workforce aged 24 or below [2]	% Workforce aged 60 and over [2]
42 (39 for general workforce)	5%	12%

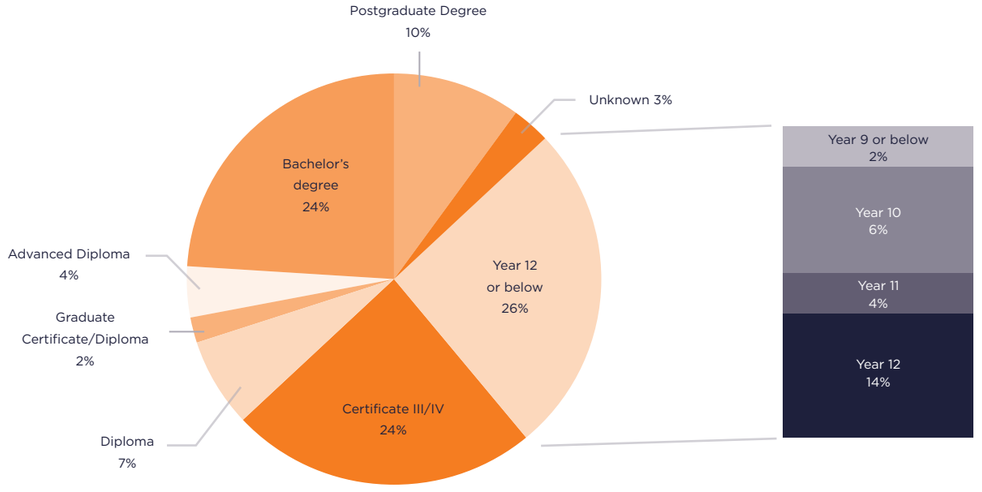
Employment trends [5]



Top 10 ANZSCO occupations: jobs projected in 2050 (Focused Ambition scenario) [1]



Education level [5]



Sources: [1] Jobs and Skills Australia, Occupation Shortage List, 2025; ABS (2021), Census Table Builder; Cyan Ventures & Deloitte, Industrial Decarbonisation Sector Competitiveness Plan. [2] Cyan Ventures & Deloitte, Transmission Sector Competitiveness Plan. [3] ABS (2021), Census TableBuilder. [4] Jobs and Skills Australia, Jobs and Skills Atlas, Industry Profiles. [5] ABS, Labour Force, Australia, Detailed, Table EQ06 - Employed persons by Industry group of main job (ANZSIC), Sex, State and Territory, November 1984 onwards (Pivot Table).

2.2 Developing the future workforce – biogenic LCLF and eFuels

Stakeholders anticipate that the future workforce would reflect the profile of chemical manufacturing with specific additions depending on the fuel production pathway. For instance, for biogenic LCLF manufacturing there would be a considerable agriculture and transport component to grow the biomass and subsequently transport it to a central location. This results in additional agricultural and transport occupations. Whilst, for eFuel manufacturing there would be more electrical occupations expected due to required renewable energy generation for creating the renewable hydrogen feedstock. These are not represented in Tables 1 and 2 because the ABS statistics do not present any workforce numbers currently.

The developing LCLF and eFuel sectors require a specific set of roles, including:

- Electrical engineers (mostly relevant for the eFuel sector);
- Trades (fitters, operators, maintenance technicians);
- Mix of engineering disciplines (chemical, process, biotech, mechanical and civil engineering); and
- Fuel analytics

Table 1 gives an overview of the top occupations and key skills for biogenic LCLF and eFuels.

Table 1: Focus occupations and key skills for biogenic LCLF and eFuels

Occupation	Current volume/ (% of proxy industry)	Current shortage status	Key training and employment pathways[6]
Chemical, Gas, Petroleum and Power Generation Plant Operators	318 (8%)	No shortage	Cert III in Process Plant Operations
Stationary Plant Operators	67 (2%)	No shortage	There are multiple pathways e.g. Certificate III in Process Plant Operations
Metal Fitters and Machinists	107 (3%)	Shortage	There are multiple pathways e.g. Certificate III in Process Plant Operations
Industrial, Mechanical, and Production Engineers	102 (3%)	State/territory shortage (SA, WA, NT)	Bachelor's degree in engineering, usually mechanical or industrial. For technically focused production roles, engineering-related VET qualifications or transition courses may also provide a pathway into the industry.
Chemical and Materials Engineers	83 (2%)	State/territory shortage (QLD, NT)	Bachelor's degree in chemical, biochemical or process engineering. It is also common to complete postgraduate studies. Registration may be required in some jurisdictions.

Sources: [4]TableBuilder, ABS 2021 Census of Population and Housing, https://tablebuilder.abs.gov.au/. [5]Jobs and Skills Australia Occupation Shortage List 2025 https://www.jobsandskills.gov.au/data/occupation-shortage/occupation-shortage-list. [6]Australian Government, Your Career, Career Pathways Explorer https://www.yourcareer.gov.au/.

Broadly, the supply pipeline for the key occupations appears healthy for the key occupations. It is less in the overall occupational volumes that shortages could appear and in specialisations within LCLF and eFuel sectors.

Table 2: Supply pipeline for biogenic LCLF and eFuels

	Current supply		Supply pipeline (all industries)				
	Current workforce volume – all industries[4]	Current workforce volume – proxy industry4	JSA growth projection (2035)[7]	SCP growth projection for (2035)[8]	Commencements and completions[9]	Net exit/ entry[10]	Median age[10]
Chemical, Gas, Petroleum and Power Generation Plant Operators	7,100	318	+886 (9%)	+20	397 [219]	+65	48
Stationary Plant Operators[11]	24,100	67	+1,747 (7%)	-	489 [327]	+95	40
Metal Fitters and Machinists	119,900	107	+8,872 (7%)	+7	578 [322]	+420	40
Industrial, Mechanical, and Production Engineers	42,500	102	+9,249 (23%)	+6	Unknown[12]	+800	38
Chemical and Materials Engineers	6,700	83	+1,656 (23%)	+5	Unknown[12]	+20	34

Sources: [7]Jobs and Skills Australia Employment Projections, 2025-2035 https://www.jobsandskills.gov.au/data/employment-projections. [8]Deloitte and Cyan Ventures, Sector Competitiveness Plans, 2025. [9]NCVER Data Builder, Apprentice completion rates five-year average 2021-2025, https://www.ncver.edu.au/research-and-statistics/data/databuilder#. [10]Jobs and Skills Australia, Jobs and Skills Atlas, Occupational Mobility, https://www.jobsandskills.gov.au/jobs-and-skills-atlas/occupation/3411-electricians/occupational-mobility. [11]ANZSCO 7129 'Other Stationary Plant Operators'. [12]Insufficient data.

2.3 Key trends

For developing the future workforce, there are a number of key trends or dynamics that need to be considered:

The early stage of industry development and uncertainty limits workforce planning: workforce development is heavily inter-connected with industry development policy

Industry immaturity currently limits workforce demand in biogenic LCLFs and eFuels. The sector remains in an early stage of development, with few commercial-scale projects operational and many still in planning or feasibility phases. As a result, large-scale employment needs have not yet materialised. Crucially, the first generation of biogenic LCLF and eFuel facilities must come online before sustained workforce demand emerges across construction, operations and supply chains. Until then, investment uncertainty, policy gaps and high costs constrain industry growth. Workforce development lags industry deployment, requiring a cautious, demand-driven approach aligned with project pipelines rather than early large-scale training or recruitment initiatives.

