

**SKILLING
THE ENERGY
TRANSITION**

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As the Clean Energy Council accelerates the transition to a clean energy future, we respectfully acknowledge Aboriginal and Torres Strait Islander people as the Traditional Custodians of the lands and waters on which we work and live. We commit to collaborate with First Nations communities, to promote sustainable practice, protect ancient sites and culture with equitable access to the benefits of clean energy. Sovereignty has never been ceded. We acknowledge Elders, past and present, and their continuing culture and connection to Country.



EXECUTIVE SUMMARY

The Australian clean energy sector is now preparing for a period of extraordinary growth and development as Australia accelerates towards a fully clean energy power system and positions itself as a global clean energy superpower. The latest Integrated System Plan from the Australian Energy Market Operator outlines the case for building 141 gigawatts of large-scale wind and solar capacity, 63 gigawatts of storage and hydro capacity and 69 gigawatts of small-scale solar and household batteries by 2050. This reflects a massive step change in the deployment of clean energy and will require significant growth in the clean energy workforce to ensure that the skilled workforce is in place to deliver these projects in a sustainable, safe and efficient way.

This presents a significant risk and vast opportunity for Australia. The sector currently employs around 30,000 people across large-scale renewable energy construction, operation and maintenance and small-scale rooftop solar design and installation. There are already shortages across many aspects of the existing workforce, particularly in fields such as engineers and electricians. This risks inhibiting the enormous potential for job creation in clean energy over the coming decades.

A collaborative and coordinated approach is now required across governments, education and training bodies, unions, regional development bodies, and the clean energy industry to deliver a pathway into the clean energy workforce to ensure Australia has the workforce to become a clean energy superpower. These pathways include:

- University education
- Vocational education and training (VET)
- Transitioning from another relevant industry
- Migration

This report explores these pathways and provides a set of clear recommendations to address existing barriers that limit the pool of skills and talent entering the industry. Delivering on these recommendations will require a concerted and coordinated effort, but it will deliver tens of thousands of quality jobs across Australia and deploy the low-cost, clean and reliable power that is key to our long-term economic success.

The following six recommendations are made to address the current and growing skills gaps across the clean energy industry.

C

Calibrate higher education to meet clean energy industries' interests

Realigning higher education funding models with industry needs, particularly around engineers, is an important first step. However, given the fast-changing nature of industry, universities and industry players need to collaborate to achieve mutual benefits across research and teaching.

A

Anticipate clean energy workforce needs

Federal and state governments should work together to capture and ensure integrity of data on the energy workforce. Projections should be embedded in the Australian Energy Market Operator's Integrated System Plan.

R

Raise the profile of working in clean energy as an opportunity for all Australians

Increased visibility is key to attracting a larger pool of talent. The career opportunities and talented existing workforce should be made more obvious, and diversity within the workforce should be championed.

E

Establish a Transition Authority

The Federal Government should establish a Transition Authority to work with all levels of government to support and coordinate local efforts and community led initiatives, and to map career pathways into emerging sectors within each region.

E

Enhance the VET sector's capacity to understand and meet the demands of industry

Federal and state governments should provide strategic support and resources for training organisations to respond to industry needs. Industry should present a unified and clear sense of its skills and training needs and work closely with training organisations to deliver them.

R

Raise the international profile of Australia as a centre of clean energy expertise

The Federal Government, possibly in collaboration with interested state governments, should look to position Australia as a global leader in energy expertise to attract relevant professionals plus aspiring young minds to higher education.



The right people with the right skills and experience in the right places ensure that the clean energy sector can meet the challenge of Australia's energy transition.

INTRODUCTION

Over the last 10 years, the share of renewable electricity generation in Australia has doubled, rising from 15 per cent in 2013 to 33 per cent in 2021. A strong and skilled workforce supports the growing sector, ensuring it remains robust, resilient and agile in the face of change.

However, skills shortages – such as Australia's lack of electricians and engineers – are putting pressure on clean energy projects.

Existing and worsening skills shortages are the result of multiple factors:

- As a relatively new sector, the renewable energy industry is still a mystery to many Australians. What are the jobs in clean energy? Where are they? What are the required skills and attributes? What are the pathways into those jobs?
- Many of the roles are regional or remote, which often limits the pool of interested candidates.
- There have been reports of poor treatment of construction workforces on some projects, particularly solar farms.
- Uncertain policy settings and tight operating margins have meant that the clean energy sector has struggled to compete with more established (and subsidised) sectors on salaries and entitlements.

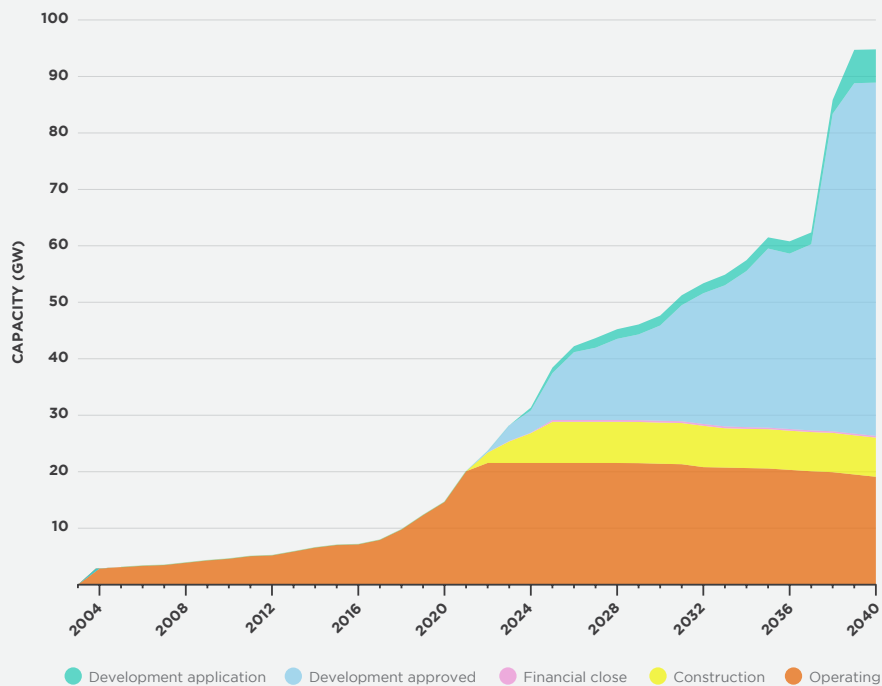
- A slow and unwieldy VET system has been a brake on the development of relevant and meaningful qualifications for electrical and mechanical tradespeople in renewable energy.
- Australia's enduring STEM (science, technology, engineering, mathematics) crisis threatens clean energy project developments, which rely heavily on STEM-based skills.
- Without policy certainty, clean energy employers and the sector as a whole have not been able to invest heavily in an education and training framework to address these market failures.

COVID-19 and subsequent national and state border closures have disrupted labour markets and heightened workforce pressures. With limits to international travel, specialist skills could not be sourced internationally. Workers with skills already in low supply could not move freely between projects in different Australian states.

As we emerge from these measures, it will not be plain sailing. Australia's post-COVID recovery relies on public infrastructure projects that will compete for many of the same construction and technical skills needed in clean energy. In addition, as international borders reopen, a booming Asia Pacific renewable energy industry will compete for Australian talent.

Now is the time to take stock and put in place measures to ensure that people and jobs are a focus of Australia's energy transition.

Projected utility-scale clean energy project growth: 2021-40



ANTICIPATED GROWTH IN THE CLEAN ENERGY WORKFORCE

In recent years, the Australian clean energy boom has resulted in skills shortages that will deepen as the sector continues to grow. According to the Clean Energy Council's *Clean Energy at Work* report – the first comprehensive study into employment in the Australian renewable energy industry – there were around 25,000 people working in the sector in 2020¹.

Based on steep and continued growth in rooftop solar and several new large-scale generation projects, that workforce is now estimated to be closer to 30,000.

If all projects in the pipeline go ahead, we expect an additional 50,000 jobs. The growth trend in utility-scale renewable energy projects is expected to continue over the next two decades. Adding to this is the growth in distributed energy resources (DER), primarily rooftop solar systems and household batteries.

There is a strong drive to concentrate renewable energy developments in renewable energy zones

(REZs) to facilitate decisions around the construction of transmission and access to the grid. In the design of the REZs, state governments are looking to expand local capacity for manufacturing through ambitious local content settings. This will further increase the demand for local skills to support Australia's energy transition. The coordination of REZs is one way to better anticipate and manage future workforce needs in clean energy.

This report covers jobs in the planning, design, construction, operation and maintenance of renewable energy generation in Australia. It does not include jobs upstream of generation such as supply chain and componentry manufacturing, nor downstream processes enabled by clean energy such as hydrogen or green steel.

