BATTERY POWERED PATHWAYS

A guide to VET roles, courses and microcredentials

2026

POWERING AUSTRALIA

Powering Australia
Powering Australia is a Federally funded Industry Growth Centre helping Australian clean tech manufacturing businesses grow faster and deliver high value, locally made clean energy products. We connect material producers to manufacturers, commercialise renewable technologies, and build the capability of Australian businesses and First Nations communities to participate in the energy transition.

Funded through the Australian Made Battery Plan, we operate the Powering Australia Industry Growth Centre. We also deliver initiatives under the National Battery Strategy, including the $20 million Building Future Battery Capabilities Program, delivered through two streams focused on technology demonstration and workforce skills development. This work is part of the Battery Workforce Skills and Training Grants Program, which supports skills development and safety across Australia's battery industries.

Powering Australia is championing clean-tech industries that generate sustainable jobs, boost economic resilience, grow domestic demand, industrial ecosystems and position Australia as a global leader in clean-energy innovation.

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1. INTRODUCTION

Background

Australia's battery industry is entering a decisive growth phase, driven by accelerating global demand for clean energy technologies and domestic priorities around decarbonisation, energy security and advanced manufacturing. Worldwide consumption of lithium-ion batteries is expanding rapidly, with global production capacity forecast to more than double by 2030. Electric vehicles and battery energy storage systems are the dominant drivers of this growth, reshaping energy, transport and industrial systems at scale.

Australia is already experiencing this momentum. Battery energy storage capacity in the National Electricity Market has expanded rapidly, electric vehicle uptake continues to rise, and investment is increasing across the battery value chain — from mining and processing through to manufacturing, installation, servicing and recycling. However, realising this opportunity depends on one critical factor: access to a sufficiently skilled, adaptable and job-ready workforce. Without targeted workforce development, projected industry growth and sovereign capability will be difficult to achieve.

For workers, this presents a rare opportunity to enter or transition into a future-focused industry that offers long-term employment, skills portability and alignment with national clean-energy objectives. For Australia, it represents a pathway to high-value jobs, regional development and economic resilience as the energy system transforms.

The battery industry is not a single occupation or technology, but a diverse ecosystem of interconnected activities spanning the full battery value chain. This includes mining and mineral processing, materials refining, component and cell manufacturing, electric vehicle and battery system assembly, installation and maintenance, servicing and support, and end-of-life dismantling and recycling.

Jobs across this ecosystem range from trade and technician roles to advanced technical and professional occupations. Around 70 per cent of the workforce is expected to consist of vocationally trained roles such as electricians, operators, technicians and allied trades, supported by university-qualified engineers, metallurgists and electrochemists. As technologies evolve, roles are also adapting to include automation, robotics, AI-enabled quality control, advanced manufacturing techniques and emerging battery chemistries.

This diversity means the battery industry offers multiple entry points — for new entrants, existing workers looking to upskill, and people transitioning from fossil-fuel-dependent sectors into clean-energy and advanced-manufacturing careers

Battery Powered Pathways is designed to help individuals, educators and training providers navigate this rapidly evolving industry with confidence. It brings together national workforce intelligence, industry consultation and training system insights to clearly map where jobs are emerging and how people can access them.

For individuals considering a career in batteries, the guide explains the structure of the battery value chain, the types of roles available in each segment, and the vocational education and training pathways that support entry and progression. It highlights qualifications, skill sets, microcredentials and units of competency that can help people make informed training decisions aligned with real job opportunities.

For trainers, Technical and Further Education (TAFEs) and Registered Training Organisations (RTOs), the publication identifies priority skills, relevant national training packages and emerging capability needs, supporting the development of responsive, industry-aligned training offerings.

By connecting industry demand with clear training pathways, Battery Powered Pathways supports a coordinated national approach to workforce development — helping ensure Australia has the skilled workforce needed to grow its battery industry, strengthen sovereign capability and deliver long-term clean-energy outcomes.

This guide

This guide is an outcome of national consultation undertaken across industry, education and government. It provides an overview of what Li-ion batteries are and why they are central to Australia's low-emissions future. It builds on the earlier Vocational Skills Gap Assessment and Workforce Development Plan (Future Battery Industries Cooperative Research Centre [FBICRC], 2021) led by South Metropolitan TAFE and subsequent updates throughout the 2025 edition.

The guide describes seven distinct segments of the battery value chain. For each segment it profiles: participating industries; the characteristics of the workforce required; and the vocational and training pathways that support entry into sustainable careers in these fields.

This 2026 edition continues to serve as an informative snapshot of the current Australian battery industry, while identifying workforce needs and pathways for allied and related workers to transition into this rapidly expanding sector. It reflects ongoing developments in training delivery, industry demand and policy direction.

The structure of the guide separates the battery value chain into seven segments, with each segment describing participating industries, the workforce profile required, and the education and training available. More than 70 courses, micro-credentials, skill sets and units of competency are referenced, with direct links to supporting information to enable informed career and training decisions.

For each segment, the relevant national Vocational Education Training (VET) training packages are identified, along with the Australian Jobs and Skills Councils responsible for maintaining workforce relevance and alignment with current industry requirements.

Australia's tertiary education and training system

Our vocational and higher education system are the core components of our tertiary education and training system, but with distinct and complimentary roles. Australia's tertiary education system consists primarily of two sectors:

- State-based TAFEs and other RTOs – VET
- Universities – Higher education.

Both sectors provide education and training programs across a spectrum of increasing complexity ranging from semi-skilled workers to tradespeople, technicians, professionals, and academic researchers. These levels are classified under the Australian Qualifications Framework (AQF) defining the overall capabilities of candidates from AQF 1 (Certificate 1) through to AQF 10 (Doctoral Degree).

Nationally recognised training

Australian VET is a national system focused on providing job-ready skills and qualifications across many industries. It is a partnership between the federal government and state/territory governments, industry bodies, and RTOs, with TAFE being the largest provider. Key aspects include a focus on industry-specific needs, flexible delivery and assessment, and national standards for quality and recognition.

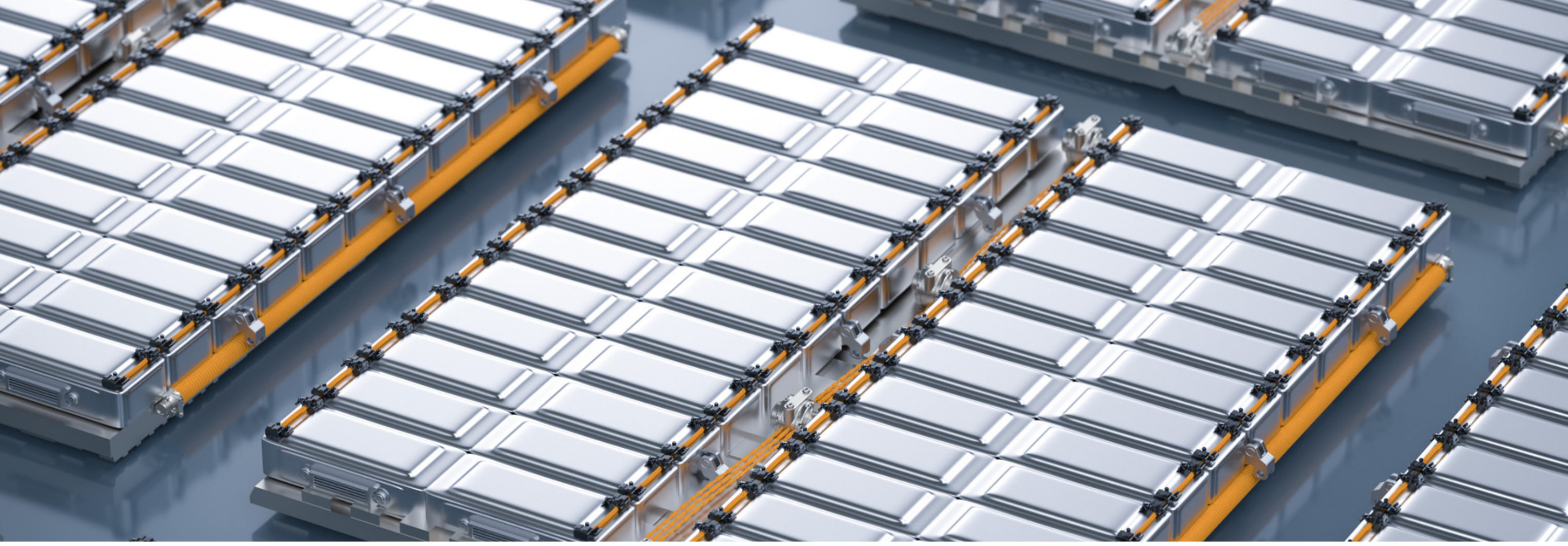
RTOs predominately deliver nationally recognised training comprising of training packages, qualifications, units of competency, skill sets, accredited courses and accredited units/modules.

Non-accredited education and training

Training organisations, including RTOs and universities also offer non-accredited micro-credentials that are short, knowledge and skills focused, and may include a statement of participation or a digital badge upon completion. With a variable duration, they are designed for specific skill development and professional development. Their objective is to develop targeted knowledge without committing to a full qualification. Unlike accredited courses, they are not part of VET or a nationally recognised qualification like a certificate or diploma. However, skills developed by learners may lead to recognition toward accredited training.

TAFE Centres of Excellence

Through the National Skills Agreement, the Australian Government and state and territory governments are jointly creating a nationally coordinated network of



TAFE Centres of Excellence to build the workforce needed for priority industries and future national challenges (Department of Employment and Workplace Relations, 2025). These Centres of Excellence are designed to enhance the capability and capacity of the VET sector, ensuring it can deliver high-quality, agile training for critical and emerging industries. This includes those central to Australia's transition to a net zero economy.

- TAFE Centre of Excellence Clean Energy Batteries – QLD
- Electric Vehicle TAFE Centre of Excellence – ACT
- Clean Energy Skills National Centre of Excellence – WA
- TAFE NSW Net Zero Manufacturing Centre of Excellence
- Tasmanian Clean Energy Centre of Excellence

The TAFE Centres of Excellence are regularly developing and releasing non-accredited education and training programs to address specialised battery workforce skills.

Who should read this guide

This guide is intended for a broad audience. It is not designed as a technical manual, nor does it attempt to provide an exhaustive list of every possible qualification, unit of competence, micro-credential or skill set relevant to Australia's battery industries. Instead, it offers a high-level overview of the workforce opportunities available, particularly for trades entrants and workers seeking to transition into clean-economy sectors.

It is also intended to support TAFEs and RTOs that are reviewing workforce development and teacher capability strategies, seeking industry-informed intelligence on emerging battery-sector employment opportunities for current and future learners.

Finally, the guide provides information for policy makers and regional development agencies seeking to understand critical workforce challenges and training priorities in their regions.