As the sector is struggling to establish itself, industry stakeholders are mostly not focused on workforce development. One stakeholder posited that workforce demand for biogenic LCLF and e-Fuels was highly binary in character: either policy mechanisms that catalyse demand will be established leading to as many as 10-12 commercial plants or there will be a continuation of the status quo with little to no development at all. This means that workforce planning is complex and dependent on policy and investment strategies: there could be limited workforce demand or a step-change instead of a gradual increase. Workforce development is inter-twined closely with industry development policy.

Leveraging skills from oil and gas sector and chemical manufacturing

One of the key sources of skilled staff could be the oil and gas sector and chemical manufacturing. On the one hand, it is an opportunity because it creates a novel career opportunity for graduate chemical and process engineers, however, on the other hand, there is the risk of the experienced layer of the workforce transitioning to other sectors and roles before the new industries are created. There are other sectors that have also identified declining oil and gas and chemical sectors as a source of labour, including offshore wind and novel carbon dioxide removal technologies. In addition, the number of engineering graduates may decline in the absence of an established offtake industry for the workforce. A clear policy timeline for the development of eFuel and biogenic LCLF industries and bridging strategies would be required to attract the experienced engineers and a continued supply of graduate engineers.

Building the pipeline of chemical engineers

Across multiple sectors, the decline in enrolments in core disciplines such as chemical engineering have been observed as an issue for future workforce development. In a recent study on workforce requirements for carbon dioxide removal technologies, industry and university sources noted chemical engineering degrees had an image problem because of the association with fossil fuel sectors (a 'gas degree') (insert ref). Biofuels is another future green sector that also faces this issue and will need to develop relationships with universities and address the image problem of the sector to secure future graduates.

Workforce supply challenges in regional Australia

Most biogenic LCLF and eFuel project developments are located in regional Australia (e.g. near the Bowen Basin, Queensland) creating additional labour challenges – both in operations but especially construction:

- Competition with established industries (e.g. mining, resources) for labour which will generally be able to offer higher pay rates. Conversely, if there were to be a decline in established industries (e.g. coal mining) this might create opportunities for workers to transfer to new career opportunities.
- Construction and the establishment of new facilities will face obstacles that are being experienced by renewable energy construction and other industries aiming to scale up in regional areas: there is limited housing, social and physical infrastructure, and services for new populations (especially at peak construction times) and there are shortages in skilled construction labour Australia-wide.

Addressing the challenges around regional workforce requires a coordinated, place-based approach for workforce, infrastructure and local policy development to avoid labour constraints and delays, as well as managing the disproportionate impacts on local communities and social licence challenges.

Notes/Sources: 2: Cyan Ventures & Deloitte, Networks Sector Competitiveness Plan, 2025, Figure B1 and B2, p54. The current industry is described as including cable, transformers, and substations. 3: Combining relevant engineering roles accounts for just under 10% of the workforce.

Addressing the challenges around regional workforce requires a coordinated, place-based approach for workforce, infrastructure and local policy development to avoid labour constraints and delays, as well as managing the disproportionate impacts on local communities and social licence challenges.

Reliance on international expertise for niche skills and expertise

Reliance on international expertise is a key workforce consideration for both biogenic LCLF and e-Fuels manufacturing but differs by pathway. For biofuels, there is a lack of specific bioprocess skills and experience, including biotech processing, deep fermentation, and seed crushing expertise, which are critical for feedstock conversion and scaling production. For e-Fuels, there is a reliance on overseas companies for electrolyser installation. The other factor that will create reliance on international expertise is that the employment demand is relatively small and uncertain in timing and will require sourcing alongside the industry development.

In both cases, projects often depend on overseas specialists during development and early operation. Addressing these challenges requires a combination of targeted skill migration or short courses with instructors from other countries. Skilled migration and co-investment are both potential pathways, but one industry source also advocated for the use of training experts from the US or Europe to transfer capacity to Australian workforces. This collaboration with international experts can help transfer knowledge to the local workforce, enabling gradual development of domestic expertise and experience as the industries scale.

3. Anchor opportunity: heavy-duty BEVs

The transport SCP identifies the manufacturing and assembly of heavy vehicles in transition from diesel to EVs as an anchor opportunity. Whilst the major auto-manufacturers have exited Australia, there remains a significant automotive supply-chain including manufacturing and assembly of on and off-road heavy vehicles. The transition to heavy BEVs creates a manufacturing opportunity for new vehicles and charging infrastructure with complex supply-chains spanning component manufacturing, assembly, vehicle modifications and servicing.

Australia has local manufacturing firms across a range of market segments in heavy vehicle manufacturing and assembly with different market dynamics. In some segments, there are well-established manufacturers (off-road mining, diesel road trucks) whilst in some sectors there are small numbers of emergent firms trying to establish themselves and scale up.

Table 3 Heavy Vehicle Manufacturing and Assembly, Key Market Segments

Segment	Description	Emerging Trends
Truck manufacturers	Truck manufacturing and assembly is estimated to account for over half of Australia's domestic motor vehicle manufacturing ($2.9 billion). There are several major firms in on-road heavy vehicles – notably Volvo (Queensland), Kenworth (Victoria).For off-road heavy vehicles (especially in construction and mining), there are also established manufacturing and assembly firms (e.g. Komatsu, Thales, Bradken). There are several major firms in on-road heavy vehicles – notably Volvo (Queensland), Kenworth (Victoria). For off-road heavy vehicles (especially in construction and mining), there are also established manufacturing and assembly firms (e.g. Komatsu, Thales, Bradken).	Australian regulatory requirements and operating conditions have underpinned a domestic diesel truck manufacturing sector. Cultural and brand loyalties and established supplier relationships have knitted the local manufacturers together with local trucking companies and drivers. However, competition from global EV truck manufacturers (especially from China) is a major challenge to the local manufacturing sector. For on-road manufacturers, there are economic challenges from international competitors, especially large-scale Chinese OEMs. Volvo has announced plans to develop a new heavy BEV manufacturing line whilst other manufacturers are continuing with diesel trucks at this point. Off-road firms also face strong price competition but there are more exacting requirements, and Australian manufacturers have an established reputation for high-quality machinery.
Diesel to electric truck retrofits	Another market segment exists for the conversion of an existing diesel truck to an EV. There are on-road and off-road firms active in Australia. In the on-road segment, Janus converts diesel trucks to battery electric with a standardised, swappable battery pack. Whilst there are no local manufacturing EV plants announced or in operation for off-road heavy vehicles, there are aftermarket conversion operators (e.g. EPCA, AMP and 3ME) whilst larger firms may also do this in-house.	The off-road sector is reasonably well-established and competitive due to the remote and difficult conditions for mining. Janus is offering a different business model to locally and imported manufactured trucks through the retrofitting model. The competitive logic of the retrofitting model is that it will be a quicker, cheaper alternative to full truck replacement that can extend the lifetime of a diesel truck whilst new EV trucks are gradually entering fleets. The challenge is whether a retrofit model working with many different truck models can compete with scale manufacturers.
EV bus manufacturers	There are several local manufacturers of bus EVs and assemblers that work with global chassis/drive suppliers. Local manufacturing of EV bus bodies includes Volgren, BusTech Group, Custom Denning and Nexport. SEA Electric assembles and manufacturers electric trucks and buses. Bus manufacturing is adjacent to truck manufacturing and there could be cross-over from firms that specialise in one of the other segments.	Local content provisions have provided greater demand and investment certainty for local bus manufacturers. For example, Foton mobility distribution is building a manufacturing facility to make 126 EV buses for Sydney with plans to expand the site into truck drivetrain manufacturing.