It also does not cover transmission. While these jobs are potentially numerous and important in the Australian renewable energy debate and in a clean economy more generally, they are outside the scope of this report.

THE CLEAN ENERGY WORKFORCE

The careers across Australia's clean energy sector are multiple and varied.

Renewable energy employers include developers responsible for planning, negotiating and designing new wind, solar and battery farms. Primary and sub-contractors are involved in the construction and then operation and maintenance of these large-scale projects in civil, mechanical and electrical occupations. In the small-scale sector, rooftop solar design and installation companies operate at residential, commercial and industrial sites.

The clean energy sector consists of people working in Australia's capital cities and in regional areas. There are people on the ground, in offices, operating large machinery, at the top of wind turbine towers or underground at hydro power plants. There are people working with wind, water, the sun and the earth.





A TECHNICAL WORKFORCE

There is a heavy reliance on technical skills, particularly engineers and electricians, in designing, installing, operating and maintaining Australia's clean energy systems. According to the Clean Energy Council's report *Empowering Everyone: Diversity in the Australian Clean Energy Sector*, more than 50 per cent of employment in renewable energy is in engineering-type roles, including electrical and mechanical trades². Some of these roles are highly specialised, such as turbine or blade technicians for the wind sector, geotechnical engineers for the hydro sector or power system modellers for grid connection. As systems age over the coming decades, there will also be a requirement for technical people with specific skills that support the recycling and reuse of clean energy systems.

Just under half the clean energy workforce is in non-engineering fields, including finance, business, law, IT, sales, agriculture, safety, training, communications and community engagement.



A PASSIONATE AND RESILIENT WORKFORCE

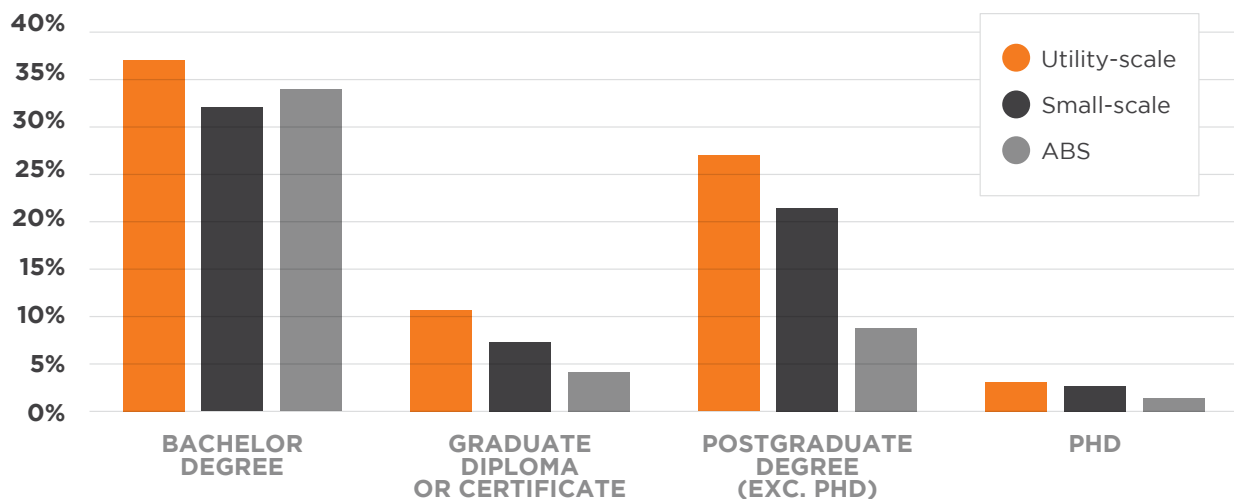
A common thread connecting many people working in the sector is the vision of a decarbonised future. The Australian clean energy workforce consists of people that are passionate, resilient and resourceful. They have the ability and desire to constantly learn and develop, both themselves and the people around them. Importantly, they are problem solvers in an environment where the problems are ever changing and the solutions must be immediate and practical.



A SKILLED WORKFORCE

The Australian clean energy workforce is highly educated and skilled. Compared to the Australian Bureau of Statistics (ABS) figures for the entire Australian workforce, the clean energy sector has a higher percentage of those with graduate, post-graduate and PhD qualifications^{3,4}.

Highest formal qualification held by degreed workforce: clean energy (2021) vs. Australian workforce (2016)

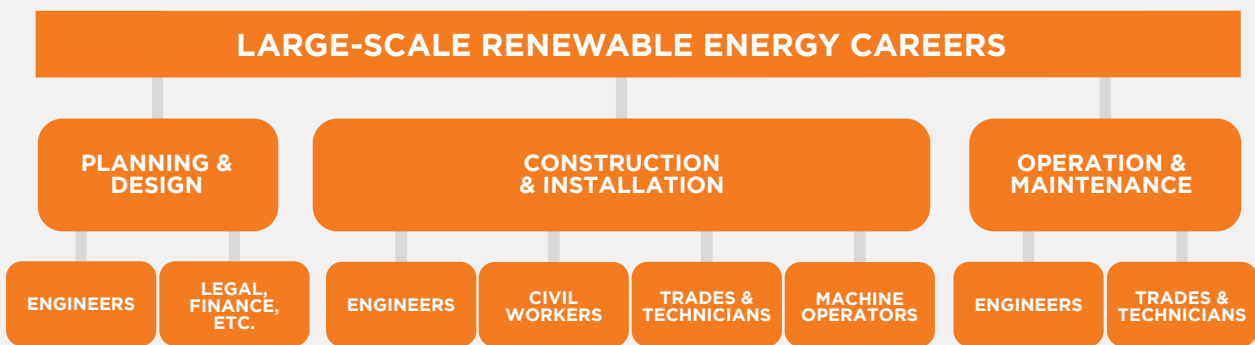


The clean energy workforce can be broadly divided into utility-scale projects and employers on one side and small-scale DER and employers on the other side.

CAREERS IN LARGE-SCALE RENEWABLE ENERGY

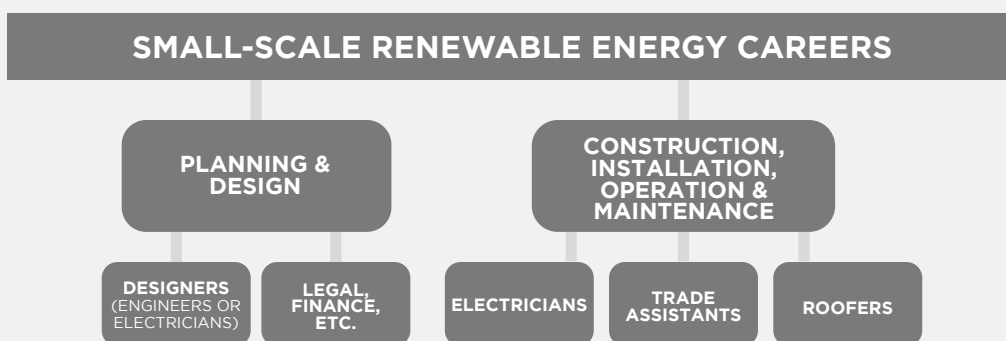
There are several categories of work in the large-scale renewable sector, but they can be crudely distinguished as:

- jobs running the business of renewable energy, including planning and design
- jobs in the physical construction of solar, wind, pumped hydro or battery projects
- jobs in the operation and maintenance of energy generation (and related) technology.



CAREERS IN SMALL-SCALE RENEWABLE ENERGY

Unlike the large-scale renewable energy sector, which mostly comprises organisations employing 200 or more people, the small-scale rooftop solar sector tends to consist of small to medium businesses and sole traders.





SKILLS IN HIGH DEMAND AND SHORT SUPPLY

The clean energy sector currently faces skills shortages. To illustrate some of these, the chart below shows the types of occupations that make up the clean energy industry with a traffic light system highlighting the level of demand for each job type.

DEGREED ROLES

Civil, electrical, power systems and grid connection engineers are highly sought after across all clean energy technologies. In slightly less high demand but also highly valued are mechanical, mechatronics and SCADA engineers. In hydropower, both geomatics and hydropower engineers are prized. In wind power, wind reliability engineers are becoming increasingly hard to recruit.

The typical work experience of an engineer in the sector is eight years. There is substantial mobility of engineers across employers and technologies. Experience in renewable energy is highly regarded as much of the work is targeted at mid-career level operators. However, new entrants to the market are needed to support the anticipated continued growth of renewables.