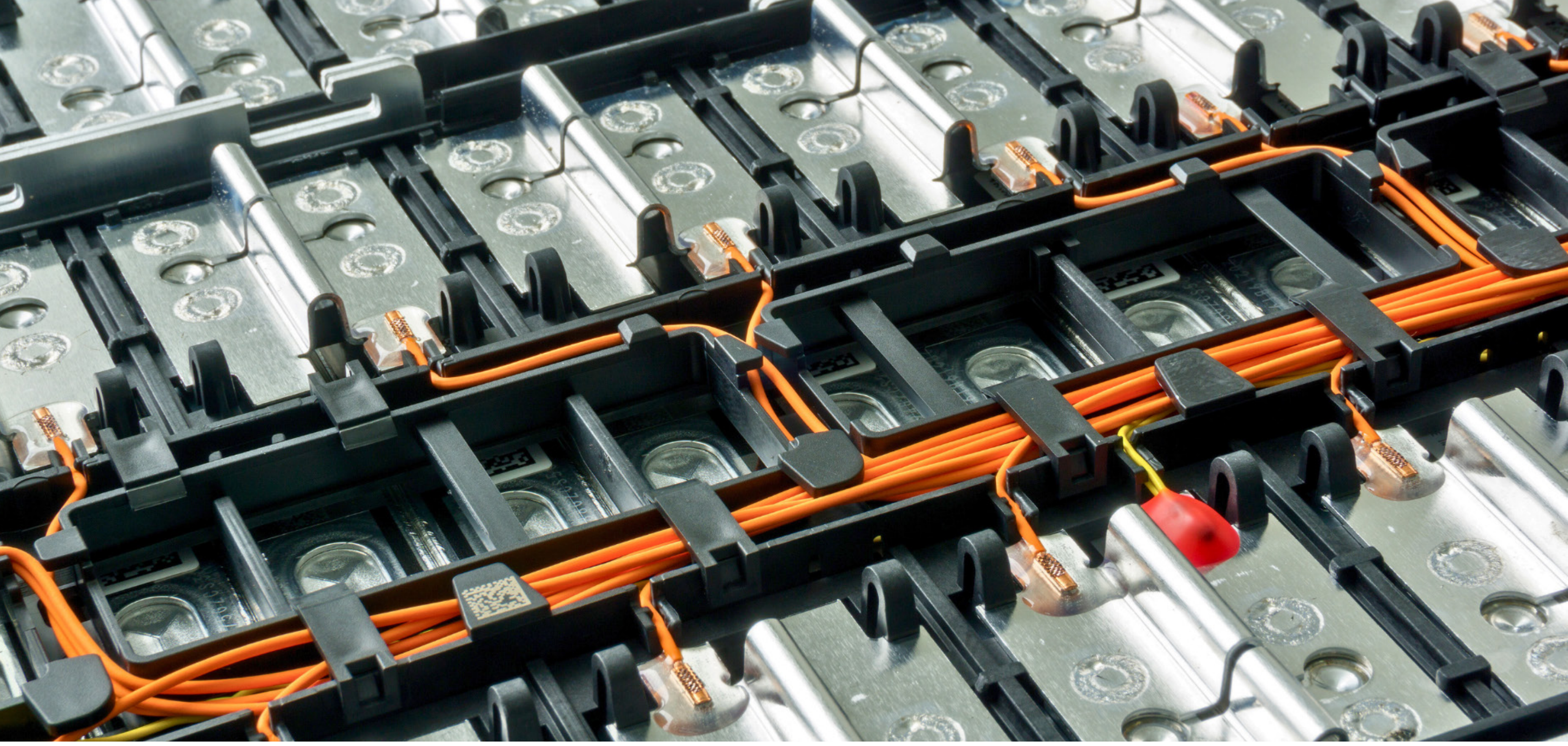
Context around its timing

The first edition of the Battery Powered Pathways guide was released following the 2024 launch of the Australian Battery Strategy (Department of Industry, Science and Resources [DISR], 2024a), which aimed to strengthen national resilience, expand domestic battery manufacturing capability, and build workforce capacity.

This work continues to align with the objectives of the Future Made in Australia National Interest Framework, which recognises Australia's resource endowments and industrial capabilities as key enablers of globally competitive clean-energy industries. Subsequent editions of this guide continue to operate within this policy framework and will track emerging industry and workforce developments through to 2028.

The battery sector continues to grow in the Australian landscape; EV sales continue to rise above previous years while large-scale BESS grow in both size and number. Today's grid-scale batteries now exceed early installations in both size and complexity, with next-generation systems continuing to scale up capacity and performance.

As the battery sector grows, new technologies, chemistries, manufacturing methods, and recycling systems continue to evolve. While every effort has been made to ensure the accuracy of information in this document, readers are encouraged to undertake further research in areas of specific interest before acting on the information presented.



2. BATTERIES AND THEIR VALUE CHAIN

Battery technologies and chemistries

As reliance on electrical energy continues to grow across all sectors, battery technologies and associated chemistries are advancing as an economic solution to energy storage and grid stability concerns. This progress has prompted scientists, researchers, industries and governments to pursue next-generation energy storage solutions that are more efficient, safer, less reliant on toxic materials, and more sustainable in terms of resource availability and cost.

Li-ion is the dominant chemistry composition for contemporary energy storage, alongside emerging technologies including metal-ion, metal air, solid-state, liquid metal, and flow batteries. These seek to address key limitations of Li-ion systems, particularly their dependence on scarce and costly materials such as cobalt and the environmental impacts associated with their extraction. (United Nations, 2025).

Lithium-ion (Li-ion) batteries

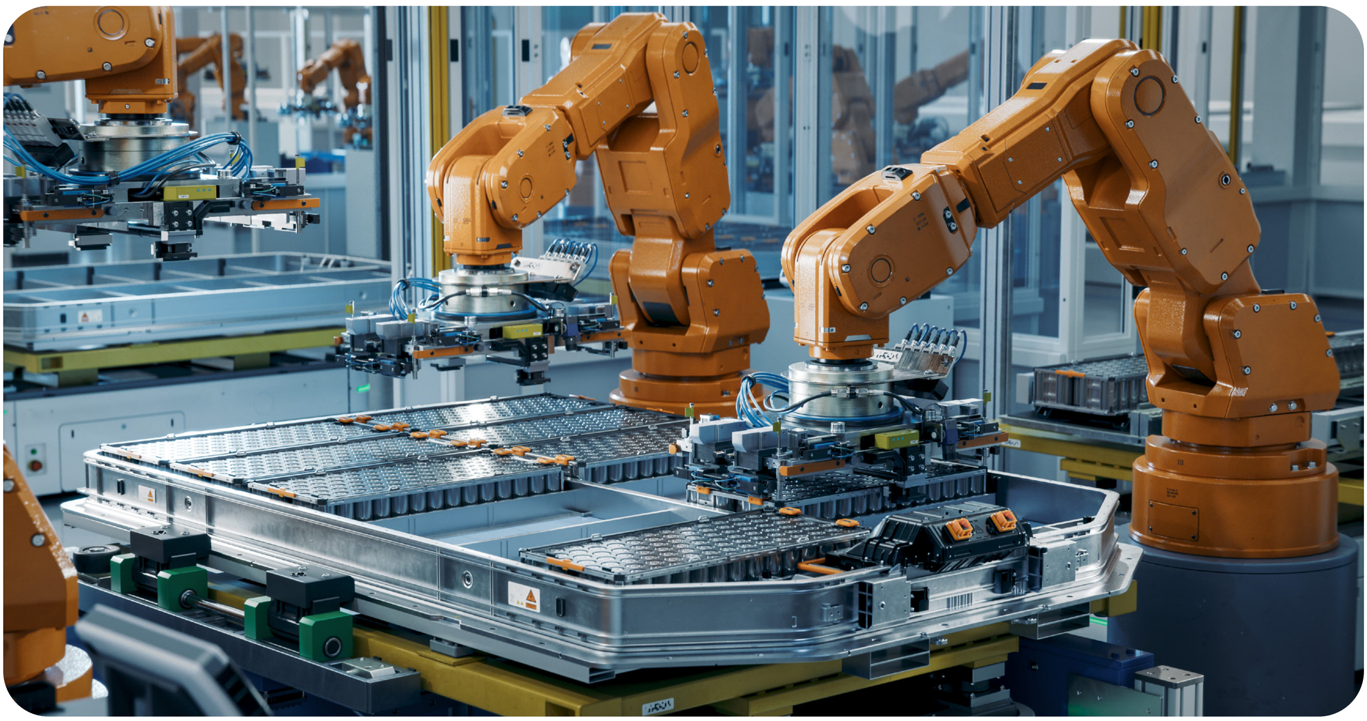
Li-ion remains the dominant technology in the battery market and proportionally half of the market share in 2022 (Melissa, 2024). These batteries contain an anode, cathode, electrolyte and current collectors, with electrical energy generated as lithium ions move from the cathode to the anode and electrons flow through an external circuit to power devices.

Though these batteries are distinguished by the use of lithium ions in the electrolyte, there may be further sub-classifications of these batteries based on additive chemicals present. The selection and portioning of chemicals within a battery cell have an effect on the battery's performance, efficiency, and overall production costs, which in turn make them suitable for specific purposes. Common chemistries include lithium manganese oxide (LMO), lithium cobalt oxide (LCO), nickel manganese cobalt (NMC), lithium iron phosphate (LFP) and nickel cobalt aluminium oxide (NCA), each offering different performance characteristics suited to electric vehicles, energy storage, consumer electronics, and industrial applications.

Emerging technologies

Emerging battery technologies like metal-air, solid-state, liquid metal, and flow batteries each offer distinct advantages and are being developed for applications ranging from electric vehicles to large-scale grid storage. The development of emerging battery technologies has given rise to several new types of electro-chemical batteries beyond the prolific Li-ion battery technologies. New battery compositions are continually in development but generally fall under the classifications.

Technology	Main Distinctive	Examples
Lithium-ion	Uses a lithium-ion solution as the electrolyte. Batteries may be further classified by the chemical composition of their cathode.	• Lithium iron phosphate (LFP) • Lithium nickel cobalt oxide (LNCO) • Lithium manganese oxide (LMO)
Metal-ion	Uses a readily available metal-ion (e.g. sodium, magnesium, aluminium, etc.) as the electrolyte.	• Sodium-ion battery • Magnesium-ion battery • Aluminium-ion battery
Metal-air	Uses a metal anode and a porous carbon cathode. The air passing through the cathode reacts rather than the carbon.	• Lithium-air battery • Sodium-air battery • Aluminium-air battery
Solid-state	Uses an electrolyte that is solid rather than typical liquid solutions. Otherwise similar to lithium-ion in chemistry.	• Lithium-sulphide battery • Lithium phosphorus oxynitride battery • Polymer-based solid-state batteries
Liquid Metal	The anode, cathode, and electrolytes are all liquid. The molten salt electrolyte has a density that causes it to sit between the molten metal electrodes, which is all held in a current catching container.	• Various, depending on metals/alloys used
Redox Flow	The electrolyte between the cathode and anode stores the energy chemically by having different oxidation states. The electrolytes are stored in tanks and 'flow' between electrodes.	• Vanadium redox flow battery • Zinc-bromine battery



Many of these new technologies have been developed to overcome the limitations of Li-ion technology, which can have significant costs, environmental impacts, and possess safety risks (United Nations, 2025). The benefits and limitations of these electro-chemical batteries have been added below.