Secondary Stage Manufacturers	Most trucks imported into Australia require secondary manufacturing to make alterations – both to the truck chassis and exclusive of the truck chassis (e.g. trailers) - either to be compliant with Australian regulations or meet local requirements. There are many sub-categories and niches of trucks - around 40 categories according to one industry source.	The secondary stage manufacturers were expected to be relatively unaffected by the transition from diesel to EV as for the most part they are making modifications to parts of the truck unaffected by the change in engine.
Electric trailers	International manufacturers of axles for use in heavy trailers are now offering 'powered axles' or 'e-axles'. Powered axles and e-axles all typically feature regenerative energy capabilities, and some may also be capable of providing motive power (an on-board power source to drive axles). Under this model, axles are electric powered with the trailer connected to a diesel engine vehicle – reducing diesel consumption. This is an emerging model that is not yet permitted on Australian roads.	The Heavy Vehicle Industry Association has produced a set of guidelines for on-road trials[13] VE motion is manufacturing the first commercially available electric trailer system – at this stage it is a pre-commercial technology.
Heavy vehicle charging infrastructure	There is one local manufacturer – Virtos – which is being run by the owners of Tritium which was one of the top manufacturers and suppliers of DC fast chargers for electric vehicles in the US and Europe. Virtos manufactures and supplies multi-megawatt charging stations for trucks.	Local electric trucking is at a very early stage but the impacts of the US-Iran war on diesel supply and pricing is likely to be a catalyst for more rapid deployment of charging infrastructure. The European market is more advanced and Virtos is aiming to be a major exporter.

3.1 The existing workforce

The ANZSIC category for Motor Vehicle and Motor Vehicle Part Manufacturing sector has been used as a proxy for the heavy vehicle manufacturing sector. Australia's existing capabilities in the local manufacturing and assembly of on- and off-road internal combustion engine (ICE) heavy-duty vehicles provide a foundation for workforce transition to EVs. The largest occupational group within the sector is Structural Steel and Welding Trades Workers (see Figure 4), with more than 3,500 workers. Employment is heavily concentrated in Victoria, containing half the workforce. QLD (23%) and NSW (15%) follow, with SA, WA and Tasmania each having significantly smaller workforces.

The median age of the workforce is 43, which is above the all-industry average of 39. Younger workers (under 25) represent 11% of the workforce, while a further 11% are aged 60 or above. Women comprise 17% of the workforce, significantly below the national workforce average, but broadly consistent with other comparable proxy industries identified in the WDPs.

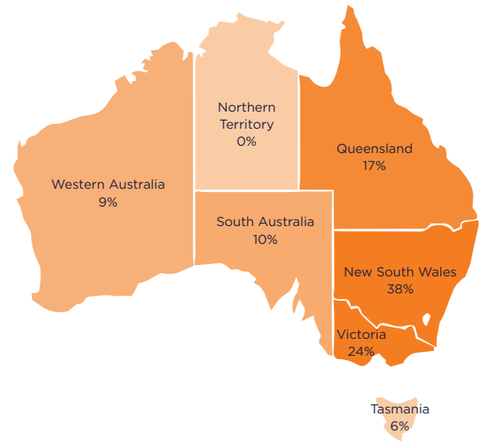
Educational attainment across the sector is mixed. The most common highest level of education is Year 12 or below (34%), followed closely by Certificate III/IV qualifications (33%). A further 29% of workers hold a university qualification, including undergraduate, postgraduate, or diploma-level degrees.

Sources: [13]Heavy Vehicle Industry Association (2025) Guidelines for On-Road Trials of Powered Trailers. https://hvia.asn.au/wp-content/uploads/2025/03/Guidelines-for-on-road-trials-of-powered-trailers-DRAFT-28-02-25.pdf

Notes: [14]Motor Vehicle and Motor Vehicle Part Manufacturing includes truck and bus manufacturing in addition to other categories including trailers, cars, automotive electrical components but is a reasonable proxy.

Figure 4: Operational workforce profile

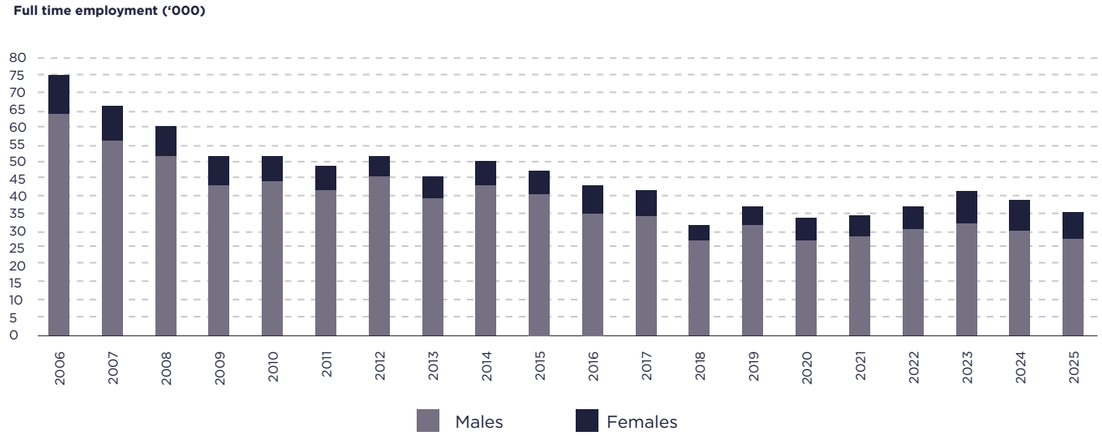
Total workforce by state or territory [3]