- Demand is currently adequately met
- Demand is currently mostly met but skill shortages exist in some regions or over some periods
- Demand is not being met consistently and skill shortages exist in most regions
- University education
- Vocational education & training (VET)

| | | WIND | SOLAR | HYDRO | BATTERY |
|--|--|------|-------|-------|---------|
| Asset manager | | ● | ● | ● | ● |
| Battery deployment manager | | | | | ● |
| Battery design specialist - residential | | | | | ● |
| Battery design specialist - utility scale | | | | | ● |
| Battery installation operations specialist | | | | | ● |
| Bids and proposals manager | | ● | ● | | |
| Blade technician | | ● | | | |
| Blade engineer | | ● | | | |
| Civil/civil design engineer | | ● | ● | | |
| Commercial manager | | | | | ● |
| Commercial sales operation and analysis | | | | ● | |
| Community liaison manager | | ● | ● | | |
| Construction manager | | | | ● | |
| Control room operator | | ● | ● | ● | ● |
| Contracts manager | | ● | ● | | |
| Development manager | | ● | ● | | |
| Electrical engineer | | ● | ● | ● | |
| Electrical power systems technician | | | | ● | |
| Electrical superintendent | | ● | ● | | |
| Electrician - solar rooftop accredited | | | ● | | |
| Engineering, procurement, construction (EPC) manager | | | | | ● |
| Environmental scientist | | | | ● | |

The National Skills Commission's *Australian Jobs 2021* report showed that 87.6 per cent of engineering university graduates are employed within four months of graduating⁵; which shows a high level of demand. According to data from LinkedIn, engineers in clean energy are 'very hard' to hire. Over the last year, as many candidates with mechanical and civil engineering qualifications were recruited as electrical project engineers in renewable energy as candidates with electrical engineering qualifications. Similar industries from which there may be an easy transfer of skills include real estate, oil and gas, construction, mining and metals, and manufacturing.

However, it takes more than engineers to support the business of renewable energy.

- Project managers oversee, coordinate and manage key relationships in achieving success with bids, proposals, developments and asset performance.
- Lawyers and finance managers are central to contract management, making the business case for renewable energy and navigating the complex regulatory and compliance environment.
- Sales managers with excellent knowledge of the energy sector support sites with bid and sales expertise, providing information and technical support to maintain relevant technical standards.
- Health and safety managers are crucial to site teams and managers being aware of and minimising risks while creating, maintaining and improving health, safety, environmental and quality standards.

GRID CONNECTION ENGINEERS AND MANAGERS

Grid connection engineers are needed for all renewable energy technologies. They are in high demand and short supply in Australia. They usually hold power systems engineering degrees, are proficient in the use of dynamic medium- to long-term simulation models for complex systems and have a minimum of 10 years of work experience. They have excellent knowledge of the National Electricity Market and compliance requirements of the Australian Energy Market Operator (AEMO) or other network service providers. They are employed by developers, balance-of-plant providers, consultants and AEMO.

| | | | | | | |
|---|--------|---|---|---|---|---|
| Field service technician - electrical | ✂ | | | | | ● |
| Field support engineer | 🎓 | | | | | ● |
| Geomatics engineer | 🎓 | | | | ● | |
| Geotechnical engineer/geologist | 🎓 | | | | ● | |
| Grid connection engineer/manager | 🎓 | ● | ● | | | ● |
| High voltage operator - power generation | ✂ | ● | ● | ● | | ● |
| HV engineer | 🎓 | ● | ● | ● | | ● |
| HSQE manager/officer | ✂ | ● | ● | | | |
| Hydropower - electrical technician | ✂ | | | | ● | |
| Hydrographer | 🎓 ✂ | | | | ● | |
| Hydrologist | 🎓 | | | | ● | |
| Hydropower civil/civil design engineer | 🎓 | | | | ● | |
| Hydropower engineer | 🎓 | | | | ● | |
| Leading hand | ✂ | ● | | | | |
| Logistics coordinator | 🎓 | ● | ● | | | |
| Maintenance technician - electrical | ✂ | | | | ● | |
| Maintenance technician - mechanical | ✂ | | | | ● | |
| Material and procurement specialist | 🎓 ✂ | ● | ● | ● | | ● |
| Mechanical/mechatronics engineer | 🎓 | ● | ● | ● | | |
| Mechanical technician | ✂ | | | | ● | |
| Operation and maintenance (O&M) manager | 🎓 ✂ | ● | ● | | | ● |
| Portfolio manager | 🎓 | ● | ● | | | |
| Power systems engineer | 🎓 | ● | ● | ● | | |
| Project manager/coordinator/engineer | 🎓 | ● | ● | ● | | ● |
| Quality manager/engineer | 🎓 | ● | ● | | | |
| Reliability engineer | 🎓 | ● | ● | ● | | ● |
| Renewable energy engineer | 🎓 | ● | ● | ● | | ● |
| Sales manager | 🎓 | ● | ● | | | |
| SCADA engineer | 🎓 | ● | ● | ● | | ● |
| Site administrator/manager | ✂ | ● | ● | ● | | ● |
| Site installation supervisor | ✂ | ● | | | | |
| Site safety manager | ✂ | | | | ● | |
| Solar farm technician - electrical | ✂ | | ● | | | |
| Solar farm technician - mechanical | ✂ | | ● | | | |
| Structural engineer | 🎓 | ● | ● | ● | | |
| Surveyor | 🎓 ✂ | | | | ● | |
| Talent acquisition specialist | | ● | ● | ● | | ● |
| Technical support engineer | 🎓 | | | | | ● |
| Technical support specialist - electrical | ✂ | | | | | ● |
| Trade assistant | ✂ | | ● | | | |
| Wholesale and trading operations and analysis | 🎓 | | | | ● | |
| Wind technician - electrical | ✂ | ● | | | | |
| Wind technician - mechanical | ✂ | ● | | | | |

- Environmental scientists conduct impact assessments that ensure compliance with environmental regulations and policies.
- Stakeholder liaison managers are responsible for ensuring that the clean energy industry is working with communities to the benefit of all.

TRADESPeOPLE AND TECHNICIANS

There are three workforce categories for tradespeople and technicians in the clean energy industry:

- 1. Construction workforce for large-scale renewable energy projects.** Engineering, procurement and construction companies and their sub-contractors are the main employers in this category. The work is regional and employs several thousands of people from different trades, but the employment is project- and task-based, which means it is generally short term.
- 2. Operation and maintenance workforce for large-scale renewable energy projects.** Large (often global) clean energy developers/owners or asset managers are the employers in this category. The work is ongoing and regional and can be shift work. It may require travel between different sites.
- 3. Small-scale (rooftop) solar and battery workforce.** Smaller businesses (fewer than 200 employees) dominate in this sector. The workforce is employed largely by retailers and contractors in the electrical industry.

Once the design and planning stage of a large-scale project is complete, the physical assets are built and run on the ground by teams of skilled tradespeople, technicians and machine operators, plus labourers. Several hundred people are needed on the ground to build each renewable energy projects. For a solar farm, construction can take up to 12 months, while a wind farm can take 18 months or more to complete. Hydro or pumped hydro can take closer to four or five years. Once a project is complete and producing electricity, the on-site workforce consists of a small team of technicians to manage the physical operation and maintenance of the asset.

In general, technicians with electrical, mechanical or civil backgrounds are highly valued, but specific technologies call for specialised skills or global accredited safety training.

Electricians and other electrical workers represent as much as 20 per cent of the clean energy workforce,

and this figure is even higher in technologies such as rooftop solar or during certain phases of a project. For example, on a solar farm, electricians might represent up to 30 per cent of the construction workforce or more during final commissioning.

The *2021 National Skills Priority List* flagged a shortage of electricians in all states except Queensland and forecast strong future demand in both general and specialist occupations, such as solar installations⁶. Some other key trade roles in clean energy include fitters and turners, fitter-welders, diesel mechanics, line workers and cable jointers, all of which were also listed as facing national shortages with moderate future demand. While roles such as blade technicians in wind power are not listed in the *Australian and New Zealand Standard Classification of Occupations* (ANZSCO), wind farm operators report growing challenges in filling such positions.

In 2020, the Clean Energy Council's *Clean Energy at Work* report noted that a third of respondents in the large-scale sector faced medium to high difficulty in filling quality, health, safety and environment roles. In the small-scale sector, around 40 per cent of respondents faced medium to high difficulties finding electricians, while 25 per cent faced the same difficulties finding appropriately experienced roofers⁷. Across both the large- and small-scale sectors, the primary reason given for recruitment difficulties was a lack of candidates with specific experience in renewable energy. A quarter of respondents indicated that lower salaries were a barrier to recruitment.

