

Australia's Clean Energy Workforce

Discussion Paper

April 2023



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About the study

The Australian Government has commissioned Jobs and Skills Australia (JSA) to undertake a capacity study on the workforce needs for Australia's transition to a clean energy economy. The study will provide critical evidence and insights to support the workforce planning, policy development and program design needed to build a strong and vibrant clean energy sector.

The final Terms of Reference for the study were published on 4 April 2023 and are available at Attachment A. These incorporate feedback from state and territory governments, industry, unions, and the education and training sector.

JSA has committed to deliver an interim report to the government in May 2023 and a final report by mid-2023. JSA also intends to publish several accompanying resources over the coming months.

The purpose of this discussion paper is to provide stakeholders, interested parties and the broader community with a sense of the study's scope and approach, and an early opportunity to provide submissions. JSA welcomes feedback on this discussion paper from all interested parties.

Why are we looking into this?

Australia is reshaping the way we generate, use and export our energy. Significant investments in clean energy technology and the electrification of our houses, vehicles and industries will help reduce emissions and cut power costs.

However, this transition will not be possible without a workforce that is equipped with the right skills. Just like any other element of the energy transition, our investment in skills development will take time and proper planning. This is especially important for workers and communities reliant on existing high-emissions intensity industries that require proactive long-term support. The scale of transformation ahead will also require us to create genuine opportunities to increase the participation of women, First Nations Australians, and other historically under-represented cohorts at all levels in the energy sector and traditional trades. These ambitions won't be achieved without effective coordination across education, training, migration, and industry, which has proved challenging to this point.

JSA will contribute its labour market and skills expertise and build upon the work that has already been produced by industry, academia, community advocates and governments. We will also be consulting widely with our stakeholders and partners to understand the widest range of perspectives and experiences. Through this independent study, the Australian Government will have the evidence it needs to make informed decisions about the future clean energy workforce.

What the study will do

The Terms of Reference (Attachment A) outline the full scope of the study:

Define	the clean energy workfor	rce and describe its current s	tate	
Analyse future demand for clean energy workers, and the impact on employment in high- emitting sectors undergoing transition	 Analyse future supply of clean energy workers: What are the skills? Where do these skills exist currently? What are the education, training and migration pathways? 	Identify the enablers and barriers to developing and delivering clean energy education and training	Regional case studies and analysis of place- based success factors	
		Explore opportunities and barriers for women, First Nations Australians, people with disability and Australians from culturally and linguistically diverse backgrounds	International comparative analysis & case studies	
•		Explore sector specific		
Analysis over the next 10, 20, 30 years based on different transition scenarios		faced by small, medium, and large employers		
The study will be supported by extensive consultation and genuine partnerships.				
led by a steering group of industry and technical experts and stakeholders				

Our mandate is to:

- help clarify what jobs and industries make up our clean energy workforce
- understand how different transition scenarios will affect our future workforce needs and impact employment in high-emitting sectors
- explore how the workforce opportunities created by clean energy can be shared across regions and with First Nations Australians, women, people with disability and Australians from culturally and linguistically diverse backgrounds
- identify the education, training and migration pathways that we should be developing, and the underlying system settings needed to enable those pathways.

The study will not look at the merits of particular technologies, projects or investments, or the non-workforce impacts of the clean energy transition.

What is a capacity study?

Capacity refers to our power and ability to do or achieve something within specific constraints. Jobs and Skills Australia's capacity studies will assess the current and future demand for, and supply of, labour and skills in a critical area of the economy. They will also make recommendations on how skill shortages (or surpluses) can be averted, within set time, resource and legislative constraints and government objectives.

JSA has established an ongoing capacity study function, which will:

- bring together subject matter experts, data specialists and people with stakeholder engagement expertise
- be informed by Project Steering Groups, with key stakeholders directly represented
- provide a detailed assessment of labour and skills supply and demand, employment arrangements, and education, training and migration pathways
- produce long-term modelling of future workforce demand and supply.

Definitions and terminology

How to define the clean energy workforce?

Our review of existing studies in Australia and internationally indicates there is no single definition of the clean energy workforce. International research into the 'green workforce' tends to use definitions from sources such as the International Labour Organisation, the United Nations Environment Programme, the U.S. Bureau of Labour Statistics and the World Economic Forum, often adapted to each country's own context.

Table 1 illustrates the breadth and variety of definitions that have been applied. Typically (but not exclusively) definitions seek to capture all activities that contribute to a reduction in carbon emissions, spanning:

- the replacement of fossil fuel based electricity with renewable energy sources including wind, solar and hydroelectricity
- the creation of other alternatives to fossil fuels for manufacturing and transport, such as biofuels
- storage solutions to manage variable power consumption including batteries and hydrogen
- transport activities to replace fossil fuels with alternatives such as electric vehicles and hydrogen
- conversion of technologies in manufacturing, construction and housing from emissions-intensive sources such as coal and natural gas to electricity powered by renewable sources and which do not otherwise generate carbon dioxide emissions
- recycling and activities to extend and manage the end-of-life of materials
- other activities to reduce energy consumption and improve energy efficiency, especially in construction and housing, such as glazing and insulation

- preserving and restoring the natural environment
- carbon capture and storage activities
- activities that enable the development of the underpinning technologies and their application, including research in our universities and other research agencies, the teaching workforce in higher education and VET providers, alongside legal, financial, and planning services.

Sources	Green jobs definitions
International Labour Organisation (ILO) ¹	Defined as decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency. Green jobs help: improve energy and raw materials efficiency limit greenhouse gas emissions minimize waste and pollution protect and restore ecosystems support adaptation to the effects of climate change
United Nations Environment Programme (UNEP) ²	Green jobs are defined as work in agricultural, manufacturing, research and development (R&D), administrative and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help protect ecosystems and biodiversity; reduce energy, materials and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.
U.S Bureau Labour of Statistics ³	 Green jobs are either: jobs in businesses that produce "goods" or "provide services" that benefit the environment or conserve natural resources jobs in which workers' duties involve making their establishment's production processes more "environmentally friendly" or fewer natural resources
World Economic Forum⁴	Green jobs are defined as roles that require specific "green skills" to perform them and are crucial for enabling a transition to a more sustainable economy. The term "green skills" largely falls under the following categories: sustainable farming green architecture and building environmental policy and analysis clean energy energy efficiency climate change ecology and resource management nature conservation

Table 1: Collated definitions of green jobs from international sources

The terms of reference for this study focus on the workforce required for Australia's transition from fossil fuel energy to renewable sources. While Australia will require each of the activities referred to above if we are to reach net zero by 2050, it is the shift to renewable fuel and energy sources that will make the most substantial contribution.

¹ <u>Sustainable development, decent work and green jobs</u> 2013 International Labour Organisation

² <u>Green Jobs: Towards decent work in a sustainable, low-carbon world</u> 2008 United Nations Environment Programme

³ Measuring Green Jobs 2013 U.S Bureau Of Labour Statistics

⁴ Jobs of Tomorrow: Social and Green Jobs for Building Inclusive and Sustainable Economies 2023 World Economic Forum

For example, electricity generation was the largest component of Australia's gross emissions in 2020 (32%), followed by stationary energy (19%) and transport (18%).⁵ The transition to renewable sources will also have the greatest impact on an identifiable, existing workforce – those in fossil fuel electricity generation.

Ideally, we want to avoid adopting a definition of the clean energy workforce that is driven by data availability. A desktop review and early consultation across government indicates that issues with data limitations and definitions are conflated. The challenges encountered in defining the workforce relate to issues in measuring emerging or changing industries and occupations. Rather than limit our definition to what can be measured, there is merit in developing a universal definition as a 'conceptual' definition. We will seek to measure this concept with existing data in the first instance and identify gaps to recommend how this measurement could be improved in the future by addressing data limitations.

Our goal is to ensure the conceptual definition is specific enough to be meaningful, and our insights using this definition are actionable. A narrower definition will allow us to make practical recommendations that support workforce planning, policy design and program development to build a vibrant clean energy sector, rather than simply indicating future demand scattered across most sectors of the workforce, including where green skills are an optional or minor component of job roles.

Proposed conceptual definition

For the purposes of this study, JSA is proposing the following definition of the clean energy workforce:

The clean energy workforce includes the workers involved in developing, generating, storing, transmitting and distributing energy generated from renewable, net-zero emissions sources ('clean energy supply'), and installing and maintaining the technology that uses clean energy rather than fossil fuels ('clean energy use'). This spans energy needed for electricity consumed by businesses and housing, transport and industrial processes.

When considering the clean energy workforce, all workers contributing to that activity will be in scope. For some components of the study (e.g. examining the barriers and enablers of the education and training pipeline), the scope will be restricted to those workers who require skills specific to adopting, developing, generating, distributing and supplying energy generated from renewable sources. For example, this would mean considering the skills required by wind turbine technicians, but not the accountant who works for a renewable energy business.

⁵ <u>Australia's Long-Term Emissions Reduction Plan: Modelling and Analysis</u> 2021 Department of Industry, Science, Energy and Resources

What is clean energy?

For the purposes of this study, clean energy refers to the development, generation, storage, transmission, distribution, supply and application of energy generated from renewable sources, as set out in Division 3, Section 17 of the *Renewable Energy (Electricity) Act 2000.*⁶

Energy supply covers the production, storage and distribution of energy. Production includes large scale electricity generation for the grid, but also things like rooftop solar on homes and businesses. This energy is then converted and stored using technologies like batteries, pumped hydroelectricity and electrolysis. Finally, energy is provided to distributed users through transmission lines, distribution lines and pipelines.

Energy use is about transitioning away from fossil fuel powered machines to ones that use renewable, non-emitting sources. This includes:

using <u>new fuels</u>, like hydrogen and biofuels, to power our machines (e.g. a car powered by hydrogen instead of petroleum)

<u>electrifying</u> machines to run on electricity rather than fossil fuels (e.g. an electric hot water heat pump instead of a gas hot water system).