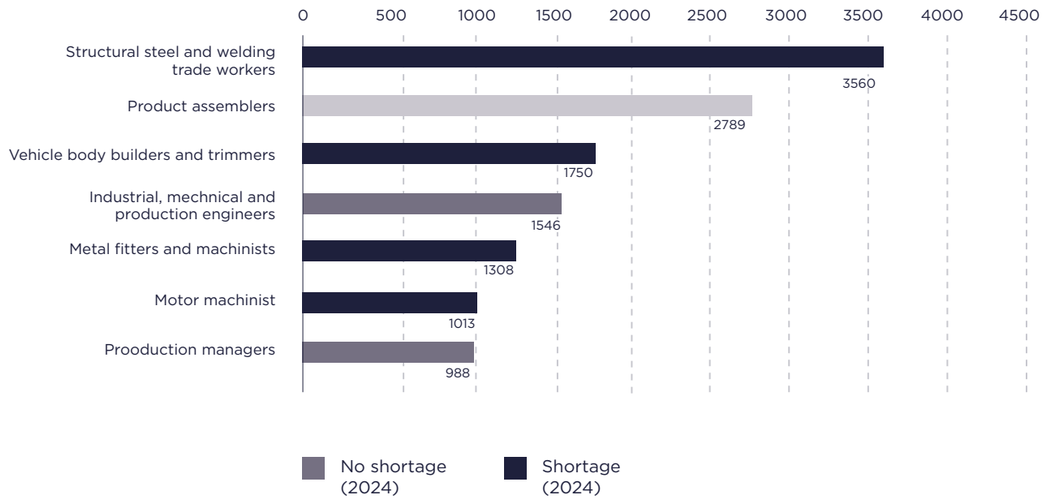
Projected growth to 2035 [3]	% Female workforce [2]	% Workforce First Nations [2]
21%	17% (43% for general workforce)	1.44% (3.3% for general workforce)

Median age [3]	% Workforce aged 24 or below [2]	% Workforce aged 60 and over [2]
43 (39 for general workforce)	11%	11%

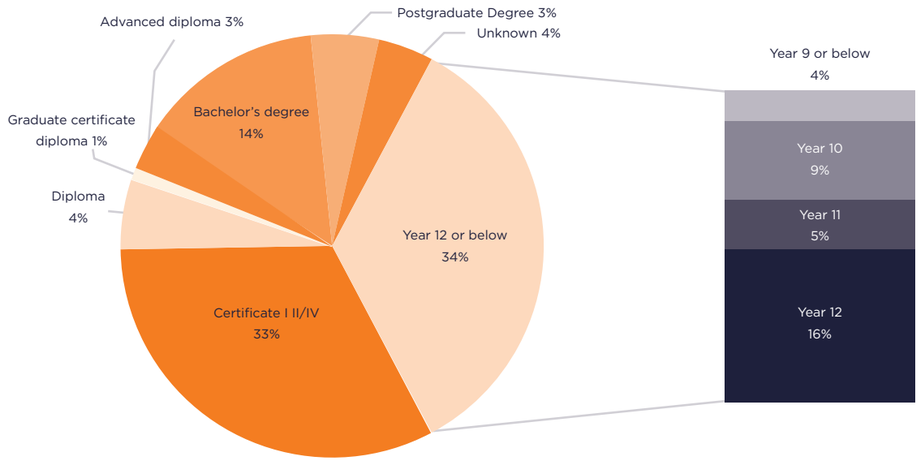
Employment trends [6]



Top 10 ANZSCO occupations (current industry) [1]



Education level [3]



Sources: [1] Jobs and Skills Australia, Occupation Shortage List, 2025; ABS (2021), Census Table Builder. [2] Cyan Ventures & Deloitte, Transmission Sector Competitiveness Plan. [3] ABS (2021), Census TableBuilder. [4] Jobs and Skills Australia, Jobs and Skills Atlas, Industry Profiles. [5] ABS, Labour Force, Australia, Detailed, Table EQ06 - Employed persons by Industry group of main job (ANZSIC), Sex, State and Territory, November 1984 onwards (Pivot Table). [6] In demand occupations from UTS research, stakeholder consultation, 2026.

3.2 Developing the future workforce

The transition from heavy diesel to BEVs involves changes to a range of components (engines, fuel system, ignition, electrical system, drive train) and the type of workers and skills required to manufacture and work on these vehicles. Whilst the current workforce has been profiled based on motor vehicle manufacturing, the business models of manufacturers also extend into servicing and maintenance of vehicles in different ways including:

- **''Trucking as a service':** it is increasingly common for OEMs to lease vehicles for operators under various contractual arrangements rather than to sell them the truck outright. The benefit for the truck drivers and operators is that it reduces operational risks as the OEM will replace trucks when they breakdown and provide maintenance services, which reduce the cost and downtime.
- **Manufacturers provide technician services:** In charging infrastructure, there are three different models for servicing and maintenance;
    - o **One**: the maintenance services are either provided by the OEM,
    - o **Two**: the OEM trains the technicians of the operating firm or;
    - o **Three**: there are third-party service dealers providing the maintenance services.

The OEM both needs to engage their own fleet of service technicians and trainers that can equip other technicians either in the operating firm or the service dealers to work on their machines. In the case of retrofitters, both on-road and off-road firms noted they were the parties servicing vehicles (and charging infrastructure where this was part of the technology package). There are different models for maintenance services but at this stage in the development of electric trucks it is often the manufacturers that are providing the maintenance services.

Consequently, whilst the core manufacturing workforce is represented within motor vehicle and motor part manufacturing, their workforce extends to the serving and maintenance occupations – diesel mechanics, auto-electricians and electrical technicians – which are also profiled below.

Table 4: Key Occupations, Employment and Training Pathways

	Current state	Key training and employment pathways
Structural Steel and Welding Trades Workers	Shortage	Certificate III in Engineering - Fabrication Trade.
Product Assemblers	No shortage	You can work as a Product Assembler without formal qualifications. Many workers learn on the job (or acquire a Certificate I or II in a related manufacturing field). Traineeships in Electronic Assembly, Process Manufacturing, Engineering - Production Technology or Repair are common pathways.
Vehicle Body Builders and Trimmers	Shortage	Vehicle Body Builders: Certificate III in Automotive Body Repair Technology, or Certificate III in Automotive Manufacturing Technical Operations - Bus, Truck and Trailer. Vehicle Trimmers: Certificate III in Automotive and Marine Trimming Technology.
Industrial, Mechanical and Production Engineers	No Shortage	Bachelor's degree in engineering, usually mechanical or industrial. Postgraduate options such as a Graduate Diploma of Engineering (Mechanical) can support specialisation or career progression. For technically focused production roles, engineering-related VET qualifications or transition courses may also provide a pathway.
Metal Fitters and Machinists	Shortage	Certificate III in Engineering - Mechanical Trade, fitting, machining, or related engineering.
Production Managers	No shortage	There is no single fixed qualification, but many enter through various professional backgrounds including manufacturing, engineering, business, or operations management with experience in supervision, scheduling, quality control, and process improvement. A Cert III in process plant operations or a diploma in process plant technology may be useful.

Maintenance and Servicing		
Diesel mechanic	Shortage	Heavy Commercial Vehicle Technology (Cert III)
Automotive electrician	Shortage	Automotive Electrical Technology (Cert III)
Motor Mechanics	Shortage	Certificate III in Mechanical or Automotive Technology or a closely related automotive mechanical trade qualification.
High-voltage electricians	Shortage*	Electrical apprenticeship completion and electrical licence obtained. On-the-job experience. Undertake specialised post-trade training, e.g. High Voltage Switching Operations course

*High-voltage electricians are a specialist sub-set of electricians and not specifically listed as shortage with JSA, but industry sources consider them to be in shortage.