Benefits, Limitations and Potential Uses of New Battery Technologies

Technology	Advantages	Disadvantages	Ideal Use
Lithium-ion	• Energy Density • Cycle Life • Weight to Power Ratio • Self-Discharge Rate	• Safety Risk (Thermal Runaway) • Production Cost • Environmental Impact	• Portable Electronics • EVs • BESS
Metal-ion	• Cost of Materials • Environmental Impact	• Energy Density • Charge Rate	• Low-Cost BESS
Metal-air	• Energy Density • Cost of Materials	• Cycle Life • Corrosion Sensitivity • Safety Risk (Reactive Materials)	• Long-Duration BESS • Grid Stabilisers • Back-Up Power Systems
Solid-state	• Energy Density • Cycle Life • Safety & Durability • Thermal Stability	• Manufacturing Costs • Material Scarcity • Production Challenges	• High-Performance EVs • Aerospace Applications • Advanced Portable Electronics
Liquid Metal	• Thermal Scalability • Charge / Discharge Rates • Cost at Grid-Scale	• Operating Temperatures (300-700°C) • Material Wear from Heat • Safety Risk (Heat)	• Utility-Scale Storage • Grid Stabilisers
Redox Flow	• Power & Energy Scalable • Cycle Life • Recoverable Materials Post-Life	• Energy Density • Material Costs • Charge / Discharge Rates	• Grid-Scale Storage • Industrial Energy Backup

Battery demand and strategic importance

With an increasing global demand for batteries and increasing geopolitical tensions, many nations are prioritising battery manufacturing and the development of domestic battery value chains to mitigate potential material shortages that could undermine energy-transition security.

Australia possesses a strong domestic supply chain across raw materials mining and processing. By contrast, domestic battery cell manufacturing and assembly is limited, relying on global suppliers to create battery cells to meet sovereign demand. This presents a vulnerability in the battery supply chain for Australia.

The Australian Government is actively bolstering the nation's battery industry to improve supply chain resilience and reduce domestic vulnerability. Current initiatives focus on expanding domestic manufacturing to accelerate the uptake of clean technologies, while also identifying and addressing barriers that hinder local battery production. Findings from this work will guide future measures to close gaps in the supply chain.

These efforts align with the Critical Minerals Strategy, which seeks to build diverse, robust, and sustainable global supply chains for essential minerals. Due to substantial reserves of lithium, nickel, cobalt, and vanadium, Australia holds a strategic advantage and reduced vulnerability to supply disruptions (DISR, 2024b).

Drawing on our position as a critical minerals supplier, Australia established a strategic framework with the United States in 2025 to strengthen resilience and security in critical mineral supply chains (DISR, 2025).

The battery value chain

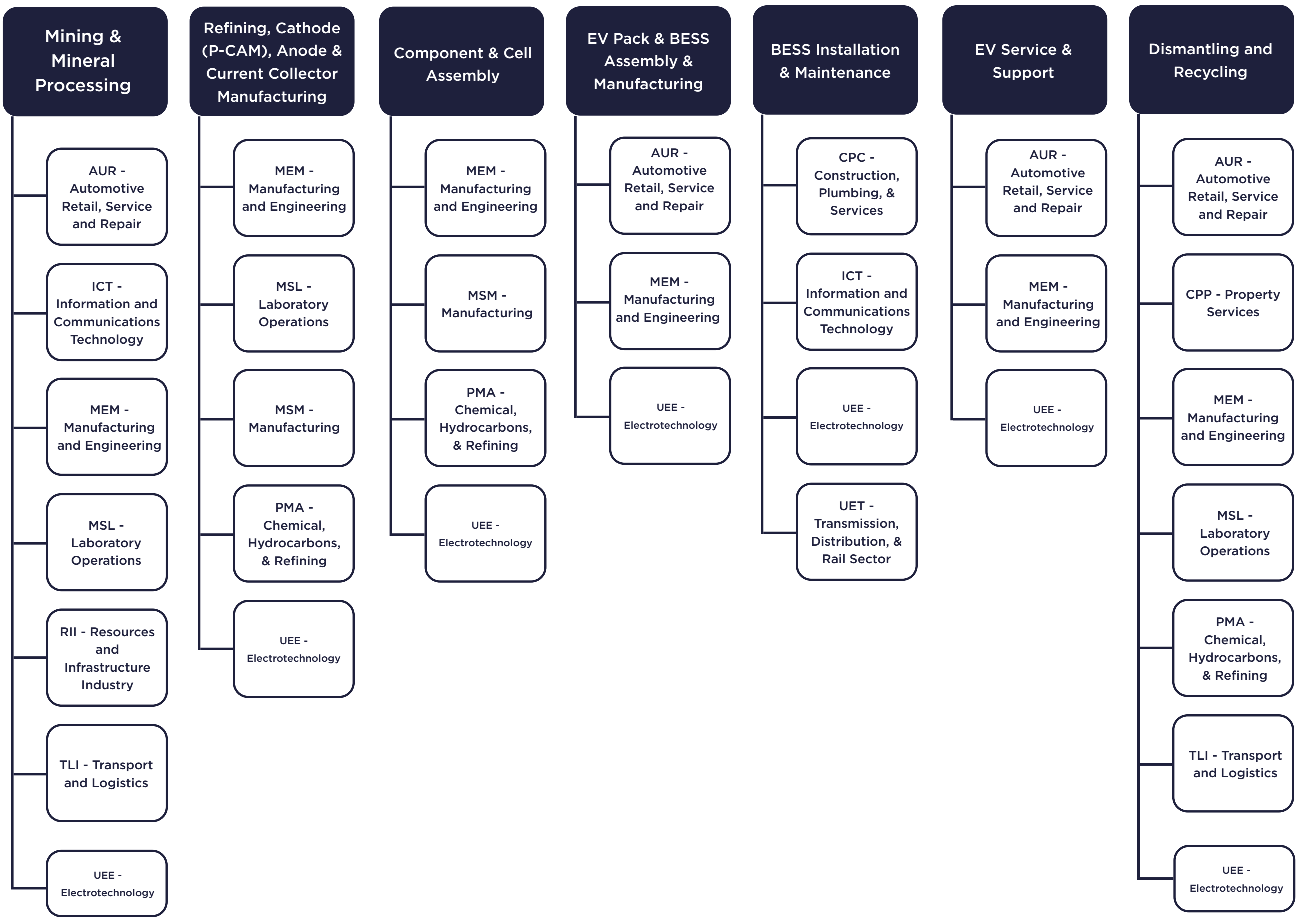
The manufacture, deployment and end-of-life management of Li-ion batteries are commonly described through a seven-stage Battery Value Chain, comprising:

- Mining and mineral processing
- Refining, precursor cathode active material (P-CAM), anode and current-collector manufacturing
- Component and cell assembly
- EV pack and BESS assembly and manufacturing
- BESS installation and maintenance
- EV service and support
- Dismantling and recycling

The workforce capabilities and skills required differ substantially across each stage of the value chain. Most organisations operate within one or two segments, supplying products or services to other participants downstream while maintaining specialised areas of expertise. For practical purposes, this guide is structured around these value-chain segments, with some flexibility where boundaries overlap.

At each stage of the value chain, industrial trades, and technical knowledge across multiple disciplines are required to build a capable workforce on the ground.

The diagram below indicates some of the training packages that contribute to the battery value chain.



While the value chain is presented here as a linear sequence, circular-economy principles are becoming increasingly important. Over time, the recycling stage is expected to integrate more directly with upstream mining and processing through the growth of recycling technologies where valuable materials are recovered from end-of-life batteries and products. It should also be noted that this guide primarily focuses on Li-ion batteries used in electric mobility and short-duration energy storage. Other battery technologies, such as long-duration flow batteries and emerging chemistries still in early commercialisation, follow different value-chain structures and are therefore only referenced at a high level.

SEGMENT 1

3. MINING AND MINERAL PROCESSING

The segment

Minerals play an essential role in the production of batteries; many of the components within a battery are derived from ores collected through mining. For instance, each cell has an active cathode made of nickel, manganese, cobalt or aluminium oxides, or phosphates of iron which are mixed with an organic electrolyte containing lithium ions. The anodes are made of finely powdered graphite often infused with silicon. The coatings of the cathode and anode are aluminium and copper, respectively. These are all considered critical minerals for clean energy and most are primarily available via mining.

The Australian mining sector continues to play a significant role in global minerals supply, being amongst the top five suppliers for vanadium, titanium, lithium, aluminium and manganese (Hughes et al., 2025). Australia also holds a variety of other critical minerals, which include nickel, cobalt, copper, silicon and graphite. There are several companies that mine and process minerals domestically, including Alcoa (aluminium), AVL (vanadium), IGO (nickel), Glencore (copper), BHP (cobalt), Talison Lithium (lithium), Simcoa (silicon), South 32 (manganese), QEM (vanadium) and Renascor (graphite).

Operations within this sector include the collection of ore, physical processing, and transport off-site to downstream processing. These processes can be mechanical in nature, or involve concentration processes such as media separation, froth flotation and chemical treatment. Each step works to increase the important minerals and remove low-value material.

A strong battery value chain relies on mineral extraction that is both cost-effective and ethically grounded, applying best-practice environmental management, demonstrating respectful engagement with First Nations communities, and reducing greenhouse-gas emissions throughout operations.

Workforce description

The mining and mineral production industry relies on both vocational trades positions and professionals from science, technology, engineering, and mathematics (STEM) based disciplines. Vocational trades are needed to handle the manual operations such as drilling/blasting, materials handling, and ore processing; as well as technical assessment roles such as metallurgical testing, mine exploration/surveying, and planning/development. The mining industry possesses a high volume of assets from plant equipment to vehicle fleets requiring constant maintenance and support, which would also need dedicated tradespeople. STEM-based professionals with knowledge in earth sciences, surveying, metallurgy, chemistry and engineering are also needed for further in-depth technical analysis. A sample of ten typical roles in mining and minerals processing can be found in the table below.

ANZSCO	Occupation	Qualification Type	Status
232212	Surveyor	Higher Education	Shortage
233611	Mining Engineers	Higher Education	Shortage
234411	Geologist	Higher Education	Shortage
312912	Metallurgical and Materials Technicians	Vocational Education	Shortage
321111	Automotive Technician	Vocational Education	Shortage
323211	Fitter (General)	Vocational Education	Shortage
323214	Machinists (First Class)	Vocational Education	Shortage
341111	Electrician	Vocational Education	Shortage
712211	Driller	Vocational Education	Shortage
712212	Miner	Vocational Education	Regional Shortage

Aligned national training packages

The table below lists aligned training packages within the mining and mineral processing industry.