MACHINE OPERATORS AND CIVIL WORKERS

The construction of a utility-scale wind, solar, battery or hydro project requires large machinery at various stages of the project. This work is often subcontracted to smaller regional businesses, but experience working in the sector on previous projects is highly regarded. Workers are needed to operate excavators, forklifts, pile machines, bulldozers, cranes and bobcats, while truck drivers and specialist construction drivers are required to ensure the delivery of large componentry.

Civil workers are needed for assembly and in laying some of the foundations. These are often lower skilled jobs, but they can provide exposure to and pathways into higher skilled roles in the sector.



SNAPSHOT - ROOFTOP SOLAR CAREERS

The degreed workforce of the small-scale (or distributed) renewable energy sector consists primarily of engineers and system designers, plus marketing, sales and business managers in both retail and installation. PV design engineers with Clean Energy Council design accreditation are in high demand. In slightly lesser demand are installation operations specialists with two or more years of experience in organising, managing and liaising with installation contractors to ensure the smooth and safe installation of battery and solar systems at the residential level.

However, half the small-scale solar workforce is trade-based and more than a third is made up of electricians, apprentices, electrical trade assistants and roofers with solar expertise. Electricians are in particularly high demand across the country as demand for residential and commercial solar systems continues to grow.

Electricians are often supported by apprentices and trade assistants. The trade assistant role can serve as a pathway to an electrical qualification. Roofers often also support the work of rooftop solar installations. To be a roofer, a trade is needed in building and construction.

The design phase of a solar and/or battery system can be undertaken by either university-qualified engineers or electricians, with the most important factor the end-to-end knowledge of the individual rather than the training pathway. However, installation of the system is always performed by a licensed electrician.

The Clean Energy Council is an accreditation body for rooftop solar and battery designers and installers in Australia.



SNAPSHOT - WIND INDUSTRY TRADE AND TECHNICIAN CAREERS

The construction and commissioning of a wind farm takes around 18 months and calls for hundreds of civil, mechanical and electrical trades workers. Construction and operation of a wind energy project is complex and a range of skillsets is required. Access roads need to be built, large components such as towers and blades have to be transported, foundations must be laid to support turbines, and a range of machinery is involved in the assembly of towers, nacelles and blade segments.

Once construction is completed, more than nine key trade-qualified field-based roles support the operation and maintenance of a wind farm. Roles include wind farm (or turbine) technicians (both electrical and mechanical), blade technicians, high-voltage operators, site installation supervisors and trade assistants.

An electrical or mechanical trade is generally needed for a technician's role in the wind sector. Alternatively, someone with solid experience and competency working with mechanical systems, machinery and problem solving in that context might be able to demonstrate competency before embarking on formal trade qualifications. This is then supplemented by relevant training or work licenses, such as the construction industry white card, a high-risk work license for tasks such as dogging, working at heights, and other safety training endorsed by the Global Wind Organisation. For some technicians, more advanced training is required in industrial rope access.

Wind power technicians in Australia are comfortable working at heights, are willing to live regionally or commute and will travel to different sites on an irregular basis. Shift work is often required. It is a highly skilled and rewarding job looking after elements of construction and then routine, preventative, corrective, and reactive maintenance and operation of turbines or blades on a wind farm.

For the last few years, turbine technicians, blade technicians and electrical roles in the wind sector have been in high demand. According to data from LinkedIn, all of Australia's top wind developers and asset managers had increased recruitment needs for wind technicians, blade technicians and engineers, finding it 'hard' to 'very hard' to fill these roles.

The most relevant industries in terms of transferable skills are construction, mechanical or industrial engineering, oil and gas, mining and metals, and automotive. Anyone with experience or interests in composite materials might also be well suited to a career as a blade technician. A particularity of blade technicians is that they will generally only work up a tower over the summer months, so it is common for these individuals to split the year working in the Northern and Southern Hemispheres following the sun.

EQUITY, INCLUSION, AND DIVERSITY IN THE CLEAN ENERGY WORKFORCE

A diverse and inclusive workforce will attract a larger pool of talent to the industry, which is facing critical skills shortages.

Research suggests that a diverse and inclusive workplace supports a robust and high performing workforce resulting in better organisational outcomes⁸.

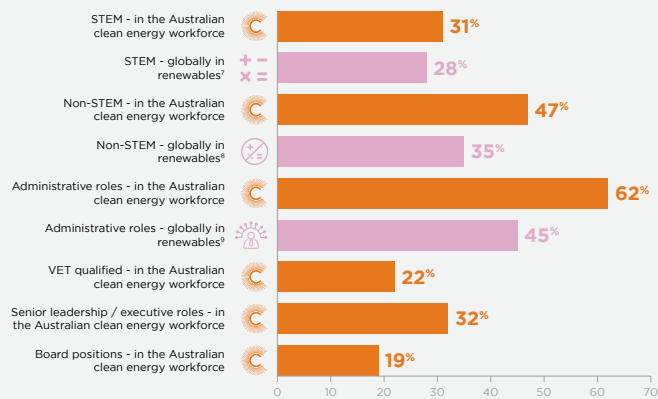
The Clean Energy Council published a report entitled *Empowering Everyone: Diversity in the Australian clean energy sector* in 2021. This report was informed by a 2021 survey undertaken by the Clean Energy Council in partnership with the Electrical Trades Union and the Australian Power Institute on the professional and social identities that make up the Australian renewable energy workforce. The results from the survey showed on average that clean energy employers are inclusive and compare favourably against other industries.



KEY FINDINGS

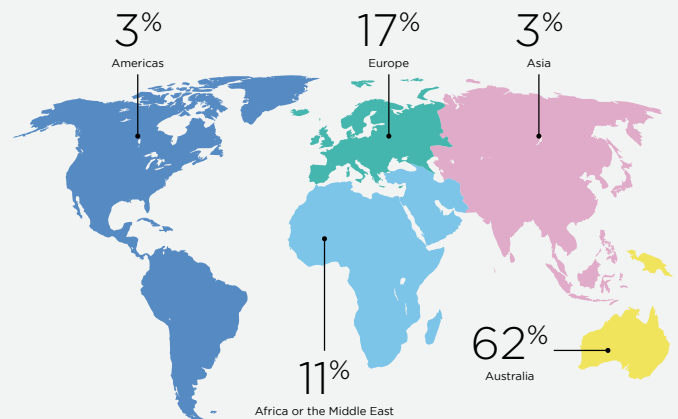
- At 39 per cent, the representation of women is higher across the Australian clean energy workforce than across some other sectors and renewables internationally.
- The workforce is rich in cultural diversity, which is consistent across technologies, gender and employment status.
- The clean energy workforce is highly skilled, with an over-representation of graduates and post-graduates
- The data does not suggest any systemic discrimination against LGBTIQ+ status or cultural background.

FEMALE REPRESENTATION ACROSS CATEGORIES



STEM: Science, technology, environment and mathematics
VET: Vocational education and training

CULTURAL BACKGROUND



Australian Bureau of Statistics, 2016 Census of Population and Housing

AREAS FOR IMPROVEMENT

- Women are underrepresented in senior leadership across the industry. Organisational culture starts at the top, which is where more women are needed.
- Women are underrepresented in both STEM and trades roles. More data is needed to understand barriers to education, recruitment and retention.
- Workers under 30 are underrepresented in the clean energy industry, accounting for only 13 per cent compared to 26 per cent of the Australian working population. More needs to be done to attract and retain young workers in the industry to ensure a robust workforce for the future.
- Aboriginal and Torres Strait Islander employment in the sector is low across the renewable energy industry. Survey findings suggest that 0.8 per cent of the clean energy workforce identify as Aboriginal and/or Torres Strait Islander compared to 3.3 per cent of the Australian population. This needs to be considered in close collaboration and consultation with Aboriginal and Torres Strait Islander communities and organisations.



PATHWAYS INTO CLEAN ENERGY CAREERS AND RELATED HURDLES

The pathways into a career in the Australian clean energy industry are university education, vocational education and training, transitioning from another relevant industry, or migration. Each of these pathways faces obstructions that limit the pool of skills and talent entering the industry.





UNIVERSITY EDUCATION

The clean energy workforce relies heavily on university graduates, with a high proportion also having post-graduate qualifications. According to the *Australia Jobs 2021* report, more than a third of the electricity, gas, water and waste services workforce had a bachelor degree or higher⁹.

Australian universities are thus an important part of supplying the skills needed to support the Australian clean energy industry. However, they are not meeting the demand.

The demand for university-qualified workers within the clean energy sector exceeds supply, with job advertisements outnumbering applicants.

The shortage of university graduates applying for clean energy jobs is due to a combination of reasons relating to both universities and industry.

On the university side, the issues are both quantitative – relating to the numbers of graduates from relevant disciplines – and qualitative – relating to the misalignment of course content with the needs of industry.