Table 5: Key occupations supply pipeline

	Current supply and projected demand			Supply pipeline		
	Current workforce volume – all industries[4]	Current workforce volume – proxy industry[4]	JSA growth projection (2035)[7]	Commencements and completions[9]	Net exit/ entry[10]	Median age[4]
Structural Steel and Welding	79,100	3,560 (11%)	+5,770 (8%)	25 [12]	+280	39
Product Assemblers	24,500	2,789 (9%)	+2,000 (7%)	24 [12]	-400	42
Vehicle Body Builders and Trimmers	6,700	1,750 (6%)	+160 (3%)	920 [366]	-10	44
Industrial, Mechanical and Production Engineers	42,500	1,546 (5%)	+9,249 (23%)	Unknown	+800	38
Metal Fitters and Machinists	119,900	1,308 (4%)	+8,872 (7%)	578 [322]	+420	40
Motor Mechanics (General)	79,300	898 (3%)	+8,346 (8%)	10,549 [5,251]	+1,420	36
Diesel Motor Mechanic	7,400	102 (0.3%)				32
Production Managers	64,700	988 (3%)	+10,451 (17%)	Unknown[15]	+325	47
Auto-electricians	10,400	297 (1%)	+815 (7%)	1,341 [642]	+145	35

Note: Table 5 does not include SCP employment growth estimates, as this information was not available in the SCP.

Sources: [15]Insufficient data

3.3 Heavy BEVs: key trends

The heavy transport manufacturing sector is entering a period of flux and transition. There is an established diesel truck manufacturing sector and supply-chain, which will be challenged by the growth of heavy BEVs and international OEMs and the emergence of alternative business models. Concurrently, there will be a challenge to transition the workforce to meet and enable growth in electric trucks and secure the futures and livelihoods of the existing workforce.

Future workforce requirements will partly depend on the mix of business models that emerge in the transition to heavy EVs and industry competition

The future workforce requirements and demand will be shaped in part by competition between Australian and international firms and between different business models.

- If Chinese OEMs make inroads to the Australian domestic market for on-road trucks, there will employment losses in local diesel manufacturers with redeployment required for production staff (body assemblers, welders, heavy diesel mechanics and fitters). Under this scenario, the local employment will be increasingly concentrated in sales, distribution and networks. At this point, there is just the one local manufacturer that has just commenced producing EV trucks in Australia (Volvo).
- The retrofitting business model is also in competition with volume-produced imported trucks, although it is possible that there will be a combination of models with some fleets gradually transitioning through retrofits with other fleets engaging in large-scale replacement. The retrofitting model employs both diesel mechanics and fitters in addition to electric skillsets – in addition to other production and engineering occupations – and therefore would create a stronger on-going demand for the diesel workforce in particular.
- There is also strong competition from Chinese imports in the off-road space and strategic considerations for mining companies as major trade partners. However, the Australian off-road truck manufacturers and system integrators appear to have a stronger competitive position than on-road manufacturers.

Whilst the direction of the transition from diesel to EV and overall imperative for the heavy vehicle sector is clear, the pace and depth of transition away from diesel skillsets and the extent of local manufacturing and assembly is uncertain depending on sectoral competition. Stakeholders observed a significant difference in the open-ness to retrain and transition into EV skillsets between older and younger workers, meaning the pace of transition will inform the impacts on the older cohorts and ability of industry to maintain labour supply.

Heavy vehicle manufacturing is integrated with services: the key workforce constraint is electricians and service technicians

For all of the manufacturing firms engaged through this project, the core production workforce was not a major concern. The manufacturing processes were late-stage assembly which utilised workers without qualifications that were trained on-the-job in production processes complemented by a smaller group of engineers in testing, commissioning and quality control.

However, the integration of manufacturing and services opens up manufacturers to workforce constraints for electricians and service technicians. The key implication from a workforce perspective is that the manufacturers are often the party with responsibility for developing the service technician workforce, directly or indirectly for dealerships. When questioned about workforce shortages or constraints, the primary concern of manufacturers were technicians (mechanical and electrical) that can service trucks. Currently this is considered a limiting factor on growth:

> *Currently, we don't have enough people trained in the field to work on the vehicles … The barrier we find is, say, one of our bigger customers … ring me up and they go, oh, in four weeks' time we're going to put some trucks into (regional location) … Who in (regional location) is going to be able to service those vehicles for me? Now that's not the customer's problem, that's my problem … I've got to say to that service agent, we would like you to look after a truck. So they go, oh, that's fantastic. You know, what you got coming in 10, 20, 15 (trucks). There's going to be two and you'll need to get somebody trained. You've got to be HV qualified. And all of a sudden, they're going for two trucks it's just not worth it.*

There is uncertainty about workforce transitions to heavy EV: improved clarity and resourcing is required for the transition pathways

There are a range of workforce transitions associated with the move from diesel to heavy EV. For some occupations these are relatively modest; for welders and fitters, the skills are considered equivalent to current requirements beyond the isolation of the battery on the vehicle.

However, for the mechanics and service technicians, which were the major focus of industry stakeholders, there are three transition pathways – each with some advantages and disadvantages for developing a workforce for heavy EVs.

Table 6: Automotive Electricians, High Voltage Electricians and Diesel Fitters, Transition Pathways to Heavy EVs

	Transition pathway	Notes
Automotive electrician	There are some courses available (e.g. Komatsu RTO offers courses for some hybrid-electric Komatsu machines) but there is a gap in terms of broad-based courses that can upskill an automotive electrician.	A qualified auto-electrician has the strongest skillset and experience working on vehicles but only up to 24v and is not qualified to work on high-voltage. Most stakeholders considered auto-electricians to be the existing occupational group with the greatest alignment and recommended upskilling to high-voltage vehicles.
High voltage electrician	A high-voltage electrician has completed post-trade qualifications as a licenced electrician, typically in high-voltage switching operations. A high-voltage electrician would need to add automotive EV units within the Cert III in automotive electric technology but there are no prescribed units or defined pathway at this point.	Some stakeholders are advocating for high voltage electrician to be the primary pathway, especially in relation to mines. Stakeholders noted limitations in relation to the current skills and experiences of high voltage electricians; specifically, whilst they have high voltage skillsets, it is in the context of electricity supply infrastructure (e.g. sub-stations) and not vehicles and with AC, not DC. Some stakeholders expressed reservations about prioritising high-voltage electricians as the key pathway.
Diesel mechanic/ mobile plant technician	There are two skillsets that holders of a Cert III in Heavy Commercial Vehicle Mechanical Technology (heavy diesel) or AUR31220 Cert III in mobile plant technology can undertake to work on heavy EVs: • AURSS00063 Battery Electric Vehicle Diagnose and Repair • AURSS00064 Batttery Electric Vehicle Inspection and Servicing The skillset enables the holder to isolate, depower and reinitialise battery EVs for various diagnose and repair functions but there are limits on working with the vehicles to holders of high-voltage licences.	The largest portion of the existing workforce are diesel technicians with a qualification as mobile plant technicians – so this is the largest source of labour supply. In general, most stakeholders are focused on the other two pathways – but in particular, mining companies with diesel technician workforces operating in the context of acute shortages in electricians are interested in transition pathways for diesel mechanics and fitters. However, some stakeholders would like to see further piloting and development of transition pathways for the diesel workforce – in particular, noting there is potential for younger fitters to cross-train and become a fitter electric mechanic. Different states are taking different approaches to the skillset – it is recognised in Queensland for example but not currently in Western Australia.