Code	Training Package	Governing Jobs and Skills Council
AUR	Automotive Retail, Service and Repair	Mining & Automotive Skills Alliance
ICT	Information and Communications Technology	Future Skills Organisation
MEM	Manufacturing and Engineering	Manufacturing Industry Skills Alliance
MSL	Laboratory Operations	Manufacturing Industry Skills Alliance
RII	Resources and Infrastructure Industry	Mining & Automotive Skills Alliance
TLI	Transport and Logistics	Industry Skills Australia
UEE	Electrotechnology	Powering Skills Organisation

Nationally recognised training

Below lists nationally recognised training relevant to the mining and minerals processing industry.

AUR - Automotive Retail, Service and Repair	
Qualifications	
AUR30320	Certificate III in Automotive Electrical Technology
AUR30620	Certificate III in Light Vehicle Mechanical Technology
AUR31120	Certificate III in Heavy Commercial Vehicle Mechanical Technology
AUR31220	Certificate III in Mobile Plant Technology
RII – Resources and Infrastructure Industry	
Qualifications	
RII20120	Certificate II in Resources and Infrastructure Work Preparation
RII30120	Certificate III in Surface Extraction Operations
RII30320	Certificate III in Underground Metalliferous Mining
RII30420	Certificate III in Resource Processing
RII31820	Certificate III in Drilling Operations
RII41421	Certificate IV in Civil Infrastructure Asset Management
ICT – Information and Communications Technology	
Qualifications	
ICT20120	Certificate II in Resources and Infrastructure Work Preparation
ICT40120	Certification IV in Information Technology
MEM – Manufacturing and Engineering	
Qualifications	
MEM30219	Certificate III in Engineering – Mechanical Trade
MEM31419	Certificate III in Engineering – Fixed and Mobile Plant Mechanic
MEM50822	Diploma Applied Technologies (Industry 4.0)
MSL – Laboratory Operations	
Qualifications	
MSL30122	Certificate III in Laboratory Skills
MSL40122	Certificate IV in Laboratory Techniques
MSL50122	Diploma of Laboratory Technology
TLI – Transport and Logistics	
Qualifications	
TLI27121	Certificate II in Rail Infrastructure
TLI40324	Certificate IV in Supply Chain Operations
UEE – Electrotechnology	
Qualifications	
UEE30820	Certificate III in Electrotechnology Electrician

Workforce distinctives

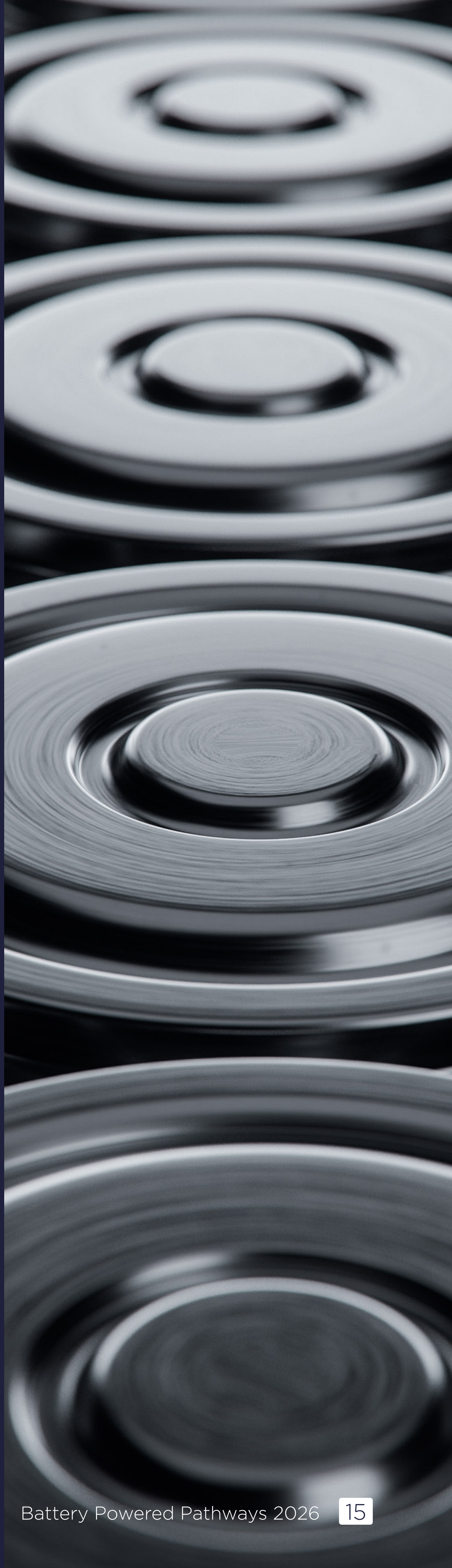
Mining operations are often based in regional or remote locations, where there is a smaller available workforce. This often leads to regional shortages in mining roles. To combat this, mining companies offer more opportunities for ‘fly-in, fly-out’ (FIFO) work, including better financial remuneration to encourage workers living in urban regions.

The major processes for mining battery-related minerals are similar to mining processing for other materials; many of the top 5 jobs shared between metallic ore mining and other forms of mining are identical (MASA, 2025). This makes the transition within the mining workforce relatively easy, with little additional training needed to shift into critical minerals mining.

Mining and mineral processing can include operations that place workers in hazardous environments, such as working from heights, in confined spaces, underground or with heavy machinery. To prioritise safety and minimise the risk of harm, injury, or death, most nationally recognised training qualifications will feature core units of competency that address safe working practices that align with Workplace Health and Safety (WHS) policies.

In recent years, Australian mining and minerals processing has taken steps to increase its environmental, social and governance (ESG) standing through the implementation of policies, partnerships, and strategies (Minerals Council of Australia, 2022). The MASA 2025 Workforce Plan identified greater diversity in the workforce; for instance, First Nations representation in the mining industry was shown to be almost double the national workforce (4.62% vs. 2.63%).

The mining industry also continues to look at new technologies to increase capacity or reduce running costs. The electrification of heavy vehicles, the incorporation of off-grid electricity generation, and the use of AI and Industry 4.0 for automation have all contributed to increased jobs in electrical and information-related fields (MASA, 2025).



SEGMENT 2

4. REFINING/MATERIALS/ COMPONENTS

The segment

Battery minerals refining

To convert the collected ore from mining into materials which can be used for battery production, refining is also required. This is a distinct process from mining as refining purifies a processed ore into a high-grade, fit-for-purpose material. For instance, a lithium hydroxide refinery can convert concentrated spodumene ore into battery-grade, 99.9% pure lithium hydroxide monohydrate.

While this segment of the battery value chain is still being developed in Australia, mining and concentrating companies are expanding into this segment to strategically position themselves as a materials supplier. The construction of Covalent Lithium's lithium hydroxide refinery in Kwinana is one such example of this, while other mining and concentrating companies such as Cobalt Blue are developing capabilities for battery cathode mineral production in Australia.

Several other companies are building or planning to build refineries for battery anode minerals. These companies include Renascor, EcoGraf and International Graphite. The Department of Industry Science and Resources have also invested into new demonstration facilities, such as the Graphinex Battery Anode Demonstration Facility in Townsville (Chisholm et al., 2025).

These investments in downstream processing are highly sought after, capital intensive and may be built with the assistance of Government subsidies. The Australian Government's critical minerals strategy (DISR, 2023) outlines opportunities to expand mining and mineral processing of battery minerals and to go "downstream" into the refining of these minerals. They can also be technically challenging to execute, reflecting the need for a technically skilled workforce for this segment of the battery value chain.

Battery, materials and components

Li-ion battery cells usually have an active cathode made from a mix of nickel, manganese, cobalt or aluminium oxides, or an iron phosphate. The chemistry of the precursor-cathode active material (P-CAM) is a key factor in the cell performance. For instance, NMC cells (which use nickel, manganese and cobalt oxides in their cathodes) generally have a better energy density than LFP cells, but LFP cells can have a higher cycle life, and are less prone to thermal runaway.

When the cell is formed, P-CAM is infused with an electrolyte containing lithium salts. At this point it is known as the cathode active material (CAM) rather than P-CAM. This forms part of the cathode structure.

The anode is usually made using finely powdered graphite and silicon to improve its performance. Binders and conductive additives may also be added to the anode to increase its strength and electrical conductivity. Newer batteries are manufactured anode free, without any graphite or equivalent material other than the current collector.

Both the cathode and anode are coated and rolled onto metal sheets, which act as the current collectors. Aluminium is often used for the cathode, while copper is used for the anode. These current collectors have tabs for the copper wires to be connected to allow the electricity to flow to other cells, the battery management system (BMS), and the rest of the circuit.

Workforce description

The refining of battery materials and production of cell components can be technically complex. To ensure that these products can be created from raw materials, process operators and technicians are key roles within this workforce. Process operators in the control room and on the production floor monitor conditions during production and make corrections when required. Technicians maintain the equipment to ensure they operate smoothly and conduct repairs when production equipment is not working.

Both technicians and operators may have laboratory staff and maintenance teams to support them. Laboratory staff assay materials by collecting/preparing samples and conducting specialist bench scale tests. Maintenance teams may include specialist or licensed vocations such as electricians, fitters, technicians and apprentices in these same fields. A sample of ten typical roles in battery materials refining and cell component production can be found below.

ANZSCO	Occupation	Qualification Type	Status
233111	Chemical Engineer	Higher Education	No Shortage
233513	Production or Plant Engineer	Higher Education	No Shortage
234912	Metallurgist	Higher Education	No Shortage
312912	Metallurgical and Materials Technicians	Vocational Education	Shortage
323211	Fitter (General)	Vocational Education	Shortage
323214	Machinists (First Class)	Vocational Education	Shortage
341111	Electrician	Vocational Education	Shortage
342314	Electronic Instrument Trades Worker	Vocational Education	Shortage
399211	Chemical Plant Operator	Vocational Education	No Shortage
711911	Chemical Production Machine Operator	Vocational Education	No Shortage

Aligned national training packages

The table below lists aligned training packages within the refining and cell component production industry.

Code	Training Package	Governing Jobs & Skills Council
MEM	Manufacturing and Engineering	Manufacturing Industry Skills Alliance
MSL	Laboratory Operations	Manufacturing Industry Skills Alliance
MSM	Manufacturing	Manufacturing Industry Skills Alliance
PMA	Chemical, Hydrocarbons, and Refining	Manufacturing Industry Skills Alliance
UEE	Electrotechnology	Powering Skills Organisation

Nationally recognised training

Below lists nationally recognised training relevant to the refining and cell component production industry.