Energy efficiency is the process of using less energy to perform the same task. This can include steps like replacing our old appliances with newer ones that use less power and retrofitting our houses with improved insulation, glazing and screening to improve thermal performance. By reducing the amount of energy that we need to produce, efficiency measures can help Australia decarbonise and improve energy affordability.

The Department of Climate Change, Energy, the Environment and Water is currently developing a National Energy Performance Strategy to examine how to maximise the contribution of these activities to net zero. Currently, the skills and workers required to perform work such as insulation and glazing are an indistinguishable part of the larger Australian construction workforce, supported by emerging specialist roles such as sustainability specialists and energy auditors⁷. If supported by further policy targets and initiatives, activities such as energy audits and housing energy efficiency retrofits are likely to emerge as a more distinct workforce.

⁶ Renewable Energy (Electricity) Act 2000 (Cth) div 3, s17

⁷ <u>Australia's current, emerging and future workforce skills needs</u> 2022 Department of Employment and Workplace Relations

Figure 1. Clean energy workforce and adjacent sectors contributing to net zero

Clean energy workforce			
Clean energ	y supply	Clean en	ergy use
		Electrification	and new fuels
Generation Transm	nission Distribution		
		Transport	Machinery and production
Renewables Hydrogen	Biofuels Storage and charging	Cooking an	<pre></pre>
Enabling clo	ean energy	Reaching net	zero by 2050
		$\overbrace{[]]}^{2} \rightarrow \overbrace{[]]}^{2}$	
Research	Teaching	Efficiency workforce	Agriculture and land management

Legal and finance

Manufacturing

technology and exports

Carbon capture and credits



Recycling and waste

The purpose of this study is to provide evidence and insights to support the workforce transition and transformation to a net zero economy by 2050. This focuses the study to understanding the skills profile of direct workers and identify education and skilling gaps. As the clean energy sector expands, more roles will require workers with specific clean energy skillsets, which may be gained by study in vocational education, in higher education, or by on-the-job skilling. Adjacent sectors of the economy will enable the adoption of clean energy, reduce our demand for energy, limit carbon emissions and expand opportunities to capture carbon above and below ground. Typically the skills in these sectors that are critical to net zero are only a small part of the current workforce and few job roles are primarily oriented towards clean energy and reducing carbon emissions. There are many roles across the economy which support the clean energy workforce that do not require skillsets specific to the sector (e.g. accountants). While contributing to decarbonisation, these enabling jobs are not the primary focus of the study. However, researchers working on clean energy technologies and educators and trainers delivering courses on renewable power installation, for example, are critical to the transition.

Likewise there are many roles in the construction, agriculture and manufacturing industries which will contribute towards the clean energy transition as existing practices and technologies move towards decarbonisation but not all will involve a change in demand or skill requirements. We are seeing the emergence of some specialised roles in clean energy and adjacent sectors such as energy performance and demand for some categories of workers, such as insulation installers, may grow depending on future policy settings. Rather than examining the whole construction, agriculture and manufacturing workforces, only the subset of workers directly and primarily involved in clean energy supply and conversion, energy efficiency and carbon will be considered part of the clean energy and adjacent workforces.

Figure 2. The clean energy workforce



Measuring the clean energy workforce

The measurement of the clean energy workforce may not be a perfect representation of the conceptual definition due to the data limitations associated with emerging industries and occupations. While certain industries are relatively well described (e.g. power distribution and transmission), many emerging industries are not well captured and are difficult to separate (e.g. the ANZSIC class 'Other Electricity Generation' groups all renewable except hydroelectricity). It is also difficult to identify which occupations are predominantly focused on clean energy. For example, solar installers are only captured in ANZSCO under the occupation 'Electrician (general)'.

Due to these limitations it is difficult to accurately produce current and future estimates of the clean energy workforce. We will learn and build on other measurement approaches to better understand the proportion of the partial ANZSIC and ANZSCO categories that cover clean energy activities (see figure 3).

(The study will also identify and measure current and future employment in transitioning sectors that are currently part of the fossil-fuel supply chain, such as thermal coal mining and coal-fired electricity generation as well as sectors with industrial processes that also generate carbon dioxide, such as cement production.)

Figure 3. Challenges in measuring the clean energy workforce

ANZSIC Industry	Draft Clean Energy Workforce Mapping
Agriculture, Forestry and Fishing	Out – not in scope
Mining	Adjacent – partial - enabling materials
Manufacturing	In – partial; Adjacent – partial - enabling materials and exports
Electricity, Gas, Water and Waste Services	In - partial
Construction	In - partial
Wholesale Trade	Out
Retail Trade	Out
Accommodation and Food Services	Out
Transport, Postal and Warehousing	In - partial
Information Media and Telecommunications	Out
Financial and Insurance Services	Out
Rental, Hiring and Real Estate Services	Out
Professional, Scientific and Technical Services	In - partial
Administrative and Support Services	Adjacent - partial - enabling
Public Administration and Safety	Out
Education and Training	Adjacent - partial - enabling
Health Care and Social Assistance	Out
Arts and Recreation Services	Out
Other Services	Adjacent - partial - enabling
ANZSCO Occupation	Draft Clean Energy Workforce Mapping

Level	Code	ANZSIC Industry	Draft mapping
1	D	Electricity, Gas, Water, Waste Services	In - partial
2	26	Electricity Supply	In - partial
3	261	Electricity Generation	In - partial
4	2611	Fossil Fuel Electricity Generation	Transitioning industry
4	2612	Hydro-Electricity Generation	In - complete
4	2619	Other Electricity Generation	In - partial

Level	Code	ANZSCO Occupation	Draft mapping
1	3	Technicians and Trades Workers	In - partial
2	34	Electrotechnology and Telecommunications Trades Workers	In - partial
3	341	Electricians	In - partial
4	3411	Electricians	In - partial
6	341111	Electrician (General)	In - partial
6	341112	Electrician (Special Class)	In - partial

ANZSCO Occupation	Workforce Mapping
Managers	Adjacent - partial - enabling
Professionals	In – partial
Technicians and Trades Workers	In – partial
Community and Personal Service Workers	Out
Clerical and Administrative Workers	Adjacent - partial - enabling
Sales Workers	Out
Machinery Operators and Drivers	In – partial
Labourers	In – partial

Terminology

Terms like clean, green and renewable are often used interchangeably in the clean energy sector and there is no consistent approach across government. This is problematic because some terms have assumed different and/or multiple meanings to various actors, at times creating confusion and inconsistencies.

JSA will seek to use clearly defined and consistent terminology where possible in the study and welcomes any thoughts or feedback from interested stakeholders. Efforts are also underway to consolidate definitions of common terms across government.

Discussion questions

- Is the conceptual definition of the clean energy workforce ambiguous? If so, how could it be more clearly defined?
- How could clean energy supply workers be identified in existing data? What are the gaps?
- How could workers involved with energy use be identified in existing data? What are the gaps?
- Which jobs require skills that are unique to the clean energy workforce?
- How do workers obtain skills that are unique to the clean energy workforce (VET/Higher Education/on-the-job skilling/other)?
- Are there any emerging occupations and industries in clean energy that aren't well captured by current definitions?

How this study relates to other work

There are a number of related activities currently underway across government, including workforce strategies, training initiatives and research programs. This study will contribute to these other activities by providing a common evidence base and definitional approach for workforce planning across government. There are also workforce activities being led by industry, the education and training sector and state and territory governments, which will be considered by JSA and explored in the final report.

Commonwealth activities

- The Government's Powering Australia Plan is the overarching roadmap for energy transformation and emissions reduction. This plan sets the scale and pace of investment and will help inform the study's workforce projections. Our findings will also support the Powering the Regions Fund by identifying emerging jobs and opportunities for successful transitions.
- The New Energy Apprenticeships program provides direct financial assistance to Australian apprentices in the clean energy sector. The study will directly inform the next phase of this program by helping define the clean energy workforce and clarify eligibility requirements. Funding under the New Energy Skills Program includes development of training pathways for clean energy roles. The study will be made available to guide the contextualisation of this project.
- Jobs and Skills Councils (JSCs) were established to provide industry with a stronger, more strategic voice in ensuring Australia's VET sector delivers stronger outcomes for learners and employers. JSA will work closely with each JSC to help identify skills and workforce needs for their sectors. JSCs will be provided access to the study to determine activities to support industry and meet skills needs.
- Earlier this year, the Australian Government launched the first Australian Energy Employment Report (AEER) survey to provide a sample of the energy workforce. Data from this initial opt-in survey may help inform elements of the Clean Energy Capacity Study, which will in turn highlight opportunities to broaden and expand the AEER as an ongoing dataset.
- The Department of the Prime Minister and Cabinet's **Net Zero Taskforce** was established to provide advice on how to best support regional communities as Australia transforms to a net zero economy. The findings from this cross-agency taskforce will guide the study in identifying regions in focus and best practice approaches to supporting worker transitions.
- The Department of Climate Change, Energy, the Environment and Water is developing several energy strategies to guide government policy and foster new technologies and industries. These strategies will draw on the study where possible as a common evidence base and deliver on key workforce recommendations.