Uncertainty over regulatory requirements to work on heavy electric vehicles and variations between states are a barrier to developing training capacity and workforce transition

Current regulatory requirements for technicians to work on electric trucks are uncertain and variable across states and between the mining and the automotive sector.

- Working on EVs is not currently included in electrical licencing but there have been proposals in some states that all types of EVs would be limited to licenced electricians or workers that hold a Certificate III in EV Technology. Both proposals have created concerns in the industry they will create severe labour constraints because of the shortage of licenced electricians and there are few technicians that hold a Certificate III in EV technology.
- There are differences between the states in the use of skillsets for diesel mechanics/mobile plant technicians and auto-electricians to qualify them to work on electric trucks. Skillsets AURSS00063 and AURSS00064 are recognised in some states such as Queensland but their application is contested and not yet legislated in Western Australia. In NSW, there is a consultation over a proposal to mandate AURSS00064 for technicians to work on all types of EVs, which has been deferred because of industry concerns about shortages. Whilst these proposals are focused primarily on light vehicles, it would also apply to heavy vehicles.
- In the mining sector, any high voltage work must be undertaken by a licenced electrician which currently includes electric vehicles. This licencing requirement affects work in the off-road truck sector as it excludes a transition by either auto-electricians or diesel mechanics without an electrical licence (and therefore apprenticeship). There is advocacy to consider an equivalent pathway to the skillsets for mining:

> *The biggest gap is mid career transition. Experienced tradespeople often have to restart a four year apprenticeship to gain electrical licences, with significant pay cuts and no recognition of prior experience. That's not scalable … We need smoother, nationally consistent pathways that recognise existing skills and allow targeted upskilling. Identifying key trades that need transition pathways — and designing those pathways deliberately — would make a significant difference (industrial company).*

- Some states have no current licencing requirements (SA, Tas, NT, ACT) but may adopt licencing requirements in the future.

Table 7: Licencing Overview for Electric Vehicles and Industry's View[17]

State/Territory	Licensing - Under review	Details	Current Status
New South Wales (NSW)	✓	The draft proposal has made AURSS00064 Battery Electric Vehicle Inspection and Servicing Skill Set mandatory for any technician working on battery EVs	Deferred - NSW Fair Trading has postponed these reforms pending industry consultation and transitional arrangements.
	✓	From June 2026, LVTs must hold EV accreditation to test or inspect EVs/hybrids for roadworthiness.	Confirmed for LVT EV testing endorsement.
Victoria (VIC)	✓	Proposal to investigate licensing options for tradespeople working on electric vehicles, including a new qualification enabling suitably trained workers to safely maintain passenger EVs.	Consultation ongoing.
Queensland (QLD)	✓	A recommendation to require licensed electrical workers (sparkies) to perform EV electrical work under the Electrical Safety Act was proposed.	No change to the regulation of work performed in the service, repair, and maintenance of EVs.
Western Australia (WA)	X	National training exists (e.g. AURSS00064 and hybrid sets) delivered but not legally mandated at the state licensing level.	Under consultation - General Motor Vehicle Repairer Certificate still valid for EV work.
South Australia (SA) **Tasmania (TAS)** **Northern Territory (NT)** **ACT**	X	No state-specific EV licence requirement.	None

In Queensland, it was stated that positive engagement with the electrical safety regulators had satisfied concerns and established electrical licencing was not required and the electrical safety act specifies EVs are not classified within the scope of electrical work or licencing. The regulatory uncertainty appears most acute in Western Australia.

Some stakeholders reported that the uncertainty around qualifications has been the subject of discussion for some time but remains unresolved. Both industry and training stakeholders reported this as a fundamental barrier:

> *'Who can work on these vehicles? What is the regulation state by state? … It's about what qualification do you need? And right at the moment, nobody can answer that question … Really, state by state, nobody has fully addressed or answered that question …the confusion we have across the country between regulations, certifications and qualifications is real and it is a barrier to the uptake of the zero emissions technologies' (manufacturer).*

There are some unintended consequences (e.g. vehicles being moved across state borders for servicing), the same types of workers are able to work or not work on the same vehicles in different contexts, and the regulatory changes and absence of certainty is inhibiting investment in training and workforce development.

SKILL AND TRAINING CAPACITY GAPS

There are a range of TAFEs and RTOs that provide heavy vehicle training across the country including TAFE NSW, Bendigo Kangan Institute, Canberra Institute of Technology, South-West Metropolitan TAFE, the Motor Trades Association RTO and company RTOs (Komatsu, Caterpillar). In Queensland, there has been significant investment in developing qualifications with a network of TAFEs. The combination of regulatory certainty and investment in training capacity has led to the highest number of completions of the skillsets in the country.

Outside Queensland, there was agreement that there is currently a shortage in training provision and there are training capacity gaps, especially for off-road electric trucks.

Demand for training is outstripping supply: There is growing provision of the skillsets for depowering and isolating heavy EV batteries by TAFEs and RTOs but industry reports that demand for training is already outstripping supply.

Training gaps for auto-electricians: Industry sources stated there is a training gap for transitioning auto-electricians into heavy high-voltage electric vehicles. As one off-road manufacturer put it:

> *'Now an auto electrician is someone that is trained on 24-volt DC but they know heavy machinery … That is the trade that we should train up and taking from 24-volts up to 800-volts DC or 1000-volts or beyond … if you wanted to talk about workforce capability, that person is probably the most in demand and probably the most lacking because we don't have a course … (we need) a six month module in battery electric earth moving equipment … (to) build, repair, maintain a battery and an electric truck.'*

There is a gap for the provision of RPL and targeted training to upskill auto-electricians to obtain a qualification.

Companies are trying to fill the training gaps: OEMS, firms and company-based RTOs are currently providing training due to gaps in externally provided training. In Western Australia, Komatsu's RTO trains 665 apprentices for Cert III in mobile plant technology or automotive electricians. Fortescue has increased its internal training programs due to a shortage in capacity within TAFE. Off-road vehicle manufacturers noted they had developed their own training content and were training service technicians in the absence of external training providers:

> *'we get asked for it by our clients and we can't direct them to a TAFE. We can't direct them to any training organisation. So, we are forced in-house to build our own training modules, which we've done at our own expense… I can't put my machine up there and not have their personnel trained, not have the operator trained, you know, so that's what I've got to do, and I have to do it as part of the EV transition.'*

Modernisation of training packages, units and apprenticeships: there is a Certificate III in EV technology for light and heavy vehicles. There are different perspectives, but a range of industry and RTO sources advocated for training packages to be modernised to incorporate new competencies and machines for heavy vehicles and review pathways and qualifications requirement. For example, in relation to off-road vehicles:

> *'a lot of our units that we're delivering are completely outdated and they don't just need small updates - they need complete rewrites … we all know that the electric vehicle maintenance is coming, but no one's providing us the resourcing or the training packages to be able to deliver that training.' (RTO, off-road).*