MEM – Manufacturing and Engineering	
Qualifications	
MEM30119	Certificate III in Engineering – Production Systems
MSL – Laboratory Operations	
Qualifications	
MSL20122	Certificate II in Sampling and Measurement
MSL40122	Certificate IV in Laboratory Techniques
MSL50122	Diploma of Laboratory Technology
MSL60122	Advanced Diploma of Laboratory Management
MSM – Manufacturing	
Qualifications	
MSM30116	Certificate III in Process Manufacturing
PMA – Chemical, Hydrocarbons and Refining	
Qualifications	
PMA20116	Certificate II in Process Plant Operations
PMA30120	Certificate III in Process Plant Operations
PMA40116	Certificate IV in Process Plant Technology
UEE – Electrotechnology	
Qualifications	
UEE30820	Certificate III in Electrotechnology Electrician
UEE40420	Certificate IV in Electrical Instrumentation

Workforce distinctives

The skills required for refining battery minerals are similar to refining other raw materials in other industries. The main difference is that battery minerals usually need to be refined to a higher level than other products. Parts such as the P-CAM, anode, and current collectors must be made with high purity to avoid battery failure during use. Additionally, the materials produced must meet stringent particle size, morphology, composition and electrochemical requirements to ensure optimum performance, so process conditions are carefully controlled. Due to the high purity and quality requirements, workers from industries with similarly high standards (such as food and pharmaceuticals) tend to be valuable workers within this industry.

This industry can include the use of hazardous chemicals during the production of battery materials. Consequently, this makes safety paramount to the training of people in this industry. A high portion of the nationally recognised training listed will include mandatory units of competency for WHS and the safe handling of chemicals.

5. COMPONENT AND CELL ASSEMBLY

The segment

Cell manufacturing steps

Manufacturing for Li-ion cells include electrode manufacturing, cell assembly and cell finishing.

When making electrodes, the Cathode Active Materials (CAM) are mixed with binding chemicals to form a slurry and is coated with precise thicknesses onto aluminium foil to form the cathode. Similarly, the anode is also applied as a slurry to copper foil. After coating, the electrodes are carefully dried to remove excess solvents, which can often be recycled. The last step before cell assembly is calendaring, where the dried anode and cathode sheets are compressed between heated rollers to increase material density and reduce porosity.

During cell assembly, the anode, separator, and cathode are all stacked together to make a flat, single battery layer. These layers are cut precisely and either rolled or stacked depending on the desired cell shape. The conducting tabs are welded to the current connectors (the metal foils) and the cell is sealed into an airtight package. The electrolyte is then injected into the cell, which permeates through the separator. The separator itself needs time to soak up the electrolyte, and it can often take days to complete this step.

In the final stages of making a battery cell, the layers are compressed with rollers to improve contact between all components. The cell then goes through its first charge and discharge cycle. Finally, the cell is degassed and aged before undergoing physical and electro-chemical testing.

The Australian context

Australia's component and cell assembly is still emerging, with much of the manufacturing taking place overseas. Instead, many Australian companies import cells and insert them into locally manufactured modules, while being controlled with locally manufactured BMS. Companies active in this segment include Gelion, Li-S Energy, and Master Instruments.

Workforce description

Given the high precision and high volume of output required in cell manufacturing, commercial scale manufacturing is often heavily automated. Similar to the refining industry, manufacturing of cells is done in environments with high temperature and humidity control. With the high automation and similar environmental controls to refining, workforce roles typically centre around technical planning and supervision. These may include production operators, supervisors, and technicians.

Production operators and supervisors oversee a range of equipment and digital systems to complete the electrode manufacturing, cell assembling, and cell finishing processes. Technicians in specialised fields fill a variety of equipment maintenance and quality control roles; they ensure products are adhering to quality standards, troubleshoot electrical or mechanical faults in equipment, and make continuous improvements to the processes. A sample of ten typical roles in component and cell assembly can be found below.

ANZSCO	Occupation	Qualification Type	Status
133411	Manufacturer	Vocational Education	No Shortage
233112	Materials Engineer	Higher Education	No Shortage
233511	Industrial Engineer	Higher Education	No Shortage
233513	Production or Plant Engineer	Higher Education	No Shortage
342313	Electronic Equipment Trades Worker	Vocational Education	Regional Shortage
342314	Electronic Instrument Trades Worker	Vocational Education	No Shortage
712311	Engineering Production Worker	Vocational Education	No Shortage
832211	Product Assembler	Vocational Education	No Shortage
839311	Product Examiner	Vocational Education	No Shortage
839912	Chemical Plant Operator	Vocational Education	No Shortage

Aligned national training packages

The table below lists aligned training packages within the component and cell assembly industry.

Code	Training Package	Governing Jobs & Skills Council
MEM	Manufacturing and Engineering	Manufacturing Industry Skills Alliance
MSM	Manufacturing	Manufacturing Industry Skills Alliance
PMA	Chemical, Hydrocarbons, and Refining	Manufacturing Industry Skills Alliance
UEE	Electrotechnology	Powering Skills Organisation

Nationally recognised training

Below lists nationally recognised training relevant to the component and cell assembly industry.

MEM – Manufacturing and Engineering	
Qualifications	
MEM30119	Certificate III in Engineering – Production Systems
MEM30422	Certificate III in Engineering – Electronic Trade
MSM – Manufacturing	
Qualifications	
MSM20216	Certificate II in Manufacturing Technology
MSM30116	Certificate III in Process Manufacturing
PMA – Chemical, Hydrocarbons and Refining	
Qualifications	
PMA30120	Certificate III in Process Plant Operations
PMA40116	Certificate IV in Process Plant Technology
UEE – Electrotechnology	
Qualifications	
UEE33020	Certificate III in Electrical Fitting
UEE40420	Certificate IV in Electrical – Instrumentation
UEE42220	Certificate IV in Instrumentation and Control

Workforce distinctives

The quality and performance of batteries are affected by the cells, so each step within cell manufacturing is tightly controlled. Similar to the refining of battery components, the manufacturing of cells has quality requirements closer to the pharmaceutical or food industries than to other manufactured products. The life design for batteries can extend to a decade of use, so cells require good performance and longevity to ensure they are fit-for-purpose.

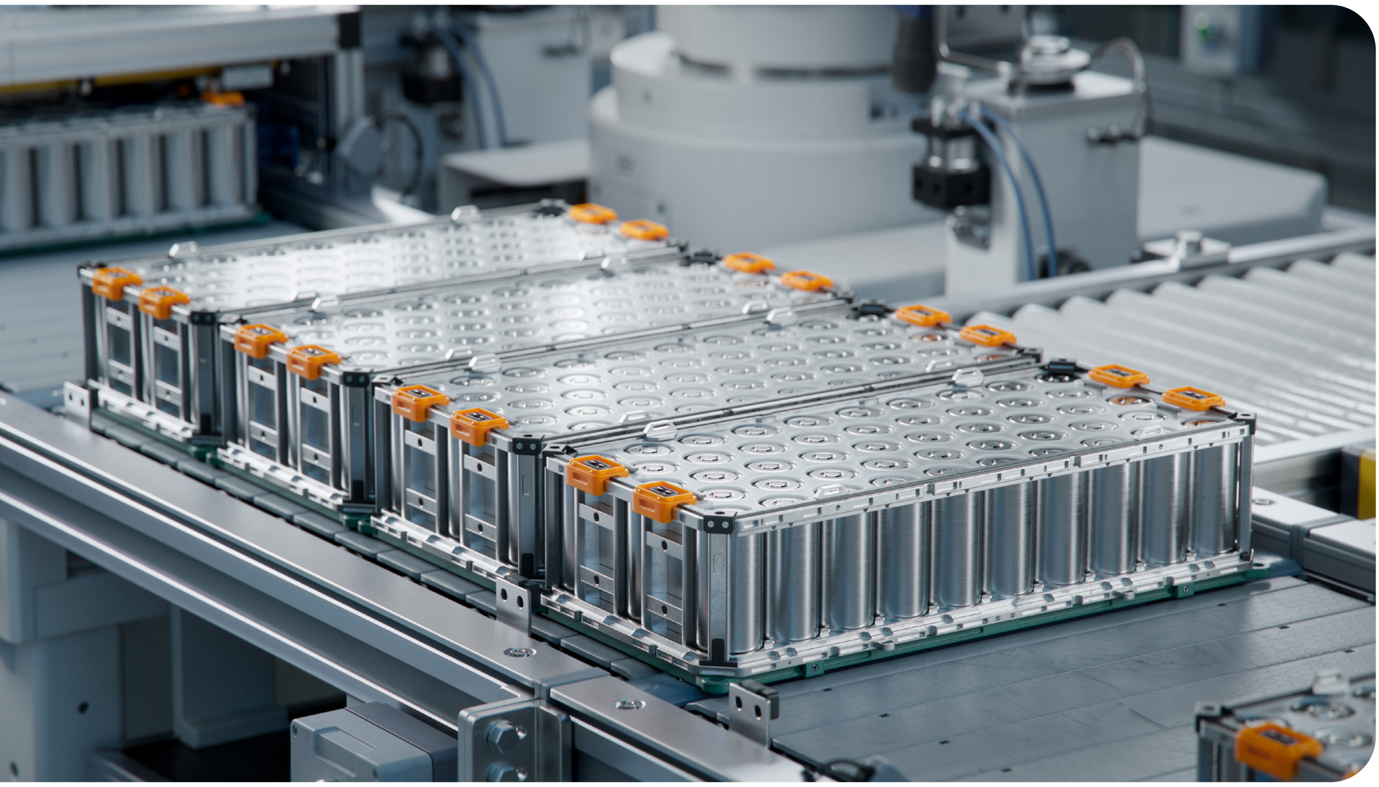
Both the EV and BESS industries require battery packs to perform to specific standards, and the consequence of failure can lead to significant social, environmental, or economic losses. Manufacturers may be able to investigate a form of traceability system to track which cells are substandard and why. A similar traceability system is already being enshrined into law by the European Union, who have mandated the Battery Passport system for ESG purposes (European Union, 2025).

As accuracy and precision are paramount to cell manufacturing, a majority of the nationally recognised training for this industry include units of competency related to the use of measuring instruments and standards.

Since September 2024, the TAFE Centre of Excellence for Clean Energy Batteries has been operating in Queensland to develop targeted training solutions including the skills to design, install, operate, and maintain renewable energy systems and batteries (Giles et al., 2024). The development of new training programs and course materials is intended to develop greater capabilities in the future workforce of battery component and cell assembly.

SEGMENT 4

6. EV PACK AND BESS ASSEMBLY AND MANUFACTURING



The segment

Electric Vehicles (EVs)

The battery packs of EVs often contain thousands of Li-ion cells arranged in series and parallel circuits to meet the vehicle's electrical power needs. The selection of battery cells and design of battery packs can be highly variable depending as a consequence of diverse EV design and performance requirements. There are several engineering choices including cell chemistry, format, cooling systems, pack voltage, charge management and structural integration which are made depending on the application.

The overwhelming majority of EVs sold in Australia feature batteries that are embedded permanently into the design, which makes battery longevity a significant consideration for EV pack design. Swappable batteries are also seen in vehicles where downtime for charging must be kept to a minimum, especially in mining and industrial applications. This is already seen in e-mobility products including e-bikes and e-scooters but may also be seen in more trucks and mining vehicles in the future (to allow drivers to swap and go in mere minutes).