Research and advice					
Net Zero Taskforce Advice to support regional communities as Australia transforms to a net zero economy. Focused on regions which are more heavily reliant on emissions intensive industries. Department of the Prime Minister and Cabinet - operating until mid-2023		Clean Ene Detailed and future workf transition ne energy work Jobs and Ski - final report	ergy Capacity Study alysis of current and force, training, and eeds of the broader clean cforce.	+	Australian Energy Employment Report (AEER) An online survey of the existing energy sector to provide a snapshot of the workforce. Over time this data asset could help government track the transition. Department of Climate Change, Energy, the Environment and Water -survey closes 30 April 2023
Skills initiatives	Governme	nt strategi	es		Powering Australia Plan
New Energy Apprenticeships Financial support for eligible apprentices	National En Workforce	ergy Strategy	National Hydrogen Strategy		Rewiring the Nation \$20 billion in low-cost finance for the upgrade and expansion of Australia's energy grid
New Energy Skills Program Funding for training	National Ele Vehicle Stra	ectric ategy	National Energy Performance Strategy		Powering the Regions Providing dedicated support to make sure traditional and new industries in regional Australia can harness the economic opportunities of decarbonisation
mentoring program	National Pattony				National Energy Transformation
Jobs and Skills Councils Developing VET training products and pathways in collaboration with industry	Department of C Water	Climate Change	e, Energy, the Environment and	t	Partnership An agreed national plan between the states, territories and Commonwealth to support investments in the grid, market reforms and making homes and appliances more efficient
Department of Employment and Workplace Relations					Department of Climate Change, Energy, the Environment and Water

State and territory activities

There are also workforce activities being led by state and territory governments, including across skilling, workforce planning and structural adjustment. A comprehensive mapping of activities will be included in the final report. Below are some illustrative examples.

The Victorian State Government's *Clean Economy Workforce Capacity Building Fund* was designed to enable training providers and industry to work together to develop new training methods and products. This fund will address short- to medium-term needs, while a longer-term Clean Economy Workforce Development Strategy is produced. The Victorian Government is also creating state-wide project-based workforce planning tools to provide insights to inform skills delivery.



The **Queensland Government** is currently developing a Future Energy Workforce Roadmap for deliver in 2023 that will identify opportunities to build clean energy workforce capacity and build on the state's dedicated Hydrogen Industry Workforce Development Roadmap 2022-2032. The Queensland Energy and Jobs Plan also includes a \$90 million investment to establish two regional transmission and training hubs.

Energising Tasmania was established by the **Tasmanian Government** in 2019 to support the energy workforce to deliver major projects across transmission, infrastructure and renewable energy. It includes a Training Fund for endorsed RTOs to deliver fully subsided training for related sectors.

The **NSW Government's** *Royalties for Rejuvenation Fund* sets aside at least \$25 million each year from mining royalties to support coal mining communities throughout the state. This funding will ensure that these communities can make targeted investments, including towards workforce development programs.

Transitions

Collie's Just Transition Plan is the **Government of Western Australia's** commitment to working with the community to create a strong and sustainable future as Collie shifts away from a dependence on coal. The plan includes \$200 million of funding to bring new and emerging industries to the region.

A *Hydrogen Jobs Plan* is being progressed by the **Government of South Australia** to help the state meet its ambition of constructing a hydrogen power station, electrolyser and storage facility by the end of 2025. The Hydrogen Jobs Plan includes 250 megawatts of electrolysers, 200 megawatts of power generation, and associated hydrogen storage.



The Northern Territory Government's *Renewable Hydrogen Master Plan* explores partnering with Charles Darwin University and training organisations to create new skills development pathways and apprenticeships for emerging renewable hydrogen jobs.

The **ACT Government** is working with Tesla and other manufacturers to develop a new course to train Canberra's first EV apprentices under a new Certificate III in Electrical Vehicle Technology in 2023.

What we already know

JSA acknowledges the extensive research and analysis that has already been produced on the clean energy workforce by industry, academia, community advocates and governments. There are also a wide range of international experiences that Australia can learn from, particularly from those countries that have also traditionally relied on emissions-intensive forms of energy generation.

Our study will work to consolidate these efforts and present a coherent and comprehensive view of the workforce, identify key challenges and understand barriers to sufficient workforce participation. We will develop clear and actionable recommendations to government to address workforce shortages in the future and ensure the existing energy workforce is adequately supported to access new opportunities.

Interested in further reading?

JSA has compiled a resource library on our website to provide readers with reports, research and other resources about the clean energy workforce transition in Australia and internationally. This library will be updated throughout the course of the study and we welcome suggestions for additional resources to include. The resource library can be found at <u>jobsandskills.gov.au/work/clean-energy-capacity-study/resource-library</u>

NB: The library is not exhaustive.

Australia

Australia is inarguably well-placed to benefit from the transition to net zero, as a country rich with clean energy source potential⁸ and established energy export capabilities and relationships⁹. However, this potential will not be fully realised without sufficient investment in understanding, supporting, educating and training the future clean energy workforce¹⁰.

The effective delivery of clean energy specific education and training will be vital to the Australia's transition. This will necessarily include both the introduction of new, exclusively clean energy focused qualifications, the incorporation of clean energy skills and knowledge into existing qualifications (for example ensuring all electrical apprentices are skilled in rooftop solar installation and maintenance) and ensuring a sufficient supply of graduates from more generalised courses that will experience increased demand as a result of the transition to clean energy, such as many fields of engineering and science.

These efforts are underway but are not yet delivered at the scale and pace required and will take time to fully establish¹¹. Further, some incentives to reskill existing workers and attract

⁸ Australia's economic opportunities in clean energy exports 2021 Accenture

⁹ Australian Energy Update 2022 Department of Climate Change, Energy, the Environment and Water

¹⁰ Employment Impacts – Modelling Methodology & Preliminary Results 2022 Net Zero Australia

¹¹ <u>Skilling the Energy Transition</u> 2022 Clean Energy Council

new students are also insufficient and marred by uncertainty and unmapped career pathways. Access to education and training is also inconsistent across regions, particularly in rural and remote areas where cost of delivery is high, markets are thin and attracting educators is difficult.

Participation

Analysis from Jobs and Skills Australia shows that occupations with skills shortages are likely to have significant gender imbalance in their workforce, particularly towards maledominated industries. For example, only around 2% of Australia's electricians and 1% of lines workers are women. Historically, Australia's energy workforce has been overwhelmingly male-dominated and homogenous, with low workforce participation of women, First Nations, LGBT+, people with disability and culturally and linguistically diverse (CALD) cohorts.

The Australian Skills Guarantee is working to support women to achieve higher paying careers via vocational education and training pathways by setting ambitious workforce participation targets for trades occupations. Whilst the current Guarantee retains a focus on women in trades, future efforts are flagged to encourage improved participation of a range of priority cohorts across both trades and non-trade occupations in major projects¹². Without addressing systematic barriers and creating genuine opportunities to lift participation, the clean energy workforce is unlikely to grow at the pace and scale required. In November 2022 the Government announced an independent Pathway to Diversity in STEM Review to determine how programs can better support diversity in STEM sectors, including clean energy¹³.

Early analysis of the demographic profile of the clean energy workforce is promising, with improved workforce participation of priority cohorts compared to the emissions-intensive energy sector. However, these representational gains have been most significant in junior to mid-level roles and priority cohorts remain underrepresented across senior leadership and board roles¹⁴. Efforts to support the diversification of the workforce must be conscious of reproducing biased workforce hierarchies and ensure that priority cohorts are not only represented within the workforce but also participating in a range of roles and levels.

The pace of change

There can be a lot of uncertainty around decarbonisation, particularly the pace of change and the many ways this change could occur. The Australian Government has now legislated an emissions reduction target of 43 per cent by 2030 and net zero by 2050, setting the nation's transition trajectory and providing greater certainty. The Australian Energy Market Operator (AEMO), among others, has done a great deal of work to explore the various pathways to decarbonisation. This includes the different mix of energy, export opportunities and assumptions around the uptake of new technologies.¹⁵

¹² <u>Australian Skills Guarantee Discussion Paper</u> 2022 Department of Employment and Workplace Relations

¹³ Diversity in STEM Review 2022 Department of Industry, Science and Resources

¹⁴ Empowering Everyone: Diversity in the Australian Clean Energy Sector 2021 Clean Energy Council

¹⁵ AEMO initially developed five scenarios in 2021 but considered the *Steady Progress* scenario to be no longer relevant given Australia's commitment to net-zero emissions by 2050

There are still uncertainties left to be explored, including the viability of new technologies, like hydrogen, to displace fossil fuels domestically.

In his book *The Superpower Transformation*, Professor Ross Garnaut suggests that in addition to exporting hydrogen (as covered in the AEMO superpower scenario), Australia could also become a major exporter of net-zero emissions manufactured goods. By using our own green hydrogen, Australia could refine and smelt iron ore and bauxite competitively. However, to realise this goal Australia would require around 10,000 terawatt-hours of annual power generation, which is over 50 times the current capacity of the National Energy Market (NEM) and 10 times the capacity required under AEMO's hydrogen superpower scenario.¹⁶

AEMO transition scenarios

Slow change – challenging economic environment following the COVID-19 pandemic, with greater risk of industrial load closures, and slower net-zero emissions action. This scenario would not reach the economy-wide decarbonisation objectives of Australia's Emissions Reduction Plan.

Progressive change – delivering a net-zero emissions economy with a progressive build-up of momentum ending with deep cuts in emissions across the economy from the 2040s. The 2030s would see commercially viable alternatives to emissions-intensive heavy industry emerge, paving the way for stronger economy-wide decarbonisation and industrial electrification in the 2040s, and nearly doubling the total capacity of the National Energy Market (NEM). EVs become more prevalent over time and consumers gradually switch to using electricity to heat their houses and businesses.

Step change – moving much faster initially to fulfilling Australia's net zero policy commitments that would further help to limit global temperature rise to below 2°C. Step change sees a consistently fast-paced transition from fossil fuel to renewable energy in the NEM. On top of the progressive change assumptions, there is also a step change in global policy commitments, supported by rapidly falling costs of energy production, including consumer devices. Increased digitalisation helps both demand management and grid flexibility, and energy efficiency is as important as electrification. By 2050, most consumers rely on electricity for heating and transport, and the global manufacture of internal-combustion vehicles has all but ceased. Some domestic hydrogen production supports the transport sector and is blended with pipeline gas, with some industrial applications after 2040.