> *'Over the past - even the past 12 months - but at three, four years, even five years, a lot of this here (in the EV Cert III) is dated. And it really needs looking at it, it needs people to sit down and go through it and go, okay, what do they need to know now? … it needs some love' (RTO, on and off-road)*

The pre-requisites for both the Automotive Electric Vehicle Technology Cert III and the skillsets are the subject of debate. One manufactured advocated for change to create an EV-oriented apprenticeship:

> *'I can't employ an apprentice because at the moment you need to have pre-quals to do the EV Cert III and the pre-quals are either an auto electrician or a diesel mechanic or a petrol mechanic. You have to already be qualified in that to do those Cert III AUR courses to become a HV technician. Now, we don't work on diesel vehicles so how do I get an apprentice qualified to work on EV when he (sic) has to have a pre-qual, which is a mechanic or an auto electrician? So, at the moment, we can't say to somebody what we do need is an EV apprenticeship. That has to take in things like brakes and gearboxes and all that sort of thing, because obviously, even though it's an EV, it still has a gearbox in the back of the EV motor. So, it's kind of like, I think right now somebody needs to start designing what is needed for an EV course … what are diesel mechanics being taught that we can throw away and what parts of that can we keep and then add the EV things into it to become an EV technician, not necessarily a diesel mechanic that's qualified to work on EV.' (industry)*

A leading RTO suggested that was possible in the existing training package with use of RPL but agreed there was scope to offer a heavy EV oriented Cert III but the demand was not yet sufficient for RTOs and would need to be offered on a national basis to pool demand.

There is debate about whether pre-requisites for the skillsets should be rationalised, but they were considered essential as an alternative to electrical licencing in Queensland.

However, the same pre-requisites for the skillsets do not exist at the unit level or for the EV qualification which could offer an alternative pathway with RPL.

Engineers with DC and battery knowledge: multiple industry sources referred to a shortage of engineers with DC and battery knowledge and skills and advocated for the development of courses and partnerships with industry to share technology to build a cohort of engineers with knowledge and skills for the sector.

BARRIERS TO DEVELOPING TRAINING CAPACITY

A range of barriers to developing new training capacity were identified by stakeholders:

- The uncertainty over qualifications is stalling training: an RTO stated they had stopped training for skillsets to transition diesel mechanics because of uncertainty of return on investment for companies funding their workers.
- The uncertainty over the qualifications inhibits investment in training resources: one RTO estimated it would be roughly a 5-year pipeline to invest in courses and staff and that they could not invest until there was certainty on the qualifications.
- High capital expenditure for new technology: multi-million-dollar investments can be required in trucks for which students are required to work on and demonstrate competence. Access to capital and technology is a major issue for training in heavy electric vehicles.
- There is limited technology standardisation and the risk of technological change creating demand for new machines and/or threatening return on investment in machines that are superseded. The risks of investing in training capacity was underlined by work to develop courses for hydrogen but demand has now fallen.
- Relationships with OEM: aside from access to capital, relationships with OEM were highlighted as critical for access to machines.
- Heavy trucks are excluded from right to repair legislation: this is a barrier for training organisations accessing manuals and information to develop courses.
- Trainer shortages: as in many areas of VET, trainer shortages were identified as a constraint.

EMERGING DEMAND FOR DATA AND IT SKILLS

The diesel truck sector has integrated software and telemetry for data analysis but a common theme amongst stakeholders is there will be increased demand for more sophisticated data and IT skills with the transition to heavy EVs.

> *'I actually think computer scientists will play more of a role in the transition than what people probably think … if you look at the mechanical truck, the diesel truck, there's 77 data points and there's not a lot of data collection. If you look at an EV, there's 3,000 data points and we currently collect data at 250 milliseconds. So, we collect 4 samples every second. That ends up a hell of a lot of data … A lot of the data is crucial to understanding how the machine operates right now, how it's going to operate in the future, what sort of maintenance is where we're headed, the health of the machine, and it can give you a variety of stuff that the diesel engine could never give you. For instance, you can work out exactly the energy taken to move dirt from point A to B … so I think a data scientist would be another area that will help greatly with the transition as we move into just a lot more data and also cloud-based systems'*

The manufacturers providing the vehicles are currently undertaking this analysis in-house. In time this could become a specialist service done in-house or through external providers. Either way, the transition to EVs will create demand for data analytics.

Other stakeholders highlighted that there was also a transition for truck workshops to the use of computers and diagnostics that were standard in light vehicle workshops.

There is also a locational mismatch for regional manufacturing facilities and staff with the right engineering and data analytic skills which are located in major cities.

4. Recommendations and actions

Recommendation 1: Investigate and develop nationally harmonised licencing and qualification standards for zero emissions vehicles

Rationale: The regulatory uncertainty and variations between states on qualifications for working on heavy electric vehicles are inhibiting the development of training capacity, slowing the training of workers with the skills to work on EVs and risk creating impediments to labour mobility.
Discussion: different states are currently undertaking a mix of processes and approaches to the qualification of workers for heavy electric vehicles. In hydrogen vehicles, industry stakeholders also identified differences in licencing for technicians which had led to the circumstance of a Queensland purpose-built qualification not being recognised in Tasmania.

Mining has different standards between states built around a requirement that any high voltage work requires a licenced electrification. One solution could be to create a restricted licence that would create a functional equivalent to the nationally recognised skillsets that enable diesel mechanics and fitters to work on heavy EVs outside the mining sector. Adding to the complexity is the state-based electrical safety regimes.

Queensland may offer a model that could be emulated in other states with regulatory certainty established through review with electrical safety regulators.

A nationally harmonised approach on the required qualification to ensure safety for auto-electricians and diesel mechanics and fitters and the transition pathways for workers and training organisations would be the ideal solution. To avoid state-by-state disputes, delays and the costs of variable standards on qualifications, it is recommended that a national or cross-state process be undertaken to resolve qualifications and safety standards.

There are different approaches that can be taken to creating nationally uniform approaches licences or qualifications; for example, creating national licenses, inter-governmental agreements between state to enact mirroring standards within states or automatic mutual recognition. There is a current process underway to create a national licence regime for electricians.

National processes can also be time-consuming in the context of a federalist system but a uniform standard is likely to produce a better long-term outcome.

Actions:

- **1.1 AUSMASA and Powering Skills Organisation (PSO) to convene a working group including Federal and State Governments, industry and training representatives and state electrical safety regulators to agree upon a process and to coordinate the development of national licence and qualification standards for low-emissions vehicles.**

Recommendation 2: Review and modernise training packages and products to develop qualifications and apprenticeship pathways for heavy electric vehicles

Rationale: training packages and units need to be modernised to develop and maintain content with currency and ensure there is an accessible EV oriented apprenticeship pathway
Discussion: unlike some areas of manufacturing, the flow of new entrants into key qualifications is quite healthy.

The primary training package is AUR – Automotive Retail, Service and Repair Training Package, but there is some overlap and adjacencies with the UEE – Electrotechnology Training Package and RII – Resources and Infrastructure Industry Training Packages. Across these training packages there are a few options as to how to structure units. There are both light vehicle and heavy EV qualifications to build upon within the training package.