Battery Energy Storage Systems (BESS)

The production of Li-ion batteries has increased to meet the demands of an emerging EV industry, which in turn has reduced the cost of Li-ion cell production. This has made the production of BESS more cost-effective. The purpose of BESS is to capture and store excess energy generated from power sources. When power generation wanes or falters, BESS can release stored energy to stabilise the grid. As a result, BESS are often designed to store a huge amount of energy and a single storage unit can incorporate 3-5,000 cells, which can be scaled to meet energy demands.

Energy storage is vital to support the shift from fossil fuels to renewable energies. These systems can be coordinated to store and release energy, provide inertia, provide back-up services in ways that reduce energy costs for all grid-connected consumers.

BESS complements renewable energy sources well by reserving excess energy generated in the daytime for use when demand is greater. Reserving the energy for peak demand will reduce Australia's need for non-renewable power generation methods, lowering emissions. Without energy storage solutions like BESS or pumped hydro, intermittent renewable energy must be supplemented with diesel, gas, coal or co-generated power generation at night. This makes BESS a key component of the transition to renewable energy.

Battery cells for utility and grid-scale BESS are usually imported in pre-existing packs for quick on-site installation. However, BESS assembly and installation is growing in Australia, with the rise of local companies designing and installing modular BESS systems. In some cases, companies are turning to repurposing used batteries from other products to create BESS units, which is discussed further in later chapters of this document.

Pack assembly

Pack assembly specifically refers to the arrangement of multiple battery cells into battery packs, which includes wiring, soldering, and electrically connecting cells together. Configuring the number of batteries in series and parallel circuits inside the pack can change the voltage and current respectively. This enables customisation of electrical properties within a battery pack.

A battery management system (BMS) is often connected to battery modules and controls any voltage, current, or temperature deviations in the battery pack operation. The BMS will often manage interactions between separate battery cells, modules, and packs, to ensure output needs are met. If voltage, current, or temperature limits are breached by a module, the BMS may shut down that module or the entire system, (depending on the severity). Prior to installation, all battery packs and systems are tested thoroughly to ensure they meet quality requirements.

Heat is generated in BESS units and cooling systems are often integrated as part of larger BESS designs.

Battery systems should not be considered as a collection of simple electrical components: they are complex interconnected electro-mechanical systems requiring operating and maintenance competencies and advanced design and manufacturing capabilities.

Workforce description

A significant portion of the tasks in this industry require a strong understanding of fundamental electrical concepts and electrical equipment. The workforce for pack and module assembly may include those with experience assembling electronics together, as well as those capable of testing them. To create the housing for battery packs and storage systems, fabrication skills and trades are also valued within this field.

In the EV sector, MASA (2025) notes that automotive technicians are restricted from the service or repair of battery packs. Instead, Original Equipment Manufacturers (OEMs) may provide manuals containing a limited scope for repair or servicing. Any works on battery pack assembly, manufacturing, servicing, or repair would otherwise be the responsibility of the OEM.

In the BESS sector, manufacturers often require Information and Communications Technology (ICT) professionals and electrical engineers to design and customise BESS systems (including the BMS), which can be highly variable to suit energy storage needs. There is a constant demand for electricians and electrical tradespeople in this industry due to a general skills shortage. Those assembling BESS units may also be responsible for their installation, which requires electrical licensing. There are also additional Solar Accreditation Australia's (SAA) requirements that must be met; more information is provided about this in the next chapter.

A sample of ten typical roles in pack assembly can be found in the table below.

ANZSCO	Occupation	Qualification Type	Status
233311	Electrical Engineer	Higher Education	Shortage
233513	Production or Plant Engineer	Higher Education	No Shortage
263212	ICT Support Engineer	Higher Education	No Shortage
312412	Electronic Engineering Technician	Vocational Education	Shortage
322211	Sheetmetal Trades Worker	Vocational Education	Shortage
323214	Metal Machinist (First Class)	Vocational Education	Shortage
341111	Electrician (General)	Vocational Education	Shortage
832211	Product Assembler	Vocational Education	No Shortage
839311	Product Examiner	Vocational Education	No Shortage
839313	Product Tester	Vocational Education	No Shortage

Aligned national training packages

The table below lists aligned training packages within the component and cell assembly industry.

Code	Training Package	Governing Jobs & Skills Council
AUR	Automotive Retail, Service and Repair	Mining & Automotive Skills Alliance
MEM	Manufacturing and Engineering	Manufacturing Industry Skills Alliance
UEE	Electrotechnology	Powering Skills Organisation

Nationally recognised training

Below lists nationally recognised training relevant to the component and cell assembly industry.

AUR – Automotive Retail, Service and Repair	
Qualifications	
AUR30320	Certificate III in Automotive Electrical Technology
AUR31120	Certificate III in Heavy Commercial Vehicle Mechanical Technology
AUR32721	Certificate III in Automotive Electric Vehicle Technology
Skills Sets	
AURSS00063	Battery Electric Vehicle Diagnose and Repair Skill Set
AURSS00064	Battery Electric Vehicle Inspection and Servicing Skill Set
MEM – Manufacturing and Engineering	
Qualifications	
MEM20219	Certificate II in Engineering – Production Technology
MEM30119	Certificate III in Engineering – Production Systems
MEM30219	Certificate III in Engineering – Mechanical Trade
MEM31925	Certificate III in Engineering – Fabrication Trade
MEM30422	Certificate III in Engineering – Electronic Trade
UEE – Electrotechnology	
Qualifications	
UEE30820	Certificate III in Electrotechnology Electrician
UEE30920	Certificate III in Electronics and Communications
UEE33020	Certificate III in Electrical Fitting
Units of Competency	
UEERA0099	Install, commission, service and maintain air conditioning systems
UEERE0006	Conduct periodic maintenance of remote area power supply battery banks
UEERE0054	Conduct site survey for grid-connected photovoltaic and battery storage systems
UEERE0060	Design grid-connected battery storage systems
UEERE0077	Install battery storage equipment power conversion equipment to grid
UEERE0078	Install battery storage to power conversion equipment

Workforce distinctives

Battery pack assembly for BESS and EVs has been a new and emerging industry within the wider Australian context. Battery pack assembly for EVs are yet to take place in Australia, with OEMs for EVs based overseas. Battery pack assembly for BESS however has been growing to meet the increasing demand for BESS installations across the nation. The need for energy storage for renewable energy projects have driven increased funding from government and industry into BESS. This is discussed in more detail in the next chapter.

Pack assembly relies heavily on manufacturing and electrical trades, and the skill sets needed in this workforce are in high demand across many industries. This puts electrical trade workers in shorter supply across this section, leaving many ongoing employment opportunities for workers who are looking to enter this industry long-term (PSO, 2025a).

7. BESS INSTALLATION AND MAINTENANCE

The segment

The approach to installing and maintaining BESS units differs depending on whether the system is for home, community or utility scale.

The term BESS refers to 'battery energy storage system' and is simply the name given to a storage system that uses a collection of collated battery cells. BESS can refer to a wide variety of systems, including home batteries, community batteries, and utility or grid scale batteries.

Home batteries

Home batteries are the smallest of the BESS units considered in this document and typically possess a lower capacity than EV batteries. Home batteries typically have a capacity of 5 – 50 kWh, which can store anywhere from half a day to over a week of photovoltaic output (Clean Energy Regulator [CER], 2025a). By comparison, a battery-powered EV may store 45 – 120 kWh of energy (Electric Vehicle Council [EVC], 2025). Often home batteries are installed at homes to complement solar panel systems. On sunnier days, solar panels may charge the battery through the excess energy generated, which can then be drawn upon on cloudy days or at night when the sun is less available. When blackouts occur at residential homes, or when local grid energy is unreliable, a home battery can provide short term power to keep appliances and lights running. Home batteries installed behind-the-meter can store power generated from solar panels, or charge from the grid at low cost for discharge at peak times when prices are higher.

Often, home batteries are installed in garages or on the sides of houses. There are multiple Australian Standards which dictate how a battery can be safely installed in a residential context.

Community batteries

Community batteries are a larger BESS unit than home batteries. They are a good option for households and businesses who choose not to install a battery directly to their premises. A significant benefit of this system is that it can support energy needs at community level, absorbing excess power from nearby solar installations and releasing it back to the community. This lowers the peak demand at a substation level, and can help to reduce costs for all consumers.

Usually, these are installed and maintained by network providers as they are installed directly onto the grid. Community batteries are often placed in parks or shared spaces (including shopping centres, retirement villages, or sporting grounds) and store anywhere from 50 to 5000 kWh (Australian Renewable Energy Agency [ARENA], 2025a).

Utility scale batteries

Utility or grid scale batteries are far larger than other types of BESS units and are designed for feeding electricity to homes and businesses at very large scale. In 2025 alone, the Australian Government agreed to fund 16 new utility-scale batteries, ranging from 300 – 1600 MWh (Department of Climate Change, Energy, the Environment, and Water [DCEEW], 2025a). The largest existing batteries in Australia have only recently exceeded the 2000 MWh mark, but future proposed batteries may surpass this in coming years. Australia has some of the world's largest installations of these systems.

Utility scale BESS are usually arranged in an array of shipping container sized units. They are often installed near solar installations to minimise energy loss via transmission while storing excess energy. They also may be installed near existing power stations and industry to utilise the existing electrical infrastructure, which can readily handle the electrical load of large BESS units. Large, dedicated infrastructure operators collaborate with OEMs and local electrical utility operators to maintain these systems and keep them functioning under optimal conditions.

A utility scale BESS can play a significant role in grid stability and often takes up a large physical space. It can take several years for a company to get through the planning, development, installation, and commissioning to install BESS at this scale. As of October 2025, there was a record 26.1 GW pipeline of energy storage projects on the National Electricity Market alone.

Workforce description

Home battery systems at the residential scale requires licensed electricians with Solar Accreditation Australia (SAA) accreditation. Licensed electricians can obtain SAA accreditation by applying for accreditation to the Grid Connected Battery Systems (Solar Accreditation Australia, 2025). Some of the prerequisites for this accreditation related to battery installation and design have been listed later in this chapter. Often, qualified solar panel installers will also get this qualification to extend the scope of their sale opportunities.

Larger BESS projects such as community batteries and utility scale BESS require the dedicated work of electrical engineers and ICT professionals to handle design work. Teams of engineers, qualified electricians, and maintenance tradespeople carry out the installation and maintenance of larger BESS projects. In some cases where thermal control measures are needed, personnel in the heating, ventilation, and air conditioning (HVAC) trades may also form part of the installation and maintenance teams.

Many peripheral roles also exist in larger BESS installation. Before installation can take place, prior set-up work may be conducted by professionals in site planning and preparation, civil works, logistics and transport, and rigging/dogging. Other roles within the workforce may also provide opportunities for line-workers, construction and logistics workers, cable jointers, environmental planners, and emergency and safety workers. A sample of ten typical roles in BESS installation and maintenance can be found below.