Hydrogen superpower – nearly quadrupling the National Energy Market (NEM) energy consumption to support a hydrogen export industry. The technology transforms transport and domestic manufacturing, and renewable energy exports become a significant Australian export, retaining Australia's place as a global energy resource. As well, houses with gas connections progressively switch to a hydrogen-gas blend before appliance upgrades achieve 100% hydrogen use.

¹⁶ The Superpower Transformation 2022 Ross Garnaut

Australia's energy workforce

2021 census data captured approximately 91,500 workers in Australia's emissions-intensive industries, with over half of these workers in the coal mining sector¹⁷. Whilst it is anticipated that employment opportunities in the clean energy sector will be abundant, and by various estimates outsize emissions-intensive employment by 2050, the skills required will not necessarily correspond with the skills of the current emissions-intensive energy workforce. Skills transferability analysis undertaken by the Australian Industry Energy Transitions Initiative estimates that approximately 47% of the existing energy workforce could transition to clean energy with minimal upskilling required. However, the location of these jobs is also likely to vary considerably and the geography of clean energy opportunities is not yet well understood¹⁸.

Competition for skilled workers is high, not just within the sector but across the entire labour market. Many key occupations, such as electricians, are also needed in other sectors like construction and manufacturing, drawing away potential workers¹⁹. In many clean energy projects, workforce demand is mostly concentrated in the construction phase and the long-term workforce profile is unclear. Further, the role of automation is not yet well understood and may affect future workforce demand²⁰.

The size of the clean energy workforce

Estimating the size of the clean energy workforce beyond direct renewable energy supply is challenging. Different studies undertaken by industry, academia and advocacy groups have understood the workforce differently and therefore produced varied estimates. The estimation logic and projected future growth scenarios of key recent studies on the clean energy workforce are outlined below.

- The most recent *Employment in Renewable Energy Activities* report from the Australian Bureau of Statistics (ABS) estimates the direct renewable energy workforce at approximately 26,850 full-time equivalent (FTE), an increase of 27% on the previous year and 120% over the past decade. This growth has been consistent across all states and territories, with the highest proportion of the workforce concentrated in the eastern coastal states of New South Wales, Victoria and Queensland. Currently solar is the largest and fastest growing renewable energy employment source, accounting for more than 50% of direct renewable energy employment across both rooftop solar and large-scale solar projects²¹. However, it must be noted this report does not forecast growth, nor does it capture the effects of the COVID-19 pandemic.
- The *Clean Energy at Work* report by the Clean Energy Council adopts the three draft 2020 AEMO scenarios: central, step change and high DER (Distributed Energy Resources). This report estimates the renewable energy workforce at around 25,000 in 2020 and forecasts the scale and pace of growth between 2020 and 2035²². Whilst

¹⁷ <u>Skilling Australian industry for the energy transition</u> **2023** Australian Industry Energy Transitions Initiative

¹⁸ <u>Renewable Energy Jobs in Australia: Stage One</u> 2020 UTS Institute for Sustainable Futures

¹⁹ <u>E3 Opportunity Assessment: Developing the future energy workforce</u> 2021 Race for 2030: Reliable Affordable Clean Energy

²⁰ Digitalization & Energy 2017 International Energy Agency

²¹ Employment in Renewable Energy Activities 2020, Australian Bureau of Statistics

²² <u>Clean Energy at Work</u> 2020 Clean Energy Council

growth is predicted across all three scenarios, it is fastest and most significant in the high DER scenario, which assumes a consumer-demand led transition, with employment peaking at 46,000 in 2021 and again in 2035, with a low of 27,000 between 2024 and 2027. The step change scenario, which anticipates policy changes in line with the government's commitments under the Paris Agreement²³, also posits significant growth, although is forecast to peak at 44,000 in 2025 and trend downwards from there until 2031, at which point there is a modest upward turn, but long-term employment levels are not forecast to exceed 37,000. This report only estimates employment in the direct renewable energy workforce and does not consider construction of electricity networks, bioenergy or renewable hydrogen. This report also does not capture the effects of the COVID-19 pandemic.

The Institute of Sustainable Futures (ISF) was commissioned to produce workforce projections for AEMO's 2022 Integrated Systems Plan, which covers the NEM²⁴. ISF used an employment factor (full-time equivalent job years per megawatt of installed capacity) based on current workforce estimates and projected this forward for each scenario. Due to information constraints, this work does not consider energy efficiency, demand-side energy management, electrification or the production of hydrogen. This work is also limited by the likelihood that workforce composition and requirements will change over time.

Under AEMO's step change scenario, ISF projects that employment will grow from 19,000 in 2023 to a peak of 81,000 in 2049. Around 30% of employment is for onshore wind generation, 25% for rooftop solar and 18% for batteries, with NSW having the greatest share of employment, followed by Queensland, Victoria, South Australia and Tasmania. Trades and technicians are by far the largest occupation group, with electricians and mechanical trades and technicians in particularly high demand.

The Net Zero Australia study (University of Melbourne, University of Queensland, Princeton University and Nous Group) models six scenarios across Australia's domestic and export sectors between 2020 and 2060 over the five stages of manufacturing, construction and installation, production, operations and maintenance, and decommissioning. It examines their impacts on energy job creation in industries relevant to energy supply^{25.} The study develops an employment factor metric which reflects average job creation per unit of energy activity. Whilst labour demand increases across all five electrification scenarios, excluding the reference scenario, opportunities for job growth are projected to be significantly greater and more sustained in the energy export sector, where growth is modelled from 40,000 to between 600,000 and 1m jobs by 2060. By comparison, the domestic sector growth is modelled from 100,000 to between 270,000 and 450,000 jobs by 2060. This study does not consider energy efficiency, appliances, vehicles, transport or downstream industrial processes, such as cement or steel manufacturing. This study also does not model labour supply.

²³ <u>The Paris Agreement</u> 2015 United Nations Framework Convention on Climate Change

²⁴ The Australian Electricity Workforce for the 2022 Integrated System Plan: Projections to 2050 2022 Institute for Sustainable Futures. Does not consider the energy markets in Western Australia or the Northern Territory.

²⁵ See <u>Methods</u>, <u>Assumptions</u>, <u>Scenarios & Sensitivities</u> 2022 Net Zero Australia report for a breakdown of the different scenarios

Regional experiences

The clean energy transition presents both opportunities and challenges to regional communities, including First Nations communities²⁶, particularly those with an historical dependence on emissions-intensive energy generation²⁷. These communities are especially vulnerable to the clean energy transition and will require substantial public and private support, including investments in reskilling and local diversification²⁸.

Following the Jobs and Skills Summit in September 2022, a Net Zero Economy Taskforce in the Department of the Prime Minister and Cabinet was established to advise government on how to best support regional communities²⁹. A First Nations Clean Energy Strategy was also established with support from the Indigenous Land and Sea Corporation and Energy Ministers³⁰, and in collaboration with a range of community, industry, union and research partners³¹. This strategy ensures First Nations communities are well placed to drive, shape and benefit from clean energy generation on First Nations land³².

Both within and beyond Australia the notion of just transitions has been widely deployed, supported by labour movements and the 2015 Paris Agreement, as a framework to ensure policy responses and government planning pay adequate attention to the transition needs and socio-economic outcomes of individuals and communities currently employed in or reliant on emissions-intensive industries³³. This study is committed to drawing on these efforts to better understand the unique and critical demographic, geographic and socio-cultural factors shaping the transition to a clean energy workforce through case studies of particular regional communities.

International experiences

Clean energy transitions are trending globally, with the International Energy Agency (IEA) estimating that just over 50% of the 65 million global energy workforce is employed in clean energy-related activities. Clean energy also accounts for virtually the entire 6% annual employment growth forecast in the energy sector. However, this growth is not consistent across regions, with the largest and fastest growing clean energy workforce in China, and the Asia Pacific region more generally.³⁴

There is a sense of both collaboration and competition as nations around the world race towards to a clean energy future. Governments are working to meet their own energy needs, achieve decarbonisation commitments and develop lucrative new export opportunities³⁵.

²⁶ <u>Heal Country, Heal Climate Priorities for climate and environment</u> 2021 Indigenous Peoples' Organisation Australia

²⁷ Towards a Just Transition from Coal in Australia? 2022 Sydney Environment Institute

²⁸ Renewables & rural Australia 2022 The Australia Institute

²⁹ Net Zero Economy Taskforce 2022 Department of the Prime Minister and Cabinet

³⁰ National Energy Transformation Partnership 2022 Australian Energy Ministers

³¹ First Nations Clean Energy Network: Tool kit

³² <u>Clean energy agreement making on First Nations land: What do strong agreements contain?</u> 2021 Centre for Aboriginal Economic Policy Research

³³ Just Transitions in Australia 2022 Monash Sustainable Development Institute

³⁴ World Energy Employment Report 2022 International Energy Agency

³⁵ <u>Renewable Energy and Jobs – Annual Review</u> 2022 International Renewable Energy Agency

Decarbonisation is expected to transform global power relations and geopolitics as new 'energy superpowers' emerge³⁶.

Common transition approaches centre on both developing new education and training pathways for the existing energy workforce, while also attracting a new generation of workers with the requisite skills to service the sector into the future³⁷. Actioning this is forecast to require significant public investment in education and training.

International analysis has also highlighted that skills transferability potential is varied across different skill levels and regions, with higher-skilled, urban energy workers having greater access to emerging clean energy labour market opportunities than lower-skilled and/or regional workers³⁸.

The study will establish a sound understanding of international best practice in order to consider how Australia can:

- draw on the experiences, contemporary and historical, of energy workforce transitions around the world to ensure workers and communities are effectively supported throughout the transition
- develop and incentivise new education and training pathways to attract future workers to the sector
- attract and prioritise skilled migrants with relevant skills, qualifications and experience to meet workforce needs where Australians are unavailable
- identify education and training gaps³⁹ on the international market and leverage its position as an education exporter to fill these gaps and be the supplier of choice.