However, modernisation of the training package and apprenticeships has been identified as a priority in the stakeholder engagement for this study.

Training package reform is a slow business so it will need to be complemented by acceleration of measures to transition existing workers (Rec 1 & 3) but is an essential foundation of maintaining and creating qualifications and apprenticeships with currency in the EV transition.

Actions:

- **2.1 AUSMASA and PSO to undertake a modernisation review of training packages for heavy vehicle EVs.**

Recommendation 3: Scale up training capacity and transition pathways for adjacent occupations to heavy EVs

Rationale: whilst the longer-term solution could be training package and apprenticeship reform, cross-skilling and upskilling workers in adjacent occupations (auto-electricians, high voltage electricians, diesel fitters and mechanics) is the most prospective source of labour supply in the short-term and may offer alternative employment for displaced workers.
Discussion: training package reform is notoriously slow and there are opportu nities to develop transition pathways for adjacent occupations. There was agreement that demand is already outstripping supply of training - with the exception of Queensland - and it may accelerate in coming years with the catalyst of the fuel crisis. In Western Australia, in particular, companies are providing training in the absence of external training supply for off-road heavy EVs.

Notwithstanding regulatory uncertainty, RTOs and TAFEs have responded to demand for skillsets to transition diesel mechanics and fitters to work on depowered electric vehicles and clarifying qualifications would be the primary measure to unlock training for these skillsets.

It will also be necessary to build the cohort of more senior staff to supervise apprentices into EV oriented pathways.

However, there are a range of other barriers to developing training capacity, especially for the off-road sector in relation to capital expenditure, and in the case of auto-electricians for off-road heavy vehicles there is a training gap for externally provided courses and RPL to transition them to high-voltage vehicles.

AUSMASA, in consultation with the network of TAFEs and RTOs, should review and identify strategies where required for the development of new training resources for identified gaps such as the auto-electrician pathway.

For the more fundamental barriers such as the capital expenditure to invest in machines and development of trainer workforce, one solution could be an industry fund modelled on construction industry funds with a co-governance board to identify and select training priorities. Companies are already investing significant funds in training, and a more efficient, structural outcome could be achieved through coordination.

Actions:

- **3.1 AUSMASA to investigate strategies for scaling training capacity for transitioning the existing workforce into heavy EV maintenance and servicing**
- **3.2 AUSMASA to investigate the establishment of an off-road heavy EV training board fund**

Recommendation 4: Undertake analysis to improve workforce demand projections and understanding of skill gaps and requirements

Rationale: there are information gaps on the volume and skills of the heavy EV service and maintenance workforce which inhibits workforce planning.
Discussion: As AUSMASA has noted, there are challenges with workforce demand projections due to the current occupational classifications. Diesel motor mechanics for example are located within motor mechanics and unable to be separately identified as an occupational group. Nor is there any data on high-voltage electricians, the supply-demand balance and the capacity to source labour from this occupation. Auto-electricians are better characterised in datasets but currently there does not appear to be any data on the volume with qualifications to work on heavy vehicles.

AUSMASA has also recommended in the 2025 Workforce further research on the skills required to work with EVs to identify if and what dedicated training pathways are required.

Action:

- **4.1 AUSMASA to undertake or commission research on the volume and skills of the workforce for heavy EV servicing and maintenance.**

Recommendation 5: Investigate the development of industry-university collaborations for engineering and heavy vehicles

Rationale: building a cohort of engineers with the skills and knowledge for working on batteries and heavy EVs
Discussion: multiple industry sources referred to a shortage of engineers with DC and battery knowledge. Engineers play roles in design but also commissioning of vehicles. Industry sources advocated for the development of:

- units based around battery systems for heavy EVs
- partnerships between universities with industry to share technology for students and work-based learning (e.g. internships)

Action:

- **5.1 Engineering Australia to investigate a pilot for a university partnership with OEMs for technology sharing, course development and internships for heavy EVs.**

Recommendation 5: Align the development of a training strategy with industry policy for bio-genic LCLF and eFuels

Rationale: training capacity development will need to be closely intertwined with industry development required an integrated approach.
Discussion: Future development of the LCLF and eFuel sectors will be strongly linked to government policy to create a level playing field with conventional fossil-fuel based fuels, and very likely that local industry growth will be induced by demand-side measures such as renewable fuel mandates, grants and/or subsidies. In view of the relatively small volume and niche skills, it was observed there is no point currently developing training courses and this would need to be done hand-in-hand with the development of the sector.

This makes a strong case for integrating workforce development and training into development and implementation of industry policy mechanisms. A training and workforce development strategy could include a combination of leveraging international expertise through skilled migration or importing international trainers, training and redeployment for workers in adjacent occupations, requirements on grant recipients or firms accessing mandates for learning workers, procurement of training to name some elements.

If a regional cluster were to emerge, this would be particular conducive to a sectoral approach that could include a joint fund and board to implement and coordinate workforce development, including construction of facilities as well as their operation. An associated challenge will be the development of a construction workforce for building facilities, the enabling infrastructure to support population growth and creating sustainable regional workforces for the operation of these facilities.

In the 2026 budget, $1.5 million was allocated for a detailed analysis of demand-side measures for sustainable aviation fuels and renewable diesel to evaluate the introduction of a national mandate and $18.5 million for a certification scheme. There is also $1.1 billion allocated to the Cleaner Fuels Program administered by ARENA. Analysis of training and workforce development options should be incorporated into industry grants and strategies.

Action:

- **6.1 ARENA, the Department of Infrastructure, Transport, Regional Development, Communications and the Arts and the Department of Employment and Workforce Relations to investigate training and workforce development within the scoping of demand-side measures for sustainable aviation fuels and renewable diesel**
- **6.2 Implementation of Cleaner Fuels Program to include funding and initiatives for regional workforce development for construction and operation of facilities**

Appendix 1
Industry reference group members

Australian Industry Group (AIG)

Mining and Automotive Skills Alliance (AUSMASA)

Powering Skills Organisation (PSO)

Manufacturing Skills Alliance (MISA)

Electrical Trade Union (ETU)

Australian Manufacturing Workers Union

TAFE NSW Net Zero Manufacturing Centres of Excellence

TAFE QLD – Centre of Excellence, Clean Energy Batteries

Department of Training and Workforce Development (WA)
Clean Energy Skills National Centre of Excellence (CESNCE)

Jobs and Skills Australia

Dr Mark Apthorpe

List of tables and figures

Table of abbreviations

Name	Abbreviations
Australian Bureau of Statistics	ABS
Australian Energy Market Operator	AEMO
Australian Manufacturing Skills Association	AUSMASA
Australian and New Zealand Standard Industrial Classification	ANZSIC
Battery Electric Vehicles	BEVs
Electric Vehicle	EV
Gross Value Added	GVA
Heavy Duty	HD
Internal Combustion Engine	ICE
Jobs and Skills Australia	JSA
Low Carbon Liquid Fuels	LCLF
Original Equipment Manufacturer	OEM
Registered Training Organisation	RTO
Sector Competitiveness Plan	SCP
Technical and Further Education	TAFE
Vocational Education and Training	VET