The COVID-19 pandemic, which led to Australia's borders closing to international students, has been one driver. According to the Department of Education, Skills and Employment, 441,000 international students were enrolled in Australian universities in 2019¹⁰, accounting for around \$10 billion or 27.3 per cent of overall Australian university revenue¹¹. By 2021, fee paying international university student numbers had dropped by 17 per cent to just 364,000. The decline in international students has affected both total graduation numbers (although this is yet to be felt for longer degrees such as bachelor qualifications) and the sector's overall revenue. The drop in revenue was partly offset by other forms of income, but over the course of the pandemic the Australian university

sector may have lost up to \$2 billion in total revenue¹². As a result, staff numbers have been cut in most universities across both administrative and academic staff¹³. The sector is rebounding quickly, but the abrupt changes have affected the agility of many universities and their ability to deliver the graduates needed to meet changing industry demands.

The pandemic is not the only factor. Australia's enduring STEM crisis has been an issue for innovation and technology-driven sectors for many years. According to data from the Organisation for Economic Cooperation and Development, Australia's output of engineering graduates of 8.2 per cent is among the lowest of all Australian graduates¹⁴. In comparison, German engineering graduates represent 24.2 per cent of all graduates. Australia's higher education sector has undergone more than a decade of both broad and incremental reform measures in attempts to address the misalignment of graduates with industry needs. The most recent of these reforms – the Job-Ready Graduates Package in 2020¹⁵ – compounds the problem, making it less financially attractive for universities to offer STEM units.

An underlying issue is the perceived philosophy that the role of higher education institutions in society is not to prepare individuals for their careers. Rather, universities should produce and disseminate new knowledge and equip individuals with the abilities to further such efforts¹⁶. In this, higher education is differentiated from vocational education, which is targeted at delivering the precise skills needed to undertake a job. The distinction begins to blur in applied degrees such as dentistry, and even engineering. Certainly, both applied and theoretical knowledge types are needed. However, they need not be mutually exclusive. As the shape of our economy and our labour demands is changing rapidly, it is likely that young people entering the workforce now will need to develop completely new skills over their careers. Why not equip them with relevant skills now and the theoretical frameworks for adapting to change so that they can be immediately and ongoingly effective and productive?

Industry must be an equal partner in acknowledging and addressing the shortage of university graduates applying for clean energy jobs. First, the visibility of careers in clean energy is low. There is not widespread understanding of what types of careers support clean energy and how to best prepare for one. This may be because the industry is

relatively new. Most people that work in the sector in 2022 did not start in renewable energy – they came from other sectors. For those people, renewable energy was not a career pathway in its own right, it was a sideways step. It may also be because the sector has grown rapidly. There has not been time to stop and reflect on the responsibilities and opportunities of the clean energy sector as what was initially a collection of innovative and competitive organisations formed into an established industry.

Second, the longstanding energy policy uncertainty in Australia and the tight profit margins that the sector operates within have made it challenging for organisations to invest in medium- to long-term education and training initiatives. Some of Australia’s

solar, wind and hydro developers and owners have developed outreach programs with schools local to projects¹⁷ or have set up scholarships with partner universities¹⁸. These efforts help in securing and maintaining the social license to operate, but they lack a strategic and systematic approach to address the pipeline of skills shortages.

Third, and in some respects linked to the previous point, the employment conditions that renewable energy employers can offer graduates to entice them into a career may not compare well with other sectors. For example, salaries in the clean energy industry are lower when compared to the oil and gas sector. This is true across the globe.

Average annual salary (in \$US) based on six years’ experience: renewable energy vs. oil and gas¹⁹

| | AFRICA | ASIA | AUSTRALASIA | CIS* | EUROPE | LATIN AMERICA | MIDDLE EAST | NORTH AMERICA |
|-------------|--------|--------|-------------|--------|--------|---------------|-------------|---------------|
| RENEWABLES | 54,086 | 49,138 | 101,591 | 45,237 | 63,058 | 43,704 | 53,097 | 80,006 |
| OIL AND GAS | 71,491 | 58,762 | 120,988 | 56,464 | 75,539 | 51,900 | 65,010 | 94,426 |

* Commonwealth of Independent States

Renewable energy projects are also in regional or remote areas that are often either hot, wet or windy, and many jobs require an appetite for regular travel to such locations. In the case of hydropower, the two biggest employers are based mainly in Hobart and Cooma, which may not appeal to career entrants attracted to bigger cities.

In addressing these challenges, universities and industry are looking to work more closely to align education offerings with employers’ requirements. However,

trends in the workforce tend to move more quickly than universities can respond. It can take as long as six years from the concept phase of a new degree design to producing the first graduates. Foresight to better anticipate directions and magnitude of skillset demand in the renewable energy industry (and industries other than renewables) is key to better planning for the tertiary sector. For this, we need strong partnerships at the organisational level and at the broad industry level between the energy and university sectors.



VOCATIONAL EDUCATION AND TRAINING (VET)

Renewable energy would not exist in Australia without the skilled tradespeople and technicians that assemble, build, install, operate and maintain the systems, both large- and small-scale. For these skilled workers, the industry relies on the Australian VET system.

In 2021, 94 per cent of those who completed a trade in Australia were employed. For those with electro technology and telecommunications qualifications, that figure was 97.7 per cent²⁰. Yet electrical apprenticeship enrollments have stagnated for a decade and completion rates have deteriorated.

Clean energy employers face challenges in sourcing appropriately skilled and experienced tradespeople and technicians.

As in higher education, there are failures on both the demand and supply sides in sourcing employees from VET providers. Some of these failures are inherent in the nature and structure of the Australian renewable energy industry and will only be addressed through structural changes. Others are more operational. Regardless, these failures can only be addressed through closer working relationships between industry and VET.

On the demand side, the key issue is in presenting and promoting a career in clean energy as an appealing prospect.

In the large-scale sector, the majority of trade and technical jobs is in the construction phase. These jobs are short term and regional. They are in hot, wet or windy places and are often subject to tight timeframes. The availability of local skills is often stretched by one renewable energy project in the surrounding area, let alone by several co-located energy and transmission projects such as those being rolled out in REZs. Adding to this, media reports around poor labour hire practices²¹ and the treatment of workers on some projects²² have not painted the industry in a positive light, even if such behaviour is not representative of the sector. Renewable energy projects also struggle to compete with public infrastructure projects on salary, many of which have the added attraction of being urban²³.

The industry is working to raise the bar on these workforce supply issues in the construction phase and is also working with local communities to ensure that workforce practices and outcomes are a race to the top rather than a burden on regional economies.

The situation for operation and maintenance careers is different in many respects. They currently represent less than 20 per cent of the workforce, but by 2035, these jobs could account for as much as half of the workforce²⁴. These are ongoing skilled jobs that can provide genuine economic development to the regions. Staff in these roles are directly employed by the asset owner or manager, but again there is low visibility of these jobs. Communities in regional locations have little sense of what ongoing employment opportunities exist on a wind, solar, battery or hydropower site. Training organisations are also unsure of the skills and qualifications to offer locals in preparation for upcoming renewable energy projects in the region.

As a result, there is a hurdle on the training side. Without clear indications of the skills and safety needs of the clean energy industry, training organisations struggle to offer and confidently market entry pathways into the sector, career progression pathways within the sector, or cross-skilling pathways from other sectors such as mining or thermal power generation. To do so, they would need certainty of the specific demand to justify engaging and training electrically skilled and experienced teachers. In the electrotechnology field, there is a widespread shortage of qualified trainers and assessors. This is owed to the lower earning capacity than that of an electrician and the cost and time commitments needed to fully qualify as a trainer.

GLOBAL WIND ORGANISATION TRAINING

The Global Wind Organisation (GWO) has set a benchmark for the industry-acceptable safety standard for the wind sector. The standard outlines the requirements of certain training courses that are delivered by certified training providers. Upon completion of a GWO course, individuals receive a certificate that is accepted by all GWO member organisations as evidence of competence and knowledge of the safety standard. Most of Australia's wind power developers and operators are GWO members, and the list of GWO training providers can be found on the GWO's website²⁵.

The issue runs deeper than the constrained abilities of individual training organisations. The qualifications and competencies available to training organisations through the national accreditation system were designed for traditional energy sectors. They are outdated or poorly contextualised to the needs of renewable energy projects.

For example, the electrician qualification does not require a person to gain any exposure to rooftop solar systems. Such opportunities are available in elective units of competency, but many training organisations do not offer the full range of electives, instead focusing on telecommunications electives for financial or practical reasons. As a result, these skills need to be acquired as a post-trade skill set. This is despite the fact that more than 3 million Australian households now have rooftop solar systems on their roofs.