³⁸ <u>A Greener Labour Market: Employment, Policies and Economic Transformation</u> 2022 International Monetary Fund

³⁶ <u>A New World: The geopolitics of the energy transition</u> 2019 International Renewable Energy Agency

³⁷ Skills Development and Inclusivity for Clean Energy Transitions 2022 International Energy Agency

³⁹ Education and training gaps in the renewable energy sector 2018 Lucas et al

Discussion questions

Australia

- What are the main barriers to employers recruiting and retaining workers with the skills required to support the clean energy transition?
- What barriers do priority social cohorts, including women, First Nations Australians, people with disability, and culturally and linguistically diverse people face in entering the clean energy workforce?
- What accredited clean energy education and training pathways (qualifications and course components) are currently available in Australia?
- What barriers do students and prospective workers face in accessing education and training specific to clean energy?
- What barriers do education and training providers face in delivering courses specific to clean energy at the scale and pace required?

Regional experiences

- Which regional and First Nations communities should JSA engage with to better understand and address the impacts of the clean energy workforce transition?
- What information and assistance do communities need to prepare and harness the opportunities of future clean energy industries?
- What programs and initiatives have worked well to support workers transition out of in emissions-intensive industries?

International experiences

- What international experiences should JSA look at to establish an understanding of international best practice in relation to:
 - o supporting workforce transitions
 - o developing education training opportunities and incentives

Analytical approach

JSA will use a range of data to establish an overview of the current state of the clean energy workforce and suitable transition pathways. This will include census and labour force data from the ABS, education and training data, as well as various other sources, to understand job vacancies and mobility.

The study will also analyse future workforce demand and supply over 10, 20 and 30 years based on different transition scenarios. These scenarios will help identify a range of possible workforce outcomes based on the pace and trajectory of change. While the purpose of the study is to examine the clean energy workforce, our modelling will also quantify the likely impacts on the broader workforce under each of these transition scenarios, which existing projections are largely yet to take into account. The scale of economic transformation required will have implications for other industries as clean energy takes a greater share of capital and labour and creates new demand for supporting goods and services.

Limitations of existing data

As the clean energy sector is still emerging, there are a number of limitations with existing workforce and skills data, including:

- the inability to differentiate between clean and traditional workforces, particularly in construction and energy efficiency sectors
- many new clean energy industries, like solar and wind, aren't disaggregated in labour market classifications, and some emerging technologies are missing entirely, like hydrogen production and electric vehicles
- longitudinal analysis isn't possible with newer roles and industries that are only starting to appear
- some roles are currently very small, particularly specialised ones, making them difficult to find in the data
- inconsistent definitions and terminology limit our ability to combine and compare data sets.

An opportunity to improve the data landscape

While the study will address these limitations where possible, longer-term solutions will be needed to truly improve the data landscape for this critical sector. The first *Australian Energy Employment Report* and the ongoing ANZSCO and ANZSIC reviews by the ABS are a promising start to this process but are unlikely to remediate the problem entirely⁴⁰. JSA is actively considering what other work will be required following this study to identify, measure and analyse the clean energy workforce, and welcomes input from interested parties.

⁴⁰ Australian and New Zealand Standard Classification of Occupations (ANZSCO); Australian and New Zealand Standard Industry Classification (ANZSIC).

Discussion questions

- What do you consider to be the most significant information gaps in this sector?
- How can government better work with industry to measure the workforce?
- Are there existing data sources that could be better leveraged or improved?

Getting involved

Our consultation approach

JSA was established with a commitment to work closely with state and territory governments, industry, unions and education and training providers. In line with this commitment, the study will be supported by extensive consultation and genuine partnerships. We will:

- ensure stakeholders and experts have opportunities to inform the study
- test insights and analysis to refine our research
- be transparent in the way we work and the decisions we make.

This discussion paper is the first element in our consultation approach. Over the following months we will also begin meeting with stakeholders and hosting roundtables on different elements of the study.

Project Steering Group

JSA's interim Director, Professor Peter Dawkins AO, has established a Project Steering Group to support the study. The role of the Steering Group is to provide subject matter expertise and technical advice, while also helping connect JSA with interested partners. Members are drawn from industry groups, unions, training providers, state governments and research backgrounds.

Stakeholder Reference Groups

JSA will also establish Stakeholder Reference Groups that will allow us to share regular project updates and consult with larger groups of participants. These targeted groups will be used to organise further engagements, including roundtables, forums, and interviews.



How to make a submission

JSA welcomes feedback on the discussion paper from all interested parties.

You can submit responses to the questions in this paper and/or provide supplementary information and views by emailing the Clean Energy Capacity Study team at <u>CleanEnergyWorkforce@jobsandskills.gov.au</u>.

How to keep updated

You can register your interest in receiving updates on the Capacity Study by emailing <u>CleanEnergyWorkforce@jobsandskills.gov.au</u>.

Jobs and Skills Australia also issues a regular e-newsletter on its broader work including this study. To subscribe, visit jobsandskills.gov.au, scroll to the bottom of the page and provide your email under the heading 'Stay up to date'.



Attachment A - Terms of Reference

Overview

The Government has commissioned Jobs and Skills Australia to undertake a capacity study on the workforce needs for Australia's transition to a clean energy economy. The Capacity Study will provide critical evidence and insights to support workforce planning, policy development and program design, needed to build a strong and vibrant Clean Energy sector, and contribute to the Government's Powering Australia Plan.

It is expected that the Capacity Study will form the basis of further work to inform the Government's strategy for workforce planning as it pertains to delivering the energy transition and the transformation to a net zero economy by 2050.

The Capacity Study will build on existing research and deepen understanding of the clean energy sector, the skills profile of existing workforces, levels of skills transferability across industries and role types and forecasts of future supply and demand for clean energy related roles.

Scope

The Clean Energy Workforce Capacity Study will identify and analyse occupations, supply and demand factors and geographical considerations to support Australia's transition from 'brown' to 'green' energy. It will:

- 1. Develop an appropriate definition of the Australian clean energy workforce
- Establish an overview of the current state of the clean energy workforce including its demographic and geographic composition, occupation, skill level, job mobility, numbers of employers, job vacancies, sector pay and working conditions, apprenticeship numbers, reliance on international specialists, and safety and licensing standards.

- 3. Analyse future demand (at the national, state and regional level) for clean energy roles over 10, 20 and 30 years based on different transition scenarios, alongside the impact on demand for employment in high-emitting sectors undergoing transition.
- 4. Analyse the potential supply (at the national, state and regional level) of clean energy workers over the next 10, 20 and 30 years by:
 - a. identifying the skills required by job roles in the clean energy workforce.
 - assessing the extent to which the required skills can be met by existing workers, particularly from transitioning sectors, and explore mobility and skills transferability between different roles and sectors.
 - c. examine the education, training and professional development pathways that will support workers entering the clean energy workforce, including new entrants, workers from transitioning industries and migrants, and assess the adequacy of their scope and scale.
 - d. consider international labour supply factors, such as the impact of international initiatives on the global skilled workforce, the recognition of foreign qualifications in the sector and the impact of targeted migration programs. Consider how regional labour mobility programs and Australian VET and higher education providers can build clean energy skills within our region (particularly the Pacific).
- 5. Identify the enablers and barriers faced by universities, TAFEs and other education and training providers to developing and delivering courses for the clean energy workforce and supporting research, including collaboration across education sectors and the capacity of the teaching and training workforce, and explore opportunities for innovation and reform to resolve any barriers.
- Explore sector specific enablers and barriers faced by small, medium, and large employers in employing and retaining a skilled, diverse workforce in the clean energy sector.
- Explore opportunities for, and barriers to, full participation in the clean energy sector for priority cohorts, including women, First Nations Australians, people with a disability and culturally and linguistically diverse Australians.
- 8. Explore through case studies of particular regions the critical place-based factors to supporting the transition to a clean energy workforce.
- Consider the experiences of the transition to clean energy in other countries, especially those that have also traditionally relied on high-emissions forms of energy generation.

Governance and Consultation

The Capacity Study will be underpinned by close consultation and collaboration with State and Territory governments and industry stakeholders, including peak bodies, employers, unions, Jobs and Skills Councils, universities, and TAFEs and training providers.

Jobs and Skills Australia will establish a Project Steering Group, with membership to include representatives from other key Australian Government agencies, State and Territory governments, industry peak bodies and employers, unions, universities, and training providers. The draft terms of reference will be reviewed by the Steering Group.

Jobs and Skills Australia will also provide opportunities for stakeholders to contribute to the study through submissions and stakeholder forums.

Jobs and Skills Australia will regularly brief the Australian Minister for Skills and Training on the study's progress and interim findings, so that ministerial colleagues in the Australian Government and the Skills Ministers Meeting can be kept informed.

Process

Jobs and Skills Australia will deliver an interim report by May 2023 and a final report by July 2023.

Attachment: Complementary policy settings

The Capacity Study will complement work being undertaken by other parts of the Commonwealth Government including the Australian Energy Employment Report (AEER), the National Battery Strategy and the National Energy Workforce Strategy. In undertaking the Capacity Study, Jobs and Skills Australia should have regard to current and potential training packages, existing skills programs across the Commonwealth and States and Territories, and contemporary policy settings and labour market needs, noting:

- A. The Australian Government and states and territories have agreed to accelerate the delivery of 465,000 additional fee-free TAFE places, with 180,000 to be delivered next year.
- B. National Cabinet have endorsed the vision and principles for longer-term VET reform under a new 5-year National Skills Agreement.
- C. The Australian Government and states and territories have committed to negotiating a National Skills Agreement which provides critical and emerging industries at a national, state and local level with the skilled workers they need and secures a domestic workforce to deliver on current and future priorities.
- D. From January 2023, Jobs and Skills Councils will provide industry (employers and unions) with a stronger, more strategic voice and greater participation in the VET sector to address workforce challenges.
- E. A VET workforce blueprint is being developed by the Australian Government and states and territories to develop a comprehensive blueprint to support and grow a quality VET workforce.
- F. The introduction of 20,000 additional Commonwealth-supported university places for under-represented groups (including rural and regional Australians) in areas of skills shortages.
- G. The establishment of the Australian University Accord to drive lasting reform at Australian universities that will drive accessibility, affordability, quality, certainty, sustainability and prosperity to the higher education sector and the country.
- H. Post-study work rights the Australian Government will allow two additional years of stay in Australia for recent international graduates with select degrees in areas of verified skills shortages.
- I. National Reconstruction Fund will provide finance for projects that diversify and transform Australia's industry and economy.
- J. The introduction of Workforce Australia in July 2022 which reformed Commonwealth employment services.