ANZSCO	Occupation	Qualification Type	Status
233311	Electrical Engineer	Higher Education	Shortage
233411	Electronics Engineer	Higher Education	No Shortage
261112	Systems Analyst	Higher Education	No Shortage
312611	Safety Inspector	Vocational Education	No Shortage
312911	Maintenance Planner	Vocational Education	No Shortage
341111	Electrician (General)	Vocational Education	Shortage
342111	Airconditioning and Refrigeration Mechanic	Vocational Education	Shortage
342211	Electrical Linesworker	Vocational Education	Shortage
342212	Technical Cable Jointer	Vocational Education	Shortage
342313	Electronic Equipment Trades Worker	Vocational Education	Shortage

Aligned national training packages

The table below lists aligned training packages within the BESS installation and maintenance industry.

Code	Training Package	Governing Jobs & Skills Council
CPC	Construction, Plumbing and Services	BuildSkills Australia
ICT	Information and Communications Technology	Future Skills Organisation
UEE	Electrotechnology	Powering Skills Organisation
UET	Transmission, Distribution and Rail Sector	Powering Skills Organisation

Nationally recognised training

The table below lists nationally recognised training relevant to the BESS installation and maintenance industry.

CPC – Construction, Plumbing and Services	
Qualifications	
CPC30720	Certificate III in Rigging
Units of Competency	
CPCCDO2011	Handle and position dogging tools and equipment
ICT – Information and Communications Technology	
Qualifications	
ICT40120	Certification IV in Information Technology
UEE – Electrotechnology	
Qualifications	
UEE30820	Certificate III in Electrotechnology Electrician
UEE32225	Certificate III in Air Conditioning and Refrigeration
UEE43322	Certificate IV in Electrical – Renewable Energy
UEE50325	Diploma of Electrical and Refrigeration and Air Conditioning
Units of Competency	
UEERA0099	Install, commission, service and maintain air conditioning systems
UEERA0006	Conduct periodic maintenance of remote area power supply battery banks
UEERE0054	Conduct site survey for grid-connected photovoltaic and battery storage systems
UEERE0060	Design grid-connected battery storage systems
UEERE0077	Install battery storage equipment power conversion equipment to grid
UEERE0078	Install battery storage to power conversion equipment

Skills Sets	
UEESS00191	Grid-connected Battery Storage Systems Designer-Installer Skill Set
UEESS00192	Grid-connected Battery Storage Systems Installer Skill Set
UEESS00193	Grid-connected Photovoltaic and Battery Storage Systems Designer Skill Set
UEESS00194	Grid-connected Photovoltaic Systems Designer-Installer Skill Set

UEESS00195	Grid-connected Photovoltaic Systems Installer Skill Set
UEESS00196	Grid-connected Renewable Energy System Site Surveyor Skill Set
UEESS00197	Grid-connected Renewable Energy Systems Inspector Skill Set
UEESS00198	Hybrid Photovoltaic, Wind and Battery Storage Systems Installer Skill Set
UET – Transmission, Distribution and Rail Sector	
Qualifications	
UET30621	Certificate III in ESI – Distribution Overhead
UET30821	Certificate III in ESI – Distribution Underground
UET30921	Certificate III in ESI – Very Remote Community Utilities

Workforce distinctives

While earlier works in BESS installation and maintenance focused on smaller scale projects, recent federal government initiatives have introduced more opportunities for grid scale BESS installations. In 2025, 32 large scale BESS projects were approved by the federal government (DCCEEW, 2025). This is projected to deliver 8.29 GW of power and 28.98 GWh of capacity to the National Energy Market.

As solar farms and retired coal stations are often located outside metropolitan areas, a significant portion of BESS installation and maintenance will take place in regional areas. This presents increased regional employment opportunities, particularly in areas where there is a shift from non-renewable power generation.

BESS maintenance can be monitored remotely, which means that there are fewer on-site maintenance workers than during the construction and commissioning phases. Post-maintenance, a different workforce would be needed for the disassembly and recycling of BESS units as they reach end-of-life. This is discussed in Dismantle and Recycle chapter.

A majority of the labour tasks involved with BESS installation and maintenance requires an electrical licence to carry out the work. Therefore, a common pathway into the BESS workforce includes becoming a qualified and licensed electrical worker (e.g. Electrician or Electrical Distribution Trades Worker). Acquiring further specialist skills, training, and expertise in battery storage technology intends to address capability gaps for existing electricians.

BESS installation and maintenance rely heavily on the employment of electrical tradespeople, which are also in high demand across many other industries. There is a critical skills shortage of electricians nationwide, particularly in the fields of renewable energy (PSO, 2025a). As the number of BESS grows and the general demand for electrical trades roles grow, workers with electrical trade training will continue to be highly sought after in this industry.

While the above discusses centralised BESS units, emerging technologies have enabled households and personal vehicles to be used as a form of decentralised BESS that can be utilised to meet national energy needs.

EV batteries can be utilised to help power a home or the grid. This is referred to as ‘vehicle-to-home’ (V2H) and ‘vehicle-to-grid’ (V2G) respectively, or collectively as part of ‘vehicle-to-everything’ (V2X). V2X uses bidirectional, charging technology to enable energy flow in two directions. This requires extra infrastructure at home, including smart, internet-based connections. Installing these products involves both electrical and ICT skills to configure the systems.

Australia is still developing technical standards required for bidirectional operation, and it is expected that a national strategy will be adopted to increase community uptake and benefits from this technology (ARENA, 2025b). New units of competency are currently in development for V2X to upskill electricians and apprentices in this new field; these units are expected to be fully revised and submitted in 2026 (PSO, 2025b).

Virtual Power Plants (VPP) continue to grow as an alternative means of energy storage and distribution. VPPs connect thousands of solar panels and home batteries into a large network. This allows renewable energy generated from homes to be sent to the grid when needed, preventing power fluctuations or local outages and keeping the supply of electricity stable. Participants of this program gain significant benefits, which include financial compensation from higher feed-in tariffs, lower costs for grid-fed electricity, and improved resilience during emergencies (CER, 2025b).

The workforce for both V2X and VPP will require electrical tradespeople to set up the infrastructure, and market analysts and modellers to set market costs for power generation or use.

8. EV SERVICE AND SUPPORT

The segment

Many countries have introduced incentives to phase out internal combustion engine (ICE) vehicles to meet climate targets. These incentives accelerated investments in EV production internationally such that EV sales reached more than 20% of new car sales globally (IEA, 2025b). Australia's battery and plug-in hybrid EV market comprised 9.5% of new car sales in 2024 (EVC, 2025).

Australia's electrification journey increasingly includes other modes of transport including heavy transport, mining, rail, ship, aircraft, and motorcycles. Australia manufactures its own electric mining, ship and motorcycle vehicles and its electrified fleet is steadily increasing. As these novel segments emerge, there is an exciting new opportunity for those involved in related industries to build new skills to manufacture and support these vehicles.

While the transition from ICEs to EVs will take time, the National Electric Vehicle Strategy aims to increase EV uptake by increasing the supply of accessible vehicles, establishing more infrastructure to support them, and encourage the demand for EVs (DCEEW, 2025b). Heavy vehicle electrification is also gaining attention within industry: EV adoption in road freight remains in its early stages but is seeing growing interest (AECOM, 2025), while mine sites continue to electrify their heavy vehicles and other mobile plant equipment (MASA, 2025). These vehicles will also rely on supporting infrastructure including charging stations and battery swapping facilities.

Workforce description

The shift from servicing ICE vehicles to EVs is already happening. So far, this shift has been led by OEMs to encourage more sales of their vehicles. In the future, apprentices entering the industry will be trained from the start to work on EVs.

A sample of ten typical roles in EV service and support can be found below.

ANZSCO	Occupation	Qualification Type	Status
233311	Electrical Engineer	Higher Education	Shortage
233411	Electronics Engineer	Higher Education	No Shortage
233512	Mechanical Engineer	Higher Education	No Shortage
312412	Electronic Engineering Technician	Vocational Education	Shortage
321111	Automotive Electrician	Vocational Education	Shortage
321211	Motor Mechanics (General)	Vocational Education	Shortage
322311	Metal Fabricator	Vocational Education	Shortage
323211	Fitter (General)	Vocational Education	Shortage
839311	Product Examiner	Vocational Education	No Shortage
839313	Product Tester	Vocational Education	No Shortage

Aligned national training packages

The table below lists aligned training packages within the EV service and support industry.

Code	Training Package	Governing Jobs & Skills Council
AUR	Automotive Retail, Service and Repair	Mining & Automotive Skills Alliance
MEM	Manufacturing and Engineering	Manufacturing Industry Skills Alliance
UEE	Electrotechnology	Powering Skills Organisation

Nationally recognised training

Below lists nationally recognised training relevant to the EV service and support industry.

AUR – Automotive Retail, Service and Repair	
Qualifications	
AUR20720	Certificate II in Automotive Vocational Preparation
AUR30320	Certificate III in Automotive Electrical Technology
AUR30620	Certificate III in Light Vehicle Mechanical Technology
AUR32721	Certificate III in Automotive Electric Vehicle Technology
Units of Competency	
AURETH011	Depower and reinitialise hybrid electric vehicles
AURETH012	Service and maintain electrical components in hybrid electric vehicles
AURETH015	Diagnose, remove and replace heavy electric vehicle rechargeable energy storage systems
AURETH101	Depower and reinitialise battery electric vehicles
AURETH102	Inspect and maintain battery electric vehicles
Skills Sets	
AURSS00037	Hybrid Electric Vehicle Inspection and Servicing Skill Set
AURSS00063	Battery Electric Vehicle Diagnose and Repair Skill Set
AURSS00064	Battery Electric Vehicle Inspection and Servicing Skill Set
Accredited Courses	
22609VIC	Course in electric vehicle charging infrastructure up to 22 kW
MEM – Manufacturing and Engineering	
Qualifications	
MEM20219	Certificate II in Engineering – Production Technology
MEM30422	Certificate III in Engineering – Electronic Trade
UEE – Electrotechnology	
Qualifications	
UEE30820	Certificate III in Electrotechnology Electrician
UEE42622	Certificate IV in Hazardous Areas – Electrical
Units of Competency	
UEERE0060	Design grid-connected battery storage systems
UEERE0077	Install battery storage equipment power conversion equipment to grid
UEERE0078	Install battery storage to power conversion equipment

In some cases, additional OEM training may be required by manufacturers to enable work to be carried out on their specific products.

Workforce distinctives

Technology has been evolving in the EV industry. Both vehicles and supporting infrastructure have been advancing at a pace that demands constant updates to vocational training nationally. The continued electrification of the automotive trade has raised questions around whether restricted electrical licences are required for EV work, as well as the alignment of training with electrotechnology training (MASA, 2025). The establishment of the TAFE Electric Vehicle Centre of Excellence in the Canberra Institute of Technology has been established to address these knowledge and skills gaps (Canberra Institute of Technology, 2025).