Although not specific to electrical occupations, the Clean Energy Council's *Clean Energy at Work* report found that candidates lacking specific experience or qualifications for renewable energy was a cause for recruitment difficulties for 48 per cent of large-scale wind and solar companies that responded and 36 per cent of small-scale solar companies that responded²⁶.

While the apprenticeship system is a cornerstone of Australia's trade labour force, its implementation and delivery is often ill-suited to the sector. Whereas a university degree is a gateway to a job in clean energy, vocational education is more often a pathway where the employer is involved early in the process. Most apprenticeships (although differences exist across Australian states in how these are regulated) require a long-term training commitment in which the individual is employed throughout the process and uses the applied aspects of the job to assess and verify competencies learnt in the classroom. Over the course of a four-year electrician's apprenticeship, often the equivalent of only one year worth of requisite competencies can be obtained through a renewable energy employer (whether in the large- or small-scale sector). The remaining skills, such as wiring a house, must be acquired through partnerships with other employers performing relevant activities. Group training organisations (GTOs), who act as a direct employer and rotate the apprentice through relevant host employers, exist to address these situations. However, conflicts in the way GTOs and large-scale renewable energy proponents operate, and a lack of support from apprentice support networks and state training departments, have hampered their abilities to build ongoing working relationships.

Constant reforms to the structure of the VET system, changes to public spending in the sector and the fragmented governance of VET across national and state

responsibilities have not helped to build a flexible, agile and responsive VET system. Most recently, the Morrison Government committed to reforms to the design and delivery of VET qualifications and the way industry engages with the sector through the Skills Reform program²⁷. However, the implementation of the new system was interrupted by the 2022 Federal Election and the subsequent change of government, further adding to the uncertainty and disorder in the sector. How and whether the Albanese Government decides to implement the reforms will somewhat determine the path to progress. What is clear is that injections of targeted funding will not be enough to remedy most of the issues. Understanding of the different modes of operation of the training sector and clean energy industry is needed, as well as frameworks to enable and broker genuine partnerships between them.

CLEAN ENERGY COUNCIL ACCREDITATION FOR SOLAR AND BATTERY DESIGNERS AND INSTALLERS

To claim federal and some state incentives, solar installation companies must ensure that the supervising electrician on an installation job is an accredited installer. The Clean Energy Council offers a series of different types of solar and battery accreditation covering grid-connected systems, off-grid systems and micro wind or hydro systems.

To become a Clean Energy Council accredited solar or battery installer, an installer must be a qualified electrician and have completed certain prerequisite units through a TAFE or private training organisation. The process involves two types of assessment: an online assessment and a practical component to demonstrate competency in the installation of a system. Accreditation is annual, and a certain number of continuous professional development points must be earned through approved training each year for the accreditation to remain valid. More information on the types of accreditation, the accreditation process and training organisations that offer prerequisite courses is available on the Clean Energy Council's website²⁸.

As well as being able to take advantage of government incentives, Clean Energy Council accreditation can provide ongoing technical support and updated information on standards, guidelines and product testing.



CROSS-INDUSTRY MOBILITY

The sector is still young enough that most people working in clean energy didn't start in clean energy.

Bringing experienced talent from other industries contributes to innovation and new perspectives.

Tested ideas from more established sectors can be introduced into clean energy.

With these efforts, the industry gains resilience and agility and may develop relationships with organisations in tangential sectors.

However, clean energy employers clearly value experience within the sector. Demand for talent is highest at the mid-career level – around 8 to 10 years – which suggests that previous experience in the sector is highly regarded. As the labour market continues to tighten, experience in

CROSS-INDUSTRY OPPORTUNITIES FOR BLADE TECHNICIANS

Blade technicians are important members of a wind farm's operations and maintenance team. They are responsible for inspecting, maintaining and repairing wind turbine blades that can be damaged by dirt, general fatigue or weather events such as rain, hail or lightning strikes. Wind turbine blades are built using a combination of advanced innovative materials, including polyester, fibreglass, carbon fibre, Kevlar and epoxy. Knowledge of and experience working with composites is therefore required. Technicians from marine or aerospace industries would be well suited. The work is done at heights with rope access and suspended platforms. Mostly, it is regular work on a roster (outside of urgent call outs) but is not done in cold or icy conditions. As such, it's the ideal job for anyone wanting to chase the summer.

a different sector is increasingly valued if the role can be shown to have similarities.

According to the *2022 Global Energy Talent Index*, 21 per cent of the global renewables workforce joined from a different sector, with almost a third from oil and gas and a third from the power sector²⁹. A LinkedIn review of Australians employed in four renewable energy roles chosen across the spectrum of technologies and job types – electrical engineer, development manager, wind farm technician and community liaison manager – showed talent flowing from and to such diverse sectors as plastics, oil and gas, public safety, investment management, manufacturing, construction, mining and metals, automotive, recruitment, government, and health.

The key to attracting talent and skills from such sectors relies on multiple factors, many of which relate to working conditions. On salary, the renewable energy sector is competitive but may not offer the high salaries of some other engineering-based industries. Similarly, the project-based nature of much of the work and the regional locations of sites can be a deterrent to many. However, according to the *2022 Global Energy Talent Index*, career progression was the primary motivation for switching sectors, with 31 per cent of respondents seeing it as a priority³⁰. In this, the industry can do better to map into and within the sector and publicise those career opportunities. Visibility of opportunities is the first step.

To attract talent, being good is as important as doing good.

An organisation's environmental, social and corporate governance (ESG) is also seen as important, with 15 per cent of respondents in the *2022 Global Energy Talent Index* citing it as a drawcard³¹. However, being a contributor to decarbonisation is not enough to score highly in ESG. Social credentials are also key.



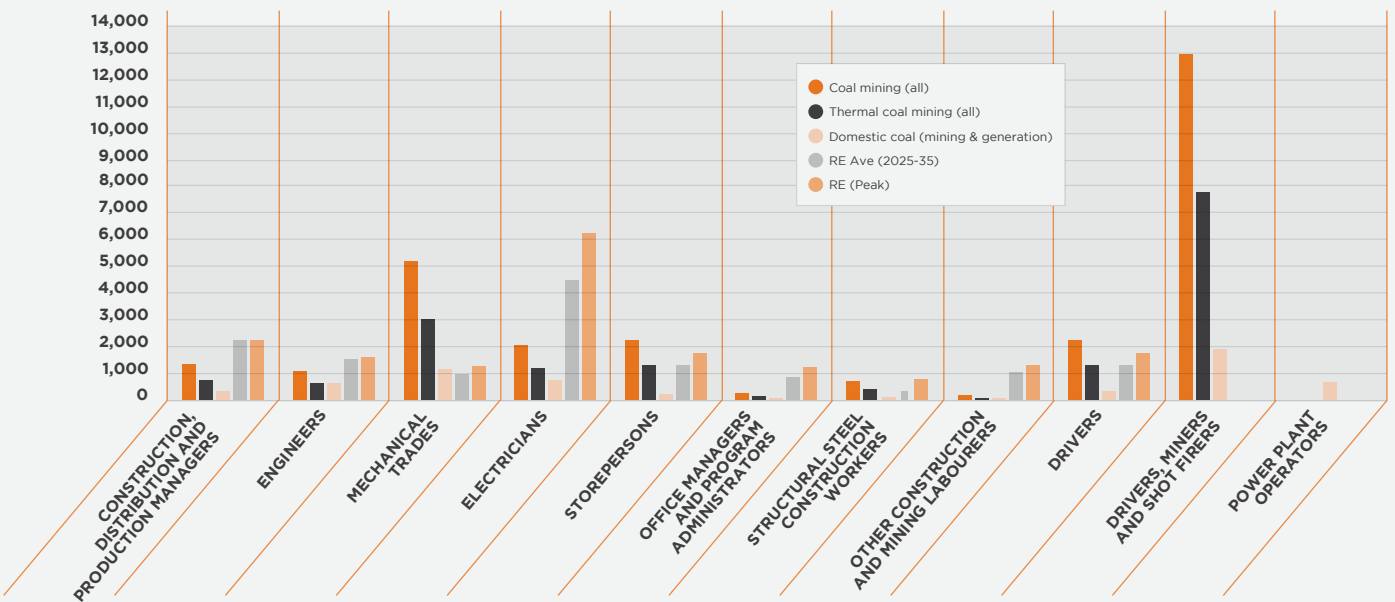
SNAPSHOT - SUPPORTING COAL WORKERS

The thermal energy industry has many of the engineering and technical skills and capabilities that are needed to support renewable energy. There is strong appetite from renewable energy developers, engineering, procurement and construction companies, and asset managers to recruit from these sectors. However, there are at least four barriers to overcome at the employment level, without even bringing in barriers from the social and community level.