Attachment B – Draft ANZSIC mapping

Level	Code	ANZSIC Name	Clean Energy Workforce	Notes
1	В	Mining	Adjacent – partial - enabling materials	Materials involved in clean energy machines and infrastructure
2	06	Coal Mining	Transitioning - fossil fuels	
3	060	Coal Mining	Transitioning - fossil fuels	
4	0600	Coal Mining	Transitioning - fossil fuels	
2	07	Oil and Gas Extraction	Transitioning - fossil fuels	
3	070	Oil and Gas Extraction	Transitioning - fossil fuels	
4	0700	Oil and Gas Extraction	Transitioning - fossil fuels	
2	08	Metal Ore Mining	Adjacent – partial - enabling materials	
3	080	Metal Ore Mining	Adjacent – partial - enabling materials	
4	0801	Iron Ore Mining	Adjacent – partial - enabling materials	
4	0802	Bauxite Mining	Adjacent – partial - enabling materials	Includes aluminium
4	0803	Copper Ore Mining	Adjacent – partial - enabling materials	
4	0804	Gold Ore Mining	Transitioning - fossil fuels	
4	0805	Mineral Sand Mining	Transitioning - fossil fuels	
4	0806	Nickel Ore Mining	Adjacent – partial - enabling materials	
4	0807	Silver-Lead-Zinc Ore Mining	Adjacent – partial - enabling materials	

4	0809	Other Metal Ore Mining	Adjacent – partial - enabling materials	Includes platinum group metals
2	09	Non-Metallic Mineral Mining and Quarrying	Adjacent – partial - enabling materials	
3	091	Construction Material Mining	Transitioning - fossil fuels	
4	0911	Gravel and Sand Quarrying	Transitioning - fossil fuels	
4	0919	Other Construction Material Mining	Transitioning - fossil fuels	
3	099	Other Non-Metallic Mineral Mining and Quarrying	Transitioning - fossil fuels	
4	0990	Other Non-Metallic Mineral Mining and Quarrying	Adjacent – partial - enabling materials	Includes silica
2	10	Exploration and Other Mining Support Services	Transitioning - fossil fuels	
3	101	Exploration	Transitioning - fossil fuels	
4	1011	Petroleum Exploration	Transitioning - fossil fuels	
4	1012	Mineral Exploration	Transitioning - fossil fuels	
3	109	Other Mining Support Services	Transitioning - fossil fuels	
4	1090	Other Mining Support Services	Transitioning - fossil fuels	
1	С	Manufacturing	Adjacent – partial - enabling materials	
2	17	Petroleum and Coal Product Manufacturing	Transitioning - fossil fuels	
3	170	Petroleum and Coal Product Manufacturing	Transitioning - fossil fuels	
4	1701	Petroleum Refining and Petroleum Fuel Manufacturing	Transitioning - fossil fuels	
4	1709	Other Petroleum and Coal Product Manufacturing	Transitioning - fossil fuels	

2	18	Basic Chemical and Chemical Product Manufacturing	Adjacent – partial - enabling materials	
3	181	Basic Chemical Manufacturing	Adjacent – partial - enabling materials	
4	1811	Industrial Gas Manufacturing	Clean energy - partial	Manufacturing industrial organic and inorganic gas in compressed, liquid or solid forms (includes hydrogen)
4	1812	Basic Organic Chemical Manufacturing	Clean energy - partial	Manufacturing organic acids and industrial alcohols such as ethanol (biofuel)
2	21	Primary Metal and Metal Product Manufacturing	Adjacent – partial - enabling materials	Metals involved in clean energy machines and infrastructure
3	211	Basic Ferrous Metal Manufacturing	Adjacent – partial - enabling materials	
4	2110	Iron Smelting and Steel Manufacturing	Adjacent – partial - enabling materials and exports	Green steel manufacturing
3	212	Basic Ferrous Metal Product Manufacturing	Adjacent – partial - enabling materials	
4	2121	Iron and Steel Casting	Adjacent – partial - enabling materials	
4	2122	Steel Pipe and Tube Manufacturing	Adjacent – partial - enabling materials	
3	213	Basic Non-Ferrous Metal Manufacturing	Adjacent – partial - enabling materials	Includes silicon
4	2133	Copper, Silver, Lead and Zinc Smelting and Refining	Adjacent – partial - enabling materials	
4	2139	Other Basic Non-Ferrous Metal Manufacturing	Adjacent – partial - enabling materials	

3	214	Basic Non-Ferrous Metal Product Manufacturing	Adjacent – partial - enabling materials	
4	2149	Other Basic Non-Ferrous Metal Product Manufacturing	Adjacent – partial - enabling materials	
2	22	Fabricated Metal Product Manufacturing	Adjacent – partial - enabling materials	Metals involved in clean energy machines and infrastructure
3	221	Iron and Steel Forging	Adjacent – partial - enabling materials	
4	2210	Iron and Steel Forging	Adjacent – partial - enabling materials	
3	222	Structural Metal Product Manufacturing	Adjacent – partial - enabling materials	
4	2221	Structural Steel Fabricating	Adjacent – partial - enabling materials	
4	2229	Other Structural Metal Product Manufacturing	Adjacent – partial - enabling materials	
3	223	Metal Container Manufacturing	Adjacent – partial - enabling materials	
2	23	Transport Equipment Manufacturing	Adjacent – partial - enabling materials	
3	231	Motor Vehicle and Motor Vehicle Part Manufacturing	Adjacent – partial - enabling materials	
4	2311	Motor Vehicle Manufacturing	Clean energy - partial	Includes Hydrogen, fuel cell, hybrid or electric vehicle manufacturing
2	24	Machinery and Equipment Manufacturing	Adjacent – partial - enabling materials	
3	241	Professional and Scientific Equipment Manufacturing	Adjacent – partial - enabling materials	

4	2419	Other Professional and Scientific Equipment Manufacturing	Adjacent – partial - enabling materials	
3	242	Computer and Electronic Equipment Manufacturing	Adjacent – partial - enabling materials	
4	2422	Communications Equipment Manufacturing	Adjacent – partial - enabling materials	
4	2429	Other Electronic Equipment Manufacturing	Adjacent – partial - enabling materials	
3	243	Electrical Equipment Manufacturing	Adjacent – partial - enabling materials	
4	2431	Electric Cable and Wire Manufacturing	Adjacent – partial - enabling materials	
4	2432	Electric Lighting Equipment Manufacturing	Adjacent – partial - enabling materials	
4	2439	Other Electrical Equipment Manufacturing	Adjacent – partial - enabling materials	Includes solar panel manufacturing
3	244		Adjacent – partial - enabling	
	244	Domestic Appliance Manufacturing	materials	
4	244	Other Domestic Appliance Manufacturing Other Domestic Appliance Manufacturing	materials Adjacent – partial - enabling materials	
4	244 2449 245	Domestic Appliance Manufacturing Other Domestic Appliance Manufacturing Pump, Compressor, Heating and Ventilation Equipment Manufacturing	materials Adjacent – partial - enabling materials Adjacent – partial - enabling materials	
4 3 4	2449 2449 245 2451	Domestic Appliance Manufacturing Other Domestic Appliance Manufacturing Pump, Compressor, Heating and Ventilation Equipment Manufacturing Pump and Compressor Manufacturing	materials Adjacent – partial - enabling materials Adjacent – partial - enabling materials Adjacent – partial - enabling materials	
4 3 4 4	2449 245 2451 2452	Domestic Appliance Manufacturing Other Domestic Appliance Manufacturing Pump, Compressor, Heating and Ventilation Equipment Manufacturing Pump and Compressor Manufacturing Fixed Space Heating, Cooling and Ventilation Equipment Manufacturing	materials Adjacent – partial - enabling materials Adjacent – partial - enabling materials Adjacent – partial - enabling materials Adjacent – partial - enabling materials	

4	2463	Machine Tool and Parts Manufacturing	Adjacent – partial - enabling materials	
4	2469	Other Specialised Machinery and Equipment Manufacturing	Adjacent – partial - enabling materials	
3	249	Other Machinery and Equipment Manufacturing	Adjacent – partial - enabling materials	
4	2499	Other Machinery and Equipment Manufacturing n.e.c.	Adjacent – partial - enabling materials	Wind turbine manufacturing
1	D	Electricity, Gas, Water and Waste Services	Clean energy - partial	
2	26	Electricity Supply	Clean energy - partial	
3	261	Electricity Generation	Clean energy - partial	
4	2611	Fossil Fuel Electricity Generation	Transitioning - fossil fuels	
4	2612	Hydro-Electricity Generation	Clean energy - complete	
4	2619	Other Electricity Generation	Clean energy - complete	
3	262	Electricity Transmission	Clean energy - partial	
4	2620	Electricity Transmission	Clean energy - partial	
3	263	Electricity Distribution	Clean energy - partial	
4	2630	Electricity Distribution	Clean energy - partial	
3	264	On Selling Electricity and Electricity Market Operation	Clean energy - partial	
4	2640	On Selling Electricity and Electricity Market Operation	Clean energy - partial	
2	27	Gas Supply	Clean energy - partial	Hydrogen blending in gas distribution network
3	270	Gas Supply	Clean energy - partial	Hydrogen blending in gas distribution network
4	2700	Gas Supply	Clean energy - partial	Hydrogen blending in gas distribution network
1	E	Construction	Clean energy - partial	
2	30	Building Construction	Adjacent – partial – energy efficiency	

3	301	Residential Building Construction	Adjacent – partial – energy efficiency	
4	3011	House Construction	Adjacent – partial – energy efficiency	
4	3019	Other Residential Building Construction	Adjacent – partial – energy efficiency	
3	302	Non-Residential Building Construction	Adjacent – partial – energy efficiency	
4	3020	Non-Residential Building Construction	Adjacent – partial – energy efficiency	
2	31	Heavy and Civil Engineering Construction	Clean energy - partial	
3	310	Heavy and Civil Engineering Construction	Clean energy - partial	Railways, dams, pipelines
2	32	Construction Services	Adjacent – partial – energy efficiency	
4	3224	Structural Steel Erection Services	Clean energy - partial	Electricity transmission towers
3	323	Building Installation Services	Clean energy - partial	
4	3231	Plumbing Services	Adjacent – partial – energy efficiency	
4	3232	Electrical Services	Clean energy - partial	Installation of electrical wiring, installation of appliances
4	3233	Air Conditioning and Heating Services	Clean energy - partial	Installation of heating equipment, refrigeration equipment, air conditioning equipment
4	3245	Glazing Services	Adjacent – partial – energy efficiency	
1	I	Transport, Postal and Warehousing	Clean energy - partial	
3	502	Pipeline and Other Transport	Clean energy - partial	
4	5021	Pipeline Transport	Clean energy - partial	Transportation of hydrogen via pipelines

1	М	Professional, Scientific and Technical Services	Clean energy - partial	
3	691	Scientific Research Services	Adjacent - partial - enabling services	
4	6910	Scientific Research Services	Adjacent - partial - enabling services	
4	6923	Engineering Design and Engineering Consulting Services	Clean energy - partial	Design, development and utilisation of machines, materials, instruments, structures, processes and systems
3	693	Legal and Accounting Services	Adjacent - partial - enabling services	
4	6931	Legal Services	Adjacent - partial - enabling services	
4	6932	Accounting Services	Adjacent - partial - enabling services	
1	N	Administrative and Support Services	Adjacent - partial - enabling services	
3	729	Other Administrative Services	Adjacent - partial - enabling services	
4	7291	Office Administrative Services	Adjacent - partial - enabling services	
2	77	Public Order, Safety and Regulatory Services	Adjacent - partial - enabling services	
3	772	Regulatory Services	Adjacent - partial - enabling services	
4	7720	Regulatory Services	Adjacent - partial - enabling services	Licensing and inspection activities (not including electricity markets)
1	Р	Education and Training	Adjacent - partial - enabling services	

2	81	Tertiary Education	Adjacent - partial - enabling services	
3	810	Tertiary Education	Adjacent - partial - enabling services	
4	8101	Technical and Vocational Education and Training	Adjacent - partial - enabling services	
4	8102	Higher Education	Adjacent - partial - enabling services	
1	S	Other Services	Adjacent - partial - enabling services	
2	94	Repair and Maintenance	Adjacent - partial - enabling services	
3	941	Automotive Repair and Maintenance	Adjacent - partial - enabling services	

Attachment C – Draft ANZSCO mapping

Level	Code	ANZSIC Name	Clean Energy Workforce	Notes
1	1	Managers	Adjacent - partial - enabling	
2	13	Specialist Managers	Adjacent - partial - enabling	
3	133	Construction, Distribution and Production Managers	Adjacent - partial - enabling	
4	1331	Construction Managers	Adjacent - partial - enabling	
6	133111	Construction Project Manager	Adjacent - partial - enabling	Coordinates construction of engineering and building projects, and all resources involved in the construction process
6	133112	Project Builder	Adjacent - partial - enabling	Plans, organises, directs, controls and coordinates the construction, alteration and renovation of dwellings and other buildings, and the physical and human resources involved in the building process
4	1332	Engineering Managers	Adjacent - partial - enabling	
6	133211	Engineering Manager	Adjacent - partial - enabling	
4	1334	Manufacturers	Adjacent - partial - enabling	
6	133411	Manufacturer	Adjacent - partial - enabling	
6	133513	Production Manager (Mining)	Transitioning - fossil fuels	
4	1344	Other Education Managers	Adjacent - partial - enabling	
6	134412	Regional Education Manager	Adjacent - partial - enabling	coordinates educational approaches and policy and curriculum resources and development for preschool, primary, middle or intermediate school, secondary, TAFE or polytechnic teachers and administrators.
6	139912	Environmental Manager	Adjacent - partial - enabling	Plans, organises, directs, controls and coordinates the development and implementation of an

				environmental management system within an
				environmental issues, such as pollution and waste
				treatment, in compliance with environmental
				legislation and to ensure corporate sustainable
				development.
1	2	Drofossionals	Adjacent - partial -	
T	Z	Professionals	enabling/energy efficiency	
4	2211	Accountants	Adjacent - partial - enabling	
6	221111	Accountant (General)	Adjacent - partial - enabling	
4	2254	Technical Sales Representatives	Adjacent - partial - enabling	
4	2312	Marine Transport Professionals	Clean energy - partial	As relevant to offshore wind
6	231299	Marine Transport Professionals nec	Clean energy - partial	As relevant to offshore wind
2	222	Architects, Designers, Planners and	Adjacent – partial – energy	
5	252	Surveyors	efficiency	
Л	2221	Architects and Landscape Architects	Adjacent – partial – energy	
4	2521		efficiency	
6	232111	Architect	Adjacent – partial – energy	
0	252111		efficiency	
6	232112	Landscape Architect	Adjacent – partial – energy	
0	232112		efficiency	
Д	2322	Surveyors and Spatial Scientists	Adjacent – partial – energy	
-	2522		efficiency	
6	232212	Surveyor	Adjacent – partial – energy	
			efficiency	
4	2326	Urban and Regional Planners	Adjacent – partial – energy	
· ·			efficiency	
6	232611	Urban and Regional Planner	Adjacent – partial – energy	
	202011		efficiency	
3	233	Engineering Professionals	Adjacent – partial – energy	
	233		efficiency	
4	2331	Chemical and Materials Engineers	Clean energy - partial	

6	233111	Chemical Engineer	Clean energy - partial	
6	233112	Materials Engineer	Clean energy - partial	
4	2332	Civil Engineering Professionals	Clean energy - partial	
6	233211	Civil Engineer	Adjacent - partial - enabling	
6	233212	Geotechnical Engineer	Adjacent - partial - enabling materials	
6	233215	Transport Engineer	Adjacent – partial – energy efficiency	
4	2333	Electrical Engineers	Clean energy - partial	
6	233311	Electrical Engineer	Clean energy - partial	
4	2334	Electronics Engineers	Adjacent - partial - enabling materials/energy efficiency	
6	233411	Electronics Engineer	Adjacent - partial - enabling materials/energy efficiency	
4	2335	Industrial, Mechanical and Production Engineers	Adjacent – partial – energy efficiency	
6	233511	Industrial Engineer	Adjacent - partial - enabling materials/energy efficiency	
6	233512	Mechanical Engineer	Clean energy - partial	
6	233513	Production or Plant Engineer	Adjacent - partial - enabling materials/energy efficiency	
4	2336	Mining Engineers	Adjacent - partial - enabling materials	
4	2339	Other Engineering Professionals	Adjacent - partial - enabling materials	
6	233914	Engineering Technologist	Adjacent - partial - enabling materials	
6	234313	Environmental Research Scientist	Adjacent - partial - enabling	
4	2344	Geologists, Geophysicists and Hydrogeologists	Clean energy - partial	Includes hydroelectricity and hydrogen storage
6	234411	Geologist	Clean energy - partial	
6	234412	Geophysicist	Clean energy - partial	

6	234413	Hydrogeologist	Clean energy - partial	
Л	23/0	Other Natural and Physical Science	Adjacent - partial - enabling	
4	2349	Professionals	materials	
6	234912	Metallurgist	Adjacent - partial - enabling	
0	234312		materials	
2	24	Education Professionals	Adjacent - partial - enabling	
3	242	Tertiary Education Teachers	Adjacent - partial - enabling	
4	2421	University Lecturers and Tutors	Adjacent - partial - enabling	
6	242111	University Lecturer	Adjacent - partial - enabling	
6	242112	University Tutor	Adjacent - partial - enabling	
4	2422	Vocational Education Teachers / Polytechnic Teachers	Adjacent - partial - enabling	
6	242211	Vocational Education Teacher / Polytechnic Teacher	Adjacent - partial - enabling	
2	27	Legal, Social and Welfare Professionals	Adjacent - partial - enabling	
3	271	Legal Professionals	Adjacent - partial - enabling	
6	271299	Judicial and Other Legal Professionals nec	Adjacent - partial - enabling	
1	3	Technicians and Trades Workers	Clean energy - partial	
2	31	Engineering, ICT and Science Technicians	Clean energy - partial	
3	312	Building and Engineering Technicians	Adjacent - partial - enabling	
4	2121	Architectural, Building and Surveying	Adjacent - partial -	
4	3121	Technicians	enabling/energy efficiency	
6	212111	Architectural Draftsperson	Adjacent - partial - enabling	Performs technical functions to assist construction
0	512111			managers, architects and surveyors.
6	312113	Building Inspector	Adjacent - partial - enabling	Specialisation: Electrical Installation Inspector
c	212100	Architectural, Building and Surveying	Adjacent – partial – energy	Occupations in this group include: Energy
0	217122	Technicians nec	efficiency	detailer
4	3122	Civil Engineering Draftspersons and Technicians	Adjacent - partial - enabling	