Battery cell design improvements have resulted in a standardised battery voltage output of either 400 or 800 V for light EVs, enabling quick charge and high output. Working on high voltage batteries can have significant safety concerns, and the Australian Automotive Service and Repair Authority (AASRA) restricts OEM manual access to those who have completed AURETH101 (Depower and reinitialise battery electric vehicles) training (Australian Automotive Dealer Association, 2023). This makes this unit of competency vital for those intending to work on EVs in Australia.

Some new mining and rail applications incorporate dynamic energy transfer systems which operate at higher voltages. The higher voltage of these systems may necessitate different skills and qualifications as well as technical requirements for their installation. Similarly, some underground mining applications incorporate battery transfer systems, which then resemble electro-mechanical systems that necessitate appropriate skills and qualifications, often complemented by specific OEM training.

EV charging infrastructure have also seen advancements that have exceeded training capabilities in current vocational training courses. Ultrafast chargers which use direct current (DC) can reach charging rates of 350 – 500 kW (energy.gov.au, 2025). This extends beyond the capacity of courses such as 22609VIC Course in Electric Vehicle Charging Infrastructure up to 22 kW (the limit for a standard 32 A three phase AC connection) which remains current until 2027 (State of Victoria, 2024). This highlights the challenge that training programs face when responding to technological advancements in this industry.

EV charging stations are continuing to be rolled out nation-wide, with further investment from state and federal governments to install charging stations around the nation. With a view to make EV charging more accessible, the federal government has invested $40 million to expand publicly available kerbside parking options (Bowen & Wilson, 2025). State governments have also contributed to the installation of chargers; for instance, the New South Wales government have recently boosted their funding by $3.2 million to rollout a further 159 charging stations across regional New South Wales (Sharpe et al., 2025).

Technological advancements and investment into EV infrastructure poses a challenge for EV technicians to participate in ongoing training. Continual training in this evolving space will ensure that they can work safely and their skills remain relevant.

SEGMENT 7

9. DISMANTLE AND RECYCLE

The segment

Batteries don't last forever. As the battery industry matures, more used batteries will become available. While some batteries may be dismantled, others can be repaired or repurposed for other applications. There are significant environmental benefits to battery cell repair, repurposing, and recycling. Batteries are prevented from being disposed of into general waste, where they can cause fires or leach harmful chemicals into the soil and waterways. Valuable materials with a high carbon/environmental footprint can also be recovered, engaging in better circular economy practices. These practices are an investment in future generations.

Battery repair

In some battery packs, a single cell or collection of cells may fail. If these cells are removed and replaced with functioning cells, then the full capacity of the battery pack can be restored at minimal cost. Repair can sometimes be difficult: In some commercial packs, proprietary cells are used, cells may be welded to current collectors or heavily integrated with structural, cooling and electrical components. This can make it harder to replace individual cells, and in turn make battery repair more costly and difficult.

Battery repurposing

As the battery gets used over time, they may have a reduced capacity and fail to store as much energy as when new. This is due to chemical changes and degradation of the battery. Products requiring high performance may have restrictions on the extent of use. For instance, batteries in an EV should be replaced once their capacity dips to below 70 – 80% of their original capacity (DISR, 2024c). However, these batteries may still be valuable for other purposes such as providing power in off-grid BESS.

Programs such as the Battery Stewardship Council's (2025) B-cycle program aim to make battery recycling easier and more readily available in Australia. The council accredits battery collection and recycling services for both metropolitan and regional areas. OEM are increasingly offering their own stewardship programs, and these companies receive and safely dispose of their battery products.

The market for repurposing EV cells and batteries have continued to develop and businesses that repurpose used EV batteries have been able to produce commercially viable products from them. For instance, the business MyNu Energy use retired EV batteries to create towable BESS trailers up to 160 kWh and storage containers up to 1 MWh (MyNu Energy, 2025). Infinitev also use retired EV batteries to make scalable BESS up to 2.4MWh (Infinitev, 2025). As more EVs continue to enter the Australian market, more opportunities for commercialisation of used batteries will lead to a greater number of manufacturers in this space.

BESS dismantling

Similar to BESS installation and maintenance, if a large BESS unit needed to be dismantled, there would need to be a team of specialised technicians, labourers, and machine operators to assist with decommissioning and demolition. However, these teams would have a greater focus on collecting waste and remediating the removal site, to avoid damage to the surrounding ecosystems.

Battery recycling

Recycling starts from collection to prevent fire risks from incorrect disposal of batteries. Used batteries are packed in fireproof boxes and transported to specialist recycling facilities where they are de-energised, and disassembled. The wiring and electronics of the battery are sent to metal recyclers while plastic components are sent to plastic recyclers. The battery cells are sorted by chemistry type and shredded or set aside for remanufacturing; the metal foils are recycled locally, while the remaining 'black mass' is made available for processing (Battery Stewardship Council [BSC], 2023).

In recent years, battery recycling facilities have evolved to address challenges within the battery recycling landscape. The world's first 'battery-in-devices' shredding plant was launched in Melbourne by EcoBatt, which can recycle batteries without needing to manually remove them from the device (Taylor, 2025). This addresses recycling challenges associated with embedded batteries in devices such as mobiles, earphones, and power tools.

The increased capacity for battery recycling in Australia has resulted in joint collaborations with international EV manufacturers. In the past year, Livium expanded the scope of its collaboration with BYD to include BESS on its existing EV battery repurposing deal (Heynes, 2025b). Similarly, EcoBatt have also partnered with BMW to recycle batteries from their vehicles (Hill, 2025).

Battery recycling policies have also evolved; for instance, the Battery Stewardship Council redesigned the B-cycle scheme to scale with external funding, participation, and scope of work (BSC, 2025).

Workforce description

Job opportunities in the Li-ion battery dismantle and recycle segment are emerging as the industry itself is still emerging.

Electrical skills will be in high demand in the decommissioning and testing stages of end-of-life. These skills will be acquired through TAFE training pathways. However, additional training will be required in the safe handling and emergency procedures for Li-ion batteries at end-of-life.

The job opportunities for battery dismantling and recycling are still emerging as the industry grows, but there are still roles that are highly valued within this space. Electrical tradespeople will be in high demand for the decommissioning and testing of batteries at their end-of-life stage.

A sample of ten typical roles in the dismantling and recycling industry can be found below.

ANZSCO	Occupation	Qualification Type	Status
233112	Materials Engineer	Higher Education	No Shortage
234211	Chemist	Higher Education	No Shortage
251312	Occupational Health and Safety Adviser	Higher Education	No Shortage
311411	Chemistry Technician	Vocational Education	No Shortage
312611	Safety Inspector	Vocational Education	No Shortage
341111	Electrician (General)	Vocational Education	Shortage
342313	Electronic Equipment Trades Worker	Vocational Education	Regional Shortage
621911	Materials Recycler	Vocational Education	No Shortage
711911	Chemical Production Machine Operator	Vocational Education	No Shortage
839918	Recycling Worker	Vocational Education	No Shortage

Aligned national training packages

The table below lists aligned training packages within the dismantling and recycling industry.

Code	Training Package	Governing Jobs & Skills Council
AUR	Automotive Retail, Service and Repair	Mining & Automotive Skills Alliance
CPP	Property Services	BuildSkills Australia
MEM	Manufacturing and Engineering	Manufacturing Industry Skills Alliance
MSL	Laboratory Operations	Manufacturing Industry Skills Alliance
PMA	Chemical, Hydrocarbons and Refining	Manufacturing Industry Skills Alliance
TLI	Transport and Logistics	Industry Skills Australia
UEE	Electrotechnology	Powering Skills Organisation

Nationally recognised training

Below lists nationally recognised training relevant to the dismantling and recycling industry.

AUR - Automotive Retail, Service and Repair	
Qualifications	
AUR30320	Certificate III in Automotive Electrical Technology
AUR30620	Certificate III in Light Vehicle Mechanical Technology
AUR32721	Certificate III in Automotive Electric Vehicle Technology
CPP – Property Services	
Qualifications	
CPP30719	Certificate III in Waste Management
CPP40919	Certificate IV in Waste Management
MSL – Laboratory Operations	
Qualifications	
MSL30122	Certificate III in Laboratory Skills
MSL60122	Advanced Diploma of Laboratory Management
PMA – Chemical, Hydrocarbons and Refining	
Qualifications	
PMA20116	Certificate II in Process Plant Operations
PMA30120	Certificate III Process Plant Operations
PMA40116	Certificate IV in Process Plant Technology
TLI – Transport and Logistics	
Qualifications	
TLI31222	Certificate III in Driving Operations
TLI40324	Certificate IV in Supply Chain Operations
UEE – Electrotechnology	
Qualifications	
UEE30820	Certificate III in Electrotechnology Electrician
UEE42622	Certificate IV in Hazardous Areas – Electrical

Workforce distinctives

Dismantling batteries require both electrical and mechanical skills. Workers also need to understand safety risks, especially thermal runaway as batteries are most likely to be deteriorating at their end-of-life stage. Battery recyclers will usually either collect batteries themselves or work with trained transport operators who know how to safely handle old Li-ion batteries. Companies that transport battery materials must comply with state and territory legislation under the Australian Dangerous Goods Code (National Transport Commission, 2024).

The battery recycling industry both nationally and internationally is still progressing. Best practice continues to evolve and research and development into this space continues. It is advised that industry keep up to date with dismantling and recycling knowledge as understanding of this field grows.

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ACRONYMS

A	Amps
AI	Artificial Intelligence
AQF	Australian Qualification Framework
BESS	Battery Energy Storage System
BMS	Battery Management System
CAM	Cathode Active Material
DC	Direct Current
ESG	Environment, Social, and Governance
EV	Electric Vehicle
FIFO	Fly-in, Fly-out
GW	Gigawatts
GWh	Gigawatt-hours
HVAC	Heating, Ventilation, and Air Conditioning
ICE	Internal Combustion Engines
ICT	Information and Communications Technology
kW	Kilowatts
kWh	Kilowatt-hours
LCO	Lithium Cobalt Oxide
LFP	Lithium Iron Phosphate
Li-ion	Lithium-ion
LMO	Lithium Manganese Oxide
LNCO	Lithium Nickel Cobalt Oxide
MASA	Mining and Automotive Skills Alliance
MWh	Meawatt-hours
NCA	Nickel Cobalt Aluminium Oxide
NEM	National Electricity Market
NMC	Nickel Manganese Cobalt
OEM	Original Equipment Manufacturers
P-CAM	Precursor Cathode Active Material
PSO	Powering Skills Organisation
RTO	Registered Training Organisation
SAA	Solar Accreditation Australia
STEM	Science, Technology, Engineering, and Mathematics
TAFE	Technical and Further Education
V	Volts
V2G	Vehicle-to-Grid
V2H	Vehicle-to-Home
V2X	Vehicle-to-Everything
VET	Vocational Education and Training
VPP	Virtual Power Plants
WHS	Workplace Health and Safety

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