1. Not all those employed in the thermal energy sector are interested in transitioning to renewable energy for many of the reasons discussed earlier in relation to average remuneration and different work patterns and arrangements. The previously noted lack of visibility of roles and the subsequent hampering of the VET sector is also an element in this reluctance.
2. The locations of proposed REZs and projects are not completely aligned with coal regions. While there is some overlap, many REZs are outside coal regions.

3. The majority of jobs currently are in short-term construction work, which is not a welcome substitute for ongoing work in a coal plant or mine.
4. The skills overlap between coal and renewables is imperfect, as seen in the below graph. In clean energy, there is no need for skills related to drilling, mining and shotfiring, and limited need for mechanical trades. However, electricians, engineers and drivers are good matches.

In *Roadmap for a Renewable Energy Future: Federal Election Policy Recommendations*, the Clean Energy Council contends that communities affected by the closure of coal need honesty, certainty, options and support³². Certainty relates primarily to timelines and processes, but the clean energy sector can also help to provide certainty around elements such as career options and cross-skilling pathways. The emerging offshore wind industry in Victoria and NSW may provide some opportunities.





INTERNATIONAL TALENT

According to a 2021 survey of the clean energy workforce conducted by the Clean Energy Council, the Australian Power Institute and the Electrical Trades Union, cultural diversity is rich in the clean energy sector. At 32 per cent, almost a third of the workforce was not born in Australia³³.

The Australian clean energy sector spawned from the European, American and Asian markets.

Many renewable energy proponents with a presence in Australia are global organisations headquartered in Europe, the US or China. It is common and logical for a new industry in Australia to form its roots through migration of skilled people from countries that are more established in that industry. Similar developments and migration are being seen in the establishment of offshore wind and electric vehicles.

Prior to the COVID-19 pandemic, mobility across countries within the same renewable energy organisation and between competitors was high. The blade technician role (see page 23) is a case in point. Most of the work in that role is carried out only in the summer months. As a

result, there was once regular traffic of such technicians between the Southern and Northern Hemispheres.

As well as new skills, Australia is also facing forgotten skills.

It has been decades since Australia has undertaken large and widespread transmission construction projects. As a result, we will likely need to import some of these skilled workers in the short term. The same is true of hydropower. Hydro Tasmania had the foresight to retain its civil and geotechnical engineering knowledge and capabilities through the creation of its consultancy arm, Entura, but Australia will still likely need to import civil and geotechnical engineers with dams expertise to meet demand.

Although Australia is considered an expensive place to live, it compares well internationally on salaries. As shown in the below table, when it comes to annual salaries, Australasia tops all regions. On day rates for contract workers, Australasia is second to North America.

Empowering Everyone: Diversity in the Australian Clean Energy Sector suggested that 17 per cent of Australia's clean energy workforce has a European background, 11 per cent has an African or Middle Eastern background, and just 3 per cent has an Asian background³⁴. This raises the question of whether there is a problem among clean energy employers in understanding and recognising foreign qualifications from our closest neighbours in Asia Pacific.

Average annual salary and contract worker day rate (in \$US) based on six years' experience³⁵

| | AFRICA | ASIA | AUSTRALASIA | CIS* | EUROPE | LATIN AMERICA | MIDDLE EAST | NORTH AMERICA |
|--|--------|--------|-------------|--------|--------|---------------|-------------|---------------|
| AVERAGE PERMANENT WORKER ANNUAL SALARY | 54,086 | 49,138 | 101,591 | 45,237 | 63,058 | 43,704 | 53,097 | 80,006 |
| AVERAGE CONTRACT WORKER DAY RATE | 374 | 391 | 522 | 260 | 532 | 296 | 505 | 571 |

* Commonwealth of Independent States

HYDROPOWER ENGINEERING ROLES

Hydrologists, hydropower engineers, geologists and geotechnical or geomatics engineers are specialised roles that are critical to hydropower. Engineers with pumped hydro expertise are also thin on the ground. These types of roles call for expertise in geographical information systems, climate projections and modelling, hydrological modelling, and geomechanical survey data collection and analysis. A decade of on-the-job training and experience is needed to be effective in some of these senior roles.

According to research by Engineers Australia, migrant engineers perceive a number of barriers to employment in Australia. These include the importance that Australian businesses place on Australian experience, the lack of recognition of foreign qualifications and that international experience is not valued³⁶.

One untapped class of often skilled and experienced migrants are refugees. Deakin CREATE (the Centre for Refugee Employment, Advocacy, Training and Education) echoes the findings from Engineers Australia around qualifications and overvaluing Australian experience. Deakin CREATE cites unconscious biases, a lack of local networks, English language skills, employers' poor understanding of migrant working rights under different categories of visas, and the perception that it is 'too difficult' to navigate visa issues as additional barriers to meaningful employment for refugees³⁷.

At the same time, Australian employers looking to sponsor skilled migrants in a targeted manner to fill specialist vacancies have found the visa process slow and inefficient. Offering permanent residency can be a way to attract highly skilled candidates, but employers have cited examples of the permanent residency processes taking more than 12 months. The faster option is the '482 visa', but this is less of a drawcard for international applicants. Further, the Labour Market Testing process for 482 visas requires employers to re-advertise the role for 28 days after an appropriate candidate has been identified. Employers also incur additional fees that make the total cost comparable to that of permanent residency. The process is thus time consuming and impractical in the current competitive labour market.



HAVING SKILL IN THE GAME:

RECOMMENDATIONS

To tackle the skills crunch, foremost the clean energy sector needs policy, and therefore investment, certainty: clear targets, strong leadership and genuine collaboration. Beyond that, Australia needs to clear the way for career entrants looking to navigate any of the four pathways into the renewable energy industry. Each pathway could be made wider, more visible and

more direct with the right policy settings and cross-sectoral collaboration.

Presented by means of the appropriate acrostic 'CAREER', six areas of focus are recommended to ensure that we are skilling the energy transition today and into the future.



Calibrate higher education to meet clean energy industries' interests

Realigning higher education funding models with industry needs, particularly around engineers, is an important first step. However, given the fast-changing nature of the clean energy industry, universities and industry players need to work closely together and collaborate to their mutual benefit across research and teaching.

Renewable energy projects and employers are widely distributed across Australia. There are more than 40 Australian universities with campuses across the country. Australians are generally prepared to relocate to attend their preferred university. By extension, it is not uncommon for graduates to move with the jobs on offer. However, often graduates from regional universities tend to stay local. As many jobs in clean energy are regional, there could be genuine opportunities for graduates from regional universities. A strategic approach is needed that considers the distribution of universities and clean energy projects, as well as the different academic fields that serve the different stages of the industry.

The Clean Energy Council supports the recommendations of Engineers Australia's report *Strengthening the engineering workforce in Australia*³⁸ to attract more engineering students and provide support to increase Engineering graduation rates.

- The **Federal Government** should revisit higher education funding models to better align them with industry needs. These needs would be informed by mechanisms established to better anticipate workforce needs (the 'A' in CAREER).
- **Federal and state governments** should facilitate and incentivise closer relationships between universities and industry players and establish frameworks for effective communication between them. This would be founded on data around projected numbers and types of careers. The Clean Energy Council can assist in brokering these relationships and in providing platforms to share experiences.
- **Australian clean energy employers and universities, with the support of Federal and state governments**, should look to offer strategic industry-wide graduate programs for key occupations (such as grid connection engineers) and key demographics (such as women), plus offer internships at second, third and fourth year of an undergraduate degree.
- **Australian universities** should welcome active involvement from Australian clean energy employers in designing and delivering teaching for relevant qualifications.

A

Anticipate clean energy workforce needs

The Australian Bureau of Statistics publishes employment figures for renewable energy activities, but these are estimates based on secondary information rather than surveys. Census data is collected in an aggregated manner that does not help to understand the characteristics of the clean energy workforce specifically. This is why the Clean Energy Council commissioned the first comprehensive survey of the clean energy workforce in 2020. We cannot manage what we cannot measure.

The Clean Energy Council's survey findings, published in the *Clean Energy at Work* report³⁹, provided a baseline and indication of the peaks in demand expected over the next several decades plus some sense of the fluctuation in that demand. It provided insight into the general trend in the types of jobs and their characteristics. To help understand the composition of the workforce in terms of workers' social and professional identities, the Clean Energy Council undertook a survey in 2021 and published the findings in *Empowering Everyone: Diversity in the Australian Clean Energy Sector*⁴⁰. However, what is needed to manage the workforce from the perspectives of place and time is a national set of data with projections linked to relevant scenarios.