6	312211	Civil Engineering Draftsperson	Adjacent - partial - enabling	Prepares detailed drawings and plans for civil engineering work in support of Civil Engineering Professionals and Engineering Technologists.
6	312212	Civil Engineering Technician	Adjacent - partial - enabling	
4	3123	Electrical Engineering Draftspersons and Technicians	Adjacent – partial – energy efficiency	
6	312311	Electrical Engineering Draftsperson	Adjacent – partial – energy efficiency	Prepares detailed drawings and plans of electrical installations and circuitry in support of Electrical Engineers and Engineering Technologists. Registration or licensing may be required.
6	312312	Electrical Engineering Technician	Adjacent – partial – energy efficiency	
4	3124	Electronic Engineering Draftspersons and Technicians	Adjacent - partial - enabling	
6	312411	Electronic Engineering Draftsperson	Adjacent - partial - enabling	
6	312412	Electronic Engineering Technician	Adjacent – partial – energy efficiency	Conducts tests of electronic systems, collects and analyses data, and assembles circuitry in support of Electronics Engineers and Engineering Technologists. Registration or licensing may be required.
4	3125	Mechanical Engineering Draftspersons and Technicians	Adjacent - partial - enabling	
6	312511	Mechanical Engineering Draftsperson	Adjacent - partial - enabling	
6	312512	Mechanical Engineering Technician	Adjacent - partial - enabling	
4	3126	Safety Inspectors	Adjacent - partial - enabling	Re below: inspection for equipment to run smoothly from a regulatory compliance view - to help the (Adjacent - partial - enabling) workforce in remaining compliant for the transition to clean energy
6	312611	Safety Inspector	Adjacent - partial - enabling	Inspects machines, equipment, working conditions and public places to ensure compliance with government and industry standards and

				regulations, in relation to occupational health and safety. Registration or licensing may be required.
4	3129	Other Building and Engineering Technicians	Adjacent - partial - enabling materials	This unit group covers Building and Engineering Technicians not elsewhere classified. It includes Maintenance Planners, Metallurgical or Materials Technicians, and Mine Deputies.
6	312912	Metallurgical or Materials Technician	Adjacent - partial - enabling materials	
6	312914	Other Draftsperson	Adjacent – partial – energy efficiency	Prepare detailed drawings, technical plans, maps, and illustrations to precise specifications. Registration or licensing may be required
6	313212	Telecommunications Field Engineer	Adjacent - partial - enabling	
6	313214	Telecommunications Technical Officer or Technologist	Adjacent – partial – energy efficiency	Carries out specialised design and support functions in telecommunications engineering including optimisation and performance monitoring of telecommunications networks, diagnosis and repair of faults, and the selection and installation of equipment.
2	32	Automotive and Engineering Trades Workers	Adjacent - partial - enabling	
3	321	Automotive Electricians and Mechanics	Adjacent - partial - enabling	
4	3211	Automotive Electricians	Adjacent - partial - enabling	
6	321111	Automotive Electrician	Adjacent - partial - enabling	Maintenance of electric cars
3	322	Fabrication Engineering Trades Workers	Adjacent - partial - enabling materials	
4	3221	Metal Casting, Forging and Finishing Trades Workers	Adjacent - partial - enabling materials	
6	322112	Electroplater	Adjacent - partial - enabling materials	Controls plating processes and maintains solutions used to coat metal articles and other parts with non-ferrous metals.
6	322114	Metal Casting Trades Worker	Adjacent - partial - enabling materials	

4	3222	Sheetmetal Workers	Adjacent - partial - enabling/enabling materials	Falls in between adjacent - partial - enabling or adjacent - enabling materials (depending on the tasks)
6	322211	Sheetmetal Worker	Adjacent - partial - enabling/enabling materials	
4	3223	Structural Steel and Welding Trades Workers	Adjacent - partial - enabling	
6	322311	Metal Fabricator	Adjacent - partial - enabling	
6	322312	Pressure Welder	Adjacent - partial - enabling	Assembles, welds and repairs pressure vessels and pipes to relevant standards.
6	322313	Welder (First Class) (Aus) / Welder (NZ)	Adjacent - partial - enabling	Fabricates and repairs metal products using various welding techniques.
3	323	Mechanical Engineering Trades Workers	Clean energy - Partial	
4	3231	Aircraft Maintenance Engineers	Clean energy - Partial	
6	323111	Aircraft Maintenance Engineer (Avionics)	Clean energy - Partial	
6	323112	Aircraft Maintenance Engineer (Mechanical)	Adjacent – partial – energy efficiency	Inspects, tests, repairs and installs aircraft hydromechanical and flight system components and aircraft engines, subassemblies and components. Registration or licensing may be required.
6	323113	Aircraft Maintenance Engineer (Structures)	Adjacent - partial - enabling materials	Inspects, dismantles and reassembles aircraft structures, and repairs and replaces components of aircraft frames. Works with both metal and carbon fibre composite materials
4	3232	Metal Fitters and Machinists	Adjacent - partial - enabling	
6	323211	Fitter (General)	Adjacent - partial - enabling	
6	323212	Fitter and Turner	Adjacent - partial - enabling	
6	323213	Fitter-Welder	Adjacent - partial - enabling	
4	3242	Vehicle Body Builders and Trimmers	Adjacent - partial - enabling	
6	324211	Vehicle Body Builder	Adjacent - partial - enabling	
2	33	Construction Trades Workers	Clean energy - Partial	

3	331	Bricklayers, and Carpenters and Joiners	Adjacent – partial – energy efficiency	
4	3311	Bricklayers and Stonemasons	Adjacent – partial – energy efficiency	
6	331111	Bricklayer	Adjacent – partial – energy efficiency	Laying double bricks for residential homes for better insulation
3	333	Glaziers, Plasterers and Tilers	Adjacent – partial – energy efficiency	
4	3331	Glaziers	Adjacent – partial – energy efficiency	
6	333111	Glazier	Adjacent – partial – energy efficiency	
4	3332	Plasterers and Renderers	Adjacent – partial – energy efficiency	
6	333211	Plasterer (Wall and Ceiling)	Adjacent – partial – energy efficiency	
6	333212	Renderer (Solid Plaster)	Adjacent – partial – energy efficiency	
3	334	Plumbers	Clean energy - Partial	Airconditioning and Mechanical Services Plumber
4	3341	Plumbers	Clean energy - Partial	Airconditioning and Mechanical Services Plumber
6	334112	Airconditioning and Mechanical Services Plumber	Clean energy - Partial	
6	334114	Gasfitter	Transitioning - fossil fuels	
2	34	Electrotechnology and Telecommunications Trades Workers	Clean energy - Partial	
3	341	Electricians	Clean energy - Partial	
4	3411	Electricians	Clean energy - Partial	
6	341111	Electrician (General)	Clean energy - Partial	Hot water solar system installers and Labourers who install solar panels are excluded from this unit group. Hot water solar system installers are included in Unit group 8214, Insulation and Home

				improvement installers. Labourers are included in
				Unit group 8999, Other Miscellaneous Labourers.
6	341112	Electrician (Special Class)	Clean energy - Partial	
3	342	Electronics and Telecommunications Trades Workers	Clean energy - Partial	
4	3421	Airconditioning and Refrigeration Mechanics	Clean energy - Partial	
6	342111	Airconditioning and Refrigeration Mechanic	Clean energy - Partial	
4	3422	Electrical Distribution Trades Workers	Clean energy - Partial	
6	342211	Electrical Linesworker / Electrical Line Mechanic	Clean energy - Partial	
6	342212	Technical Cable Jointer	Clean energy - Partial	
4	3423	Electronics Trades Workers	Clean energy - Partial	
6	342314	Electronic Instrument Trades Worker (General)	Clean energy - Partial	
6	342315	Electronic Instrument Trades Worker (Special Class)	Clean energy - Partial	
4	3992	Chemical, Gas, Petroleum and Power Generation Plant Operators	Transitioning - fossil fuels	
6	399211	Chemical Plant Operator	Transitioning - fossil fuels	
6	399212	Gas or Petroleum Operator	Clean energy - partial	Electricity generation from hydrogen
6	399213	Power Generation Plant Operator	Clean energy - partial	Includes hydroelectricity
1	5	Clerical and Administrative Workers	Adjacent - partial - enabling	
4	5619	Other Clerical and Office Support Workers	Adjacent - partial - enabling	
6	561999	Clerical and Office Support Workers nec	Adjacent - partial - enabling	
2	59	Other Clerical and Administrative Workers	Adjacent - partial - enabling	
4	5999	Other Miscellaneous Clerical and Administrative Workers	Adjacent - partial - enabling	
6	599999	Clerical and Administrative Workers nec	Adjacent - partial - enabling	
1	7	Machinery Operators and Drivers	Adjacent - partial - enabling materials	

4	7123	Engineering Production Workers	Adjacent - partial - enabling materials	
6	712311	Engineering Production Worker	Adjacent - partial - enabling materials	
4	8214	Insulation and Home Improvement Installers	Adjacent – partial – energy efficiency	Hot water solar system installers are included in Unit Group 8214, Insulation and Home Improvement Installers.
6	821411	Building Insulation Installer	Adjacent – partial – energy efficiency	
6	821713	Steel Fixer	Adjacent - partial - enabling	
6	821714	Structural Steel Erector	Adjacent - partial - enabling	
4	8322	Product Assemblers	Adjacent - partial - enabling	
6	832211	Product Assembler	Adjacent - partial - enabling	
3	839	Miscellaneous Factory Process Workers	Adjacent - partial - enabling materials	
4	8391	Metal Engineering Process Workers	Adjacent - partial - enabling materials	
6	839111	Metal Engineering Process Worker	Adjacent - partial - enabling materials	
4	8994	Motor Vehicle Parts and Accessories Fitters	Adjacent - partial - enabling	