Some of this work is happening at the state level in an uncoordinated manner. In the context of the NSW REZs, the NSW Renewable Energy Sector Board commissioned a series of research projects into the skills and training needs of the clean energy sector and the impacts of renewable energy (and transmission) projects and its associated supply chain. The Victorian Government has commissioned two pieces of research on the likely jobs and skills needed to support clean energy through the auspices of the Victorian Clean Economy Jobs and Skills Taskforce and through the work of the Department of Environment, Land, Water and Planning. The Tasmanian Government has also undertaken some work through the Energising

Tasmania project. However, there has been no harmonisation of these efforts, nor any regard for the competition for labour across borders when projects are announced concurrently.

The Federal Government recently announced its Australian Energy Employment Report project, which will be a national survey of organisations in the Australian energy sector to understand jobs, people and their skills, and to estimate where and what these jobs might be in the future. While this is a welcome development, it is not enough.

- **State governments** should coordinate their workforce needs by sharing information and harmonising their requirements for local employment, apprentices and local supply chain through the REZs, rather than competing. The **Federal Government** could play a role in brokering such an arrangement.
- The **Australian Energy Market Operator** should be required to include workforce projections in its Integrated System Plan scenarios so that constraints can be placed on the rapid change in labour demand, whether up or down.
- **Federal and state governments** should include workforce projections in all public infrastructure announcements. Such announcements should include indications of how labour demands interact with other projects in the same region and how they will be accommodated.
- The **proposed VET Industry Clusters** should be required to report periodically to a central body, such as the proposed Jobs and Skills Australia, on skills and training needs projected over a rolling decade.
- The **Federal Government** should fund research into the workforce needs of emerging industries, such as electric vehicles, offshore wind and hydrogen.

R

Raise the profile of working in clean energy as an opportunity for all Australians

Increased visibility is key to attracting a larger pool of talent. The Clean Energy Council has published a series of online resources to help demystify the careers that exist in clean energy and instruct jobseekers in how to prepare for them. This includes mapping skills transferability and mobility from other sectors by occupation. The Clean Energy Council also runs Career Expos that allow students, migrants and anyone interested in a career in clean energy to network and make contacts within the industry.

In addition, the Clean Energy Council is developing and delivering learning and development resources to help fill skills gaps within the industry. This serves to assist jobseekers to upskill to enter the clean energy workforce. It also provides professional development opportunities to the existing workforce.

However, much more can be done to raise the profile of a job in clean energy and to retain existing employees.

- **Australian clean energy employers** should look to understand and recognise international qualifications and experience. The Clean Energy Council can assist with this by providing tailored online resources and discussion forums.

- **Australian clean energy employers with the support of local and state governments** should present to school-aged children living near clean energy projects, such as the proposed REZs, to drive interest in a career in clean energy. The Clean Energy Council can assist with this by providing tailored resources or creating platforms to share experiences.
- **Australian clean energy employers** should ensure that they are meeting the highest standards of ESG and providing appealing work conditions to both attract and retain workers.
- **Australian clean energy employers** should look to offer portable entitlements so that construction workers can envisage a career in clean energy. Employers could also look to establish visible sector-wide benchmarks for employment, safety, skills and training to promote mobility of workers across the industry.
- **Australian clean energy employers** should show and promote inclusion and equity in the workplace. This is an important element of ESG and allows employers to access underrepresented labour groups. The Clean Energy Council is assisting with this by offering scholarships, networking opportunities and mentoring for women, with these programs to be expanded to include other underrepresented groups.

E

Establish a Transition Authority

In *Roadmap for a Renewable Energy Future: Federal Election Policy Recommendations*⁴¹, the Clean Energy Council recommended the establishment of a new authority with at least \$1 billion in funding to invest in transition initiatives in coal communities across Australia. This authority would take the lessons from local experiences in coal communities and act to coordinate and leverage resources and capability across local governments, unions, training providers, universities and regional development

initiatives. An important part of this authority's role would be to map pathways from coal careers into renewable energy careers.

- The **Federal Government** should establish a Transition Authority to work with all levels of government to support and coordinate local transition projects or community led initiatives and to map career pathways into emerging sectors within each region.

E

Enhance the VET sector's capacity to understand and meet the demands of industry

Under reforms instigated by the Morrison Government, a new governance structure will support the VET sector. Part of the reforms redefine how industry engages with the sector through proposed 'Industry Clusters' that are to provide direction and oversight of the national VET system's performance. The arrangement is designed to "improve the speed to market of qualifications and ensure training product development is aligned to skills in demand and meets industry need"⁴².

The Albanese Government has indicated that it will support the major elements of the new Industry Cluster arrangement, but there will likely be some modifications. In the immediate post-election period, there remains uncertainty as to which parts will be modified and how. There is also uncertainty as to how effectively the new arrangements will match training to industry needs. If they are effective, this will go some way to bolstering the VET sector's capacity to understand and meet the demands of industry, but more is needed.

Closer relationships are needed between training organisations and industry players. This could be facilitated by a consistent and coherent industry presence. For this, industry players would come together to agree on, harmonise and guarantee portability across employers of training expectations, experience and entitlements.

To do their part, training organisations need support to ensure that they have the right equipment and skilled trainers. In *Roadmap for a Renewable Energy Future: Federal Election Policy Recommendations*⁴³, the Clean Energy Council recommended that the Federal Government establish a \$200 million clean energy skills package that offers targeted support for training facilities to undertake initiatives such as purchasing or constructing relevant equipment and infrastructure.

The Clean Energy Council supports the VET recommendations of Tomorrow's Trades to Power Australia's Future by the Electrical Trades Union, Master Electricians Australia and partners..

- The **Federal Government** should offer additional funding for RTOs in Renewable Energy Zones, provide certainty around VET governance arrangements and ensure that these improve the alignment between the delivery of VET and industry skills needs.
- **Federal and state governments** should strategically facilitate and incentivise closer relationships between training organisations and industry players and establish frameworks for effective communication between them. As not all training organisations or regions can specialise in the same areas of expertise, governments can provide strategic oversight by coordinating specialisation across the country.
- **State governments** should review the effectiveness of GTOs and seek to better support them in achieving their stated outcomes.
- **Australian clean energy employers** should look to harmonise their training expectations for key roles in the construction, operation and maintenance of renewable energy projects. The VESI Minimum Skills Matrix provides a salient example. Such a matrix would provide the visibility of training needs that training organisations require, provide construction workers with easy mobility between projects and employers in a region, allow industry-wide management of safety standards, and offer career progression pathways for workers. The Clean Energy Council can assist in instigating the conversation and providing platforms for these.
- **Federal and state governments** should review the requirements for becoming a VET trainer and assessor. They should also explore options to facilitate industry involvement in teaching, such as a more flexible approach than the one-size-fits-all Certificate IV in Training and Assessment.
- The **Federal Government** should establish a \$200 million clean energy skills package.



R

aise the international profile of Australia as a centre of clean energy expertise

Although a heavy focus is and should be on skilling, cross-skilling and upskilling Australians, the need to import workers and students to support the development of clean energy is inevitable, especially in the short term. This would also support Australian universities.

The Federal Government, possibly in collaboration with interested state governments, should look to position Australia as a global leader in energy expertise to attract relevant professionals plus aspiring young minds.

The Clean Energy Council supports the recommendations of Engineers Australia's report *Strengthening the engineering workforce in Australia*⁴⁴ to retain more engineers in the workforce and to assist engineering migrants in gaining meaningful employment.

- The **Federal Government** should fund research to understand deterrents to international candidates moving to Australia to progress their clean energy careers. It is likely that it is not high on the international radar, so a concerted advertising campaign to sell the energy career prospects of Australia would help unlock some opportunities. However, there are also likely to be other barriers. Such research should include an international review of methods employed by nations to attract students and workers to specific sectors. Prominent methods have included pay bonuses after certain periods,

scholarships with work requirements and fast-tracked citizenship opportunities.

- The **Federal Government** should revisit the visas available for talented international candidates and look to make the criteria and process more workable. Transparency is also needed around how decisions are made to target the immigration of skilled people, while trade deals could include fast-track visa processes for relevant international skills, such as engineers.
- The **Federal Government** should address failures that lead to migrants with skills relevant to clean energy not finding meaningful employment in the sector.
- The **Federal Government** should look to attract aspiring students by providing funding for internationally renowned Professorial Chairs in key disciplines, such as Power Systems Engineering. This Chairs could work with entities such as the Clean Energy Council, Australian Power Institute, Engineers Australia and interested Australian universities to raise the visibility of Australia's teaching and research in disciplines relevant to renewable energy technologies. The Chairs could also look to map international qualifications in clean energy against Australia's to ensure that appropriate, visible and cost-effective bridging options exist